Engl 7, Critical Thinking
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Course Reader

Contents:

Part I: Basics

1. Syllogisms: The Three Rules

A claim is any sentence that can be true or false—that is, all sentences except questions, commands, exclamations—and all claims came be expressed in one of the following four forms, each involving two terms (A and B):

All A are B	No A is B
Some A are B	Some A are not B

We'll be covering claims in more depth in later chapters. For now, all you need to know is that "Oaks are trees" would be expressed as "All oaks are trees" (All A are B); "Dogs aren't cats" would become "No dog is a cat" (No A is B); "Many Californians are immigrants" would be "Some Californians are immigrants" (Some A are B); "A few students are not enrolled in the class" becomes "Some students are not enrolled" (Some A are not B); and so on.

Notice that, for some terms, we are talking about an indefinite quantity, "some," but for others we are talking about either "all" or "none"—100% or 0%. The terms which fall into the "all or none" category are said to be "distributed." So, when we say "All oaks are trees," we mean "100% of oaks are trees," and so "oaks," the A term, is distributed. Notice also that two of the four forms of a claim are negative (No A is B and Some A are not B). The following will help you remember the four forms of a claim, which terms are distributed, and which claims are negative:

Form of the claim	Is A or B distributed?	Pos. or Neg.
All A are B.	A, but not B.	Positive
No A is B.	Both A and B.	Negative
Some A are B.	Neither A nor B.	Positive
Some A are not B.	B, but not A.	Negative

Now we're ready to apply these definitions in three rules that determine whether a syllogism is valid or not. It doesn't really make any difference in which order you apply the rules, but in general you'll find the order listed here is the most helpful, since the first rule only deals with the two premises, so you don't have to consider the conclusion until you get to the second rule.

The first rule deals with the "middle term," which is the term repeated in both premises (but not the conclusion). In a valid syllogism, there is always one and only one middle term.

1. The "middle term" must be distributed in at least one of the premises.

The second rule deals with negative claims in the syllogism:

2. If the conclusion is a negative claim, one (but not both) of the premises must be a negative claim; if the conclusion is not a negative claim, neither of the premises can be negative.

And the third rule at distributed terms in the conclusion:

3. If a term is distributed in the conclusion, it must be distributed in one of the premises.

Notice that the second rule means that if the conclusion is negative, then one of the premises must be negative, and vice versa. But there's no "vice versa" in the third rule: you only check if terms distributed in the conclusion are distributed in the premises, but not if terms distributed in the premises are distributed in the conclusion.

Any syllogism that passes all three rules is considered **valid**, which means that the conclusion logically follows from the premises. If, in addition, both premises are also **true**, then the argument is considered **sound** and you must accept the conclusion as true, as well. But if a syllogism fails even one of the three rules, then it is **invalid**, and no decision can be made as to the truth of the conclusion. So the conclusion of a sound argument is always true, and the conclusion of an invalid argument may or may not be true—you just can't tell which.

Let's try some examples.

1. First premise: All dogs go to heaven.
   Second premise: Saddam Hussein is not a dog.
   Conclusion: Saddam Hussein won't go to heaven.

Restated in forms of a claim, this would be:

All dogs are heaven-bound.
No Saddam is a dog.
So no Saddam is heaven-bound.

(Notice that we need the verb is each case to be a form of "to be.") Now let's apply the rules.

Rule 1: The middle term is "dog" and it is distributed in both premises. Passed.
Rule 2: The second premise and the conclusion are both negative claims. Passed.
Rule 3: Both terms ("Saddam" and "heaven-bound") are distributed in the conclusion, but "heaven-bound" is not distributed in the premise. Failed.

So this syllogism is invalid. Will Saddam Hussein be going to heaven? We can't say, one way or the other.

2. First premise: Some students don't like gym class
   Second premise: All football players like gym class.
   Conclusion: Some students are not football players.

Restated in forms of a claim, this would be:

Some students are not gym-lovers
All football players are gym-lovers
So some students are not football players.

And now the rules:

Rule 1: The middle term is "gym-lover" and it is distributed in the first premise. Passed.
Rule 2: The first premise and the conclusion are both negative claims. Passed.
Rule 3: The second term in the conclusion ("football players") is distributed, and it is also distributed in the premise. Passed.

So this syllogism is valid. And as long as you think that the two premises are true, then you *must* accept that the conclusion is also true.

3. First premise: Some meat-eaters like to eat steak.
   Second premise: Vegetarians do not like to eat steak.
   Conclusion: Vegetarians are not meat-eaters.

Restated in forms of a claim, this would be:

Some meat-eaters are steak-lovers.
No vegetarian is a steak-lover.
No vegetarian is a meat-eater.

Intuitively, would say this argument is valid or invalid? Now, let's apply the rules and see.

Rule 1: The middle term is "steak-lover" and it is distributed in both premises. Passed.
Rule 2: The second premise and the conclusion are both negative claims. Passed.
Rule 3: Both terms ("vegetarian" and "meat-eater") are distributed in the conclusion, but "meat-eater" is not distributed in the premise. Failed.

Did this one "sound" valid? It's easy to be confused—especially when you know the conclusion is a true statement. Just because the conclusion is true, however, doesn't mean that the argument is valid. The only way to be sure is to check that the argument passes all three rules.

2. Claims (or Statements)

For the purposes of critical thinking, all sentences can be divided into those that can be true or false, and those that cannot. Only a few sentences cannot be true or false: **commands** ("Just do it."), **exclamations** ("Far out!"), and **questions** ("Why not?"). Exclamations and commands are rare in the persuasive appeals that we call **arguments** in critical thinking, though they are much more frequent in the kind of arguments you get into at home or in a bar or after an accident, where there is a good deal less analysis than anger. Questions can be found more frequently in critical thinking, but these are often **rhetorical questions**: questions asked in such a way that they make a point without requiring an answer, or questions with answers so obvious they don't really need to be asked.

Sentences that can be true or false—the vast majority of all sentences in critical thinking—are called **statements** or **claims**. Note that you don't need to know whether a statement **is** true or false, just that it has the form of sentence that **can be** true or false. We may never know the truth of such sentences as "Before he died, Elvis was thinking of becoming a vegetarian" or "The universe is younger than its oldest galaxies"; we may not even completely understand them. But as long as they have the possibility of being true or false, such sentences are statements.

We can further categorize statements by three qualities:

1. whether they are verifiable, evaluative, or advocatory claims;
2. whether they are specific or, if non-specific, whether the qualification strengthens or weakens the claim;
3. whether they serve as conclusions, premises, or support in an argument.

In this section, we will be focusing on the first two qualities only. You can find more information about conclusions, premises, and support in the section on the structure of an argument, and you can find help in distinguishing premises and conclusions in the section on identifiers.

Qualified and Specific Statements

Specific claims contain or imply language or figures of an exact nature:

- 45% of the people surveyed supported the reforms.
- One-third of the investment has been lost.
- This marked the first time that India successfully orbited a satellite.

In those three sentence, "45%," "one-third," and "first" represent specific information. Such statistical statements are powerful and persuasive expressions in an argument, but they are also easy to attack, because a single example to the contrary is sufficient to refute them. The most common **specific statements** are **universal** ones, in which the figure involved is either "100%" or "0%," usually expressed by words such as **always, never, all, none, everyone, no one**, and so on. For more on this, see the section on <u>Universal Statements</u>.

Non-specific claims are ones in which no specific number is cited; as a result, they are often more difficult to attack. Consider the following examples:

- 49% of those casting ballots voted for Kennedy.
- Approximately 49% of those casting ballots voted for Kennedy.
- More than 49% of those casting ballots voted for Kennedy.
- Less than half of those casting ballots voted for Kennedy.
- Kennedy received more votes than did Nixon.

Only the first example above is a **specific** claim. The second **qualifies** that specific claim with the word "approximately," making the statement weaker but harder to disprove. The last three examples are all **comparative** statements, a type of qualification that operates by comparing the subject of the statement with something else (49% of the votes vs. "more than 49%," half the votes vs. "less than half," the votes for Kennedy vs. the votes for Nixon). Comparative and other non-specific claims are usually harder to disprove than specific claims, but not always; often, they are also more effective in an argument.

A claim with a modifier is considered **qualified** whether it is specific or non-specific. Non-qualified claims have no modifiers at all: "The investment has been lost" or "Kennedy received votes." These sound universal, but may not be.

Note that many claims *appear* to be specific, but are usually *intended* to be non-specific. Consider these examples:

- Jacques is a good boy.

- Americans are rich and well-educated.
- Mercedes are reliable cars.

All of these examples convey an *implied* "all" or "always." But even if we said, "Jacques is *always* a good boy," we wouldn't be surprised to find out about the time Jacques wasn't good. And though Americans may be rich and well-educated *as a group*, compared to many other peoples in the world, we surely recognize that there are many Americans *individually* who are either not rich or not well-educated. Generally speaking, apparently specific claims should be *understood* as non-specific when they deal with personal behavior or group attributes because humans (and other organisms) are individually inconsistent and collectively diverse. To some extent, this is true of other populations, including manufactured items like automobiles. We understand that "Mercedes are reliable cars" doesn't mean "100% of Mercedes are reliable cars." Yet "Mercedes have aluminum-head engines" may well mean "100% of Mercedes have aluminum-head engines"; and (most interestingly) we may be willing to put "all" in front of the statement, "Mercedes are expensive cars," even though we know that a heavily damaged Mercedes can be bought for only a few dollars. The point here is that, sometimes, context and convention may affect our understanding of even simple statements. The job of a critical thinker is to understand the statements *as they were meant*, rather than insisting on a purely literal construction.

Statements of Verification and Evaluation

Fact and Opinion. In critical thinking, the difference between what are commonly called "facts" and "opinions" is not great—if, in fact, it exists at all. Both "facts" and "opinions" can be used to support arguments, and sometimes strong expert "opinions" can outweigh weak or inconsistent "facts." Indeed, considering that much of what we know about the physical sciences is based on hypotheses—that is, opinions that cannot be confirmed—you might wonder why we bother distinguishing between "fact" and "opinion" at all.

Verification and Evaluation. A more important distinction for critical thinking is between claims that are thought to be verifiable, and those that are presented as evaluative. In this sense, **verifiable claims** are those that can be confirmed either by observation or by reference to established sources, such as books. **Evaluations** are statements of taste and interpretation. Notice that opinions can be expressed sometimes as statements of verification and sometimes as statements of evaluation. Consider the following claims:

- "Willa thinks that's a shade of blue."
- "Willa thinks that's a lovely shade of blue."
- "That's a shade of blue."
- "That's a lovely shade of blue."

The first two are clearly opinions, but they are expressed as **statements of verification**, because the issue is whether that is what Willa thinks, not what the color is. The third one is also a **statement of verification**, because (for most people) "blue" is something ascertainable by observation. But the fourth claim is a **statement of evaluation**, because what is "lovely" is a matter of taste. And it doesn't matter whether the claim is true or false—that is, a *false* statement of verification is not a statement of evaluation. All four of our examples can be false—Willa might think otherwise, for the first two, and the color might be red, for the second two—but they are nevertheless three statements of verification, followed by a statement of evaluation.

Sometimes, a third class of claims is identified: **advocatory** or **moral** claims, which deal not with what was, is, or will be, but with what **ought** to have been or **ought** to be. Thus, "Ike is a free man" is a claim of **verification**, "Ike is a good man" is a claim of **evaluation**, and "Ike ought to be a free man" and "Ike should be a good man" are both **advocatory statements**. Rather than create a separate category, however, we can treat such claims as a special case of **evaluation**: "Ike ought to be free" and "Ike should be good" will be treated as the evaluative claims, "It would be right for Ike to be free," and "It would be right for Ike to be good."

The point of categorizing statements into specific and qualified, on one hand, and verifiable and evaluative, on the other, is to understand better the arguments in which they appear. We have already seen that specific claims are the most persuasive but also the most easily refuted. Correctly identifying such statements helps to indicate what needs to be done to attack and defend an argument. Knowing if a statement is one of verification, evaluation, or advocacy helps ensure a consistency of argument, because if the conclusion is a statement of verification, it must be supported by at least one premise that *is* a verifiable claim; and so too with conclusions of evaluation.

3. Types of Statements and Conversions

Statements can be classified into four types or patterns, as follows:

All A are B.

No A is B.

Some A are B.

Some A are not B.

Of course, the language used in arguments is much more complex than those four statements. As a result, part of your task as a critical thinker will be to restate claims to fit one of those patterns, composed of two terms subject and complement) connected by a state-of-being verb (some form of "to be," such as "is," "are," "were," "will be," and so on). The restatement can reduce the complexity of the original sentence as much as you like, providing it creates no change or confusion in the meaning. "All horses eat hay," for example, can be restated as "All horses are eaters." This may sound a little odd, but it is important to replace verbs expressing action with state of being verbs.

Take the claim, "I like good food." Does that mean "Everything I like is good food," or does it mean "All good food is something I like"? The correct restatement is the latter, "All good food is something I like." This has the form, "All A are B," where "good food" is A and "something I like" is B. But had we failed to convert the original verb, "like," to a state-of-being verb, we might have mistakenly assigned "I like" to A and "good food" to B, producing the equivalent of "Everything I like is good food," which we have already determined to be an erroneous restatement.

But we can also restate the claim, "I like good food," as "I am a good-food-liker." This sounds clumsy, but it, too, accurately represents the original idea. So how do we decide whether to restate this as "All good food is something I like" or "I am good-food-liker"? Both have the form "All A are B," but they are otherwise completely different. B in the former focuses on the food, "something I like," for example, while B in the latter focuses on the person, "good-food-liker." Is one a better choice than the other?

The problem here is really a problem of language, not logic. Without a context, we cannot tell whether the point of the claim is about the food itself ("something"), or about the person ("food-liker"). Faced with this choice when dealing with an argument, you would need to choose the form that has the same focus as the rest of the argument. Thus, "I like good food, and this is good" would involve the "something I like" food-focused version, while "I like good food, and people who like good food are good people" would involve the "good-food-liker" person-focused version.

As the previous example suggests, accurately expressing the sequence of terms in a statement is often very important. Two of the four types of claims, however, can switch the order of their terms without altering their logical implications. These two valid conversions are:

No A is B is equivalent to **No B is A**.

Some A are B is equivalent to **Some B are A**.

In other words, "No deciduous trees are evergreens" is equivalent to "No evergreen trees are deciduous," and "Some apples are red" is equivalent to "Some red things are apples." These may sound obvious, but language can be confusing, so remember that those are the only two possible valid conversions.

4. Universal Statements

Any term which is described in terms of “all” or “none” is called a **universal**, or **distributed**, term. Thus, in “all dogs” and “no dogs,” the term “dogs” is universal and, in “some dogs,” it is non-universal. Further, a universal claim is one in which the logical subject is a universal term, and a non-universal claim is one in which the logical subject is a non-universal term. Consider the following examples:

All dogs go to heaven.

No dogs are allowed.

I enjoy good bouzouki music.

All that glisters is not gold.

All the king’s men could not put Humpty together again.

“All dogs go to heaven” is in the form of a standard universal claim, as is the negative “No dogs are allowed.” In both cases, the subject, “dogs,” takes a universal modifier, “all” or “no.”

Restating the claim, “I enjoy good bouzouki music” with a state-of-being verb (see the chapter on “Deduction”) might result in one of two statements: either “I am a good-bouzouki enjoyer” or “All good bouzouki music is enjoyed by me.” In one of the restatements, “bouzouki music” is the logical subject; in the other, “I” is the logical subject. The terms used elsewhere in the syllogism will determine which restatement should be used.

The last two examples look similar, but the combination of “all” and “not” can have irregular results. “All that glisters is not gold,” for example, should be understood as “Some things that glister are not gold,” and since the subject here is modified by the qualifier “some,” this is a non-universal claim. By contrast, “All the king’s men could not put Humpty together again” can be restated as “No king’s man is a Humpty reassembler,” which is a universal claim.

Notice, too, that qualifiers which do not modify the logical subject do not affect the universality of the claim. Since “All dogs go to heaven” is a universal claim, so is “All dogs usually go to heaven,” because it qualifies “going to heaven” and not “dogs.” And since “Some dogs go to heaven” is a non-universal claim, so is “Some dogs always go to heaven.” This can get more confusing when there is a question about whether the “all” is meant as a universal (“each and every one”) or a **collective** (“together as a group”). Thus, “All dogs rarely go to heaven” probably means that it is rare for all dogs, as a group, to go to heaven, but does not address the chances of individual dogs, and so is a collective and not a universal claim.

Finally, remember that many unqualified terms are meant to be universal. This includes **all singular nouns**, and plural nouns where “all” is implied. Consider the following claims:

Nancy Tsukiyama is a police officer.

The Tsukiyama family is moving

The Tsukiyamas are generous.

The first claim has a singular subject, “Nancy Tsukiyama.” The subject of the second example is “the Tsukiyama family,” a collective noun. Though collective nouns are grammatically singular, they can be qualified in ways that singular nouns cannot: “Some of the Tsukiyamas family is moving” makes sense, “Some of Nancy Tsukiyama is a police officer” does not. The subject of the third claim is a plural noun, “The Tsukiyamas.” All three of these examples, therefore, may be universal claims. The first example, with a singular subject, is universal by definition. The question to ask about the others is whether the speaker would be surprised to discover one Tsukiyama who is not moving, in the second example, or one Tsukiyama who is not generous, in the third. You can imagine that, if there are only five Tsukiyama, it is likely that the speaker means “all” in both claims; but if there are tens of thousands of Tsukiyamas, it is likely that the claims are not meant to be universal.

5. Premises, Conclusions, and Support

An **argument** is a series of statements used to persuade someone of something. That "something" is called the **conclusion** or **main claim**. The first job in analyzing any argument is to identify its conclusion. One way to identify conclusions, or other parts of an argument, is to look for their identifiers.

Premises are statements that directly support the conclusion. A simple argument has two premises and a conclusion; a more complex argument may contain many claims, but these can always be divided up into groups of three—two premises and a conclusion. In an argument, the conclusion is **only** supported by its two premises, but each premise itself can be supported in a number of ways:

- **Supporting arguments**. A supporting argument is one which has as its conclusion the same statement as the premise being supported. All premises can be supported in this way, but such supporting arguments are often not stated. A special type of supporting argument is a **definition**, and while these, too, are usually unstated, at times it is necessary to define a term because either the term itself or the particular denotation being used is unusual.

- **Assumptions**. Eventually, all support for premises can be traced back to a set of beliefs which the person making the argument considers to be self-evident, and therefore not in need of further support or analysis. These may be called assumptions, presumptions, suppositions, or, in certain situations, postulates and axioms. Such assumptions serve as the premises for supporting arguments and, in general, any premise can be called an assumption.

- **Evidence**. A premise can be made more acceptable when it supported by various kinds of evidence: statistical studies, historical information, physical evidence, observations, or experiments, eyewitness accounts, and so on. The relative strength of evidence is determined by how reliable a person believes it to be. Almost no evidence is beyond dispute—we might challenge the methodology of a study, the accuracy of the information, the manner in which physical evidence was collected, and the eyesight or motivation of an eyewitness. And remember that the evidence only supports the premises—evidence cannot be an argument itself.

- **Authority**. Sometimes, we are not in a position to judge supporting evidence for ourselves: there may simply be too much of it, or it may be too technical in nature, or it may not be directly available to us. In those cases we often rely on the judgments of others, authorities whom we believe to be more likely to come to an accurate evaluation of the evidence than we are ourselves. Though we tend to think of such expertise in scientific, medical, or other scholarly fields, authority in arguments can also come from religious teachings, folk wisdom, and popular sayings—anything or anyone that we accept as somehow able to reach a more accurate evaluation. The relative strength of an authority in an argument depends on how willing a person is to accept the judgment of that source, but even in the strongest of cases, use of an authority merely supports a premise, and does not make an argument by itself.

- **Explanations and anecdotes**. Sometimes, we are more willing to accept a premise if we are given background information or specific examples. Such explanations and accounts are not given the importance of evidence or authority in an argument. Anecdotal evidence, for example, is by definition less statistically reliable than other sorts of evidence, and explanations do not carry the weight of authority. But both anecdotal evidence and explanations may affect our **understanding** of a premise, and therefore influence our judgment. The relative strength of an explanation or an anecdote is usually a function of its clarity and applicability to the premise it is supporting.

The various sorts of support for a premise—supporting arguments, evidence, authority, and explanations and anecdotes—interact in what we might call a **hierarchy of support or evidence**, in which one sort is given priority over another. In a murder trial, for example, the prosecution is usually based on the assumption that the jury's hierarchy of evidence will have at the top physical evidence (fingerprints, blood samples), especially as explained by technical authorities (forensic pathologists, ballistics experts), followed by eyewitness accounts, then by other sorts of authorities (psychologists, sociologists), and finally by explanations and anecdotes (character witnesses, personal histories). If the prosecution is right, their strong physical evidence and eyewitness accounts will outweigh the defendant's character witnesses, because of their relative placement in the jury's hierarchy of evidence. However, because that hierarchy is determined by each individual on a case-by-case basis, one can never be totally sure how any one piece of support will be accepted.

Facts and Opinions. In the section on statements, we distinguish between three kinds of claims: verifiable, evaluative, and advocatory. Generally speaking, **evidence** takes the form of a **verifiable** statement, and **authority** takes the form of a **evaluative** statement. We have avoided using the terms "fact" and "opinion," in part because of the strong connotations these words carry. People tend to think that "facts" are much more reliable and convincing than "opinions," yet many "facts," such as statistical surveys, scientific measurements, and historical events, are ultimately based on "opinions." Thus, the difference between verifiable evidence ("The victim's blood was found on the suspect's clothes") and evaluative authority ("According to my analysis, the sample taken from the suspect's clothes matches the victim's blood type) is often more a matter of presentation than of fact vs. opinion.

Misunderstandings and Disagreements. The point of identifying the various parts of an argument – the premises, conclusion, and support – is to avoid misunderstandings, one of the most common problems that occurs in arguments. If two people agree on all the terms of the argument, but disagree on the solution, we say they are having a "disagreement." But often they only think they agree on the terms of the argument. For example, what if I asked a classroom full of students, "Who thinks tuition is too high?" or "Who thinks the price of gasoline is too high?" I imagine most people would raise their hands, though perhaps a few might not. Yet behind those questions is an assumption that there is some amount of money that tuition or gasoline ought to cost, and that we know or can know that amount. So, if you would raised your hand to answer one or both of the questions of those questions affirmatively, you might think you'd be in agreement with all the other people raising their hands – and you would likely be wrong. And the real problem is that we often don't notice such misunderstandings. Instead, the discussion frequently stops when we *think* we are in agreement, and just as frequently goes on and on when we *think* we are disagreeing. So, before you simply assume you are agreeing or disagreeing about the same thing, be sure to clarify whether one or both sides are simply misunderstanding something crucial to the argument. Misunderstandings and disagreements are sometimes called "verbal disputes" and "real disputes," respectively.

6. Inference Identifiers

The language in which an argument is presented often contains words or phrase to help identify its parts, especially its premises and conclusion. These words and phrases are **identifiers** of the function played in the argument. Unfortunately, identifiers are only as precise as the persons using them, and both the individual making an argument and the one evaluating it are liable to make mistakes by inexact or sloppy use of identifiers. Since the purpose of an argument is to communicate an idea clearly, the careful use and interpretation of identifiers is an important skill for critical thinking.

The following are some of the most common premise and conclusion identifiers:

Premise Identifiers:	**Conclusion Identifiers:**
since	therefore
for	thus
because	so
supposing that	as a result
given that	consequently
assuming that	we can conclude that

These are only a few of the words and phrases commonly used to identify premises and conclusions. In addition, keep in mind that:

1. some of these words can also appear within the context of an argument, but without indicating an inference. “So,” for example, has several meanings, only one of which is a synonym for “therefore.”

2. sloppy usage may produce confusing identifiers. A common answer to the question, “What would you think if the sky suddenly clouded up and turned very dark,” is “I would assume it was going to rain.” Yet “it is going to rain” here is a *conclusion*, not an assumption or premise.

3. “if” and “then” are often used to identify premises and conclusions, respectively. However, “if” and “then” are also used to introduce the two halves of a conditional premise. In either usage, “then” is sometimes omitted; and it has other meanings, as well.

4. an identifier may not immediately precede or follow the word or phrase whose function it is indicating. For example, in the sentence “Thus, whenever the sun rises, the rooster crows,” there are two claims: a premise, “the sun rises,” and a conclusion identified by “thus” (but not immediately following it), “the rooster crows.”

5. in cases where there are no identifiers, the most frequent order is *conclusion first*, followed by one or both premises. If both premises are given, they are often conjoined with “and” or “but.” For example, “I like Mozart. I like most classical composers, and Mozart was a classical composer.”

7. Validity, Truth, and Soundness

The first rule in evaluating any argument is **never bother to disagree with a conclusion**, because if you find nothing wrong with its **form** (or how the argument is made) and nothing wrong with its **content** (or the assumptions on which the argument is based), then you **must** accept its conclusion. As a result, to challenge an argument, you must challenge either its form or its content, not its conclusion directly. Because we can **always** evaluate the form of an argument, but not always its content, the process of analyzing an argument usually begins with its form.

Validity. When the form of an argument is acceptable, that is, when its premises and conclusion are in the proper relationship, we say that the argument is **valid**. A valid argument, then, is one that is in an acceptable form; and invalid argument is one in an unacceptable form. Rules for determining the validity of an argument are given in the sections on inductive and deductive reasoning. If an argument is found to be **invalid**, all judgment of its must be suspended because, to be acceptable, an argument **must** be valid. The conclusion of an invalid argument is not necessarily wrong; because of the invalidity, there is simply no way to evaluate that argument.

Truth. If, however, the form of an argument is found to be **valid**, then the content of its premises must be evaluated, to determine if they are **true** or **false**. A true premise is one that you believe **has or can be verified, or is self-evident**, in the case of a verifiable statement, or **has or can be justified, or is self-evident**, in the case of an evaluative or advocatory statement. The verification or justification usually comes in the form of support, such as evidence, expert opinion, and supporting arguments.

As a general rule, in judging premises and their support, you should accept as verifiable or justifiable all claims that follow these three rules:

1. They are not in conflict with what you know or understand to be true.
2. They do not require you to believe or accept other unsupported elements that are in conflict with what you know or understand to be true.
3. They bear the proper burden of proof.

Burden of Proof refers to the sense you have, in any dispute, of how much each side needs to prove in order to win your agreement. Sometimes, this burden of proof is an established rule: in the United States, for example, the criminal court system operates on the rule that a person is innocent until proven guilty, which means that the prosecution carries all of the burden of proof; if the defendant is not proven guilty, then he or she should not be convicted of a crime, even if the defense cannot or does not prove him or her innocent of that crime.

Generally, by initiating a claim one takes on a greater degree of the burden of proof than the same position would warrant otherwise. If, for example, Warren said, “California became a state in 1850,” he would be expected to offer more proof for his position than if someone else said “California became a state in 1851,” and Warren disagreed. In an easily verifiable case like that, the burden of proof is almost even, so the person making the claim is usually expected to support it first.

In most arguments, however, it is usually the side that supports altering or rejecting the **status quo**—the current beliefs, practices, and information—which has most of the burden of proof. **The more controversial the matter, generally speaking, the more evenly is the burden of proof shared by all sides; and the more extreme or unusual one side of an argument is, the greater its burden of proof.** In such extreme cases, initiating the claim is normally insufficient to offset the burden of proof. Thus, if Aziza says, “There are no ghosts,” we might be willing to accept her claim without any support, even though she has initiated it, because the burden of such an argument would be carried overwhelmingly by the side that supports a belief in ghosts.

Intentionally shifting the burden of proof, in order to avoid offering support for one’s premises, is a logical fallacy.

Consider the following arguments:

1. I can prove there is life on Mars. Samples of Martian rocks show evidence of the kind of chemical reaction that can only involve a living organism.
2. I can prove there is life on Mars. Spectroscopic analysis through the Hubble telescope has revealed a

purplish area on the Martian surface, and according to Mozyritzski's Second Law, that purplish area must be associated with living organisms.

3. I can prove there is life on Mars. A spaceship filled with Martians abducted me last night.
4. Prove there is life on Mars? Can you prove there isn't?

The fourth one is the easiest to deal with: at the minimum, a claim of life on Mars carries **some** of the burden of proof, and therefore has to be substantiated. The fact an opponent cannot disprove the claim is insufficient for the claim to be accepted; it must be proved. The third argument makes the same claim and does support it, but the support (that the speaker was abducted by Martians) requires you to believe something else that is itself unsupported and even more unusual. The second argument is similar to the third, although it may be easier to accept Mozyritzski's Second Law (whatever that is) than Martian abductors; we can reject Martian abductors without further consideration, but to accept or reject an argument based on Mozyritzski's Second Law, we first need to find out what it is, whether it applies in this case, and how accepted it is generally. The first argument was, in fact, made by scientists in 1996, and it is certainly the most creditable of the four examples here. That "chemical reaction" may be no more verifiable than Mozyritzski's Second Law, but it is more accessible. (In fact, other scientists soon disputed the claim.) So, as presented above and without further support, those four arguments appear in descending order of their acceptability. Yet even the claim, "There's no life on Mars," would carry some of the burden of proof, if for no other reason than someone initiated it.

Soundness. Finally, if an argument is valid and its premises are true, it is termed a **sound** argument, and its conclusion **must** be accepted. In many cases, however, there is insufficient reason to find the premises of a valid argument totally true; the more complex the argument, the less likely that it will be considered undeniably sound. In such cases, we often talk of the "relative soundness" of an argument by describing it as **strong** or **weak**. A strong argument is valid in form, and with premises and support that make a compelling case for its acceptance. A weak argument is also valid in form, but its premises and support do not compel their acceptance.

8. Vagueness and Ambiguity

Though seemingly synonymous in common usage, **vagueness** and **ambiguity** are entirely different but very important problems in critical thinking.

Definitions

- A word or phrase is said to be **ambiguous** if it has **at least two specific meanings** that make sense in context.
- A word or phrase is said to be **vague** if its meaning is not clear in context.

The difference, then, is a clear one (and not at all vague): If Montgomery doesn't know *what* is meant by a phrase, then that phrase is *vague* for him. If Montgomery doesn't know *which* of two or more specific meanings is intended, then it is *ambiguous* for him.

Have you seen the ad on TV about trying "to quit smoking cold turkey"? Van's little sister asked her who would want to smoke cold turkey in the first place! That is a perfect example of an unintentional ambiguity and the problems it can cause.

Consider this line from a help-wanted ad: "Three-year-old teacher needed for pre-school." Most people think this is funny, because the ad seems to be seeking a teacher that is three years old. But the phrase is **ambiguous**: the ad is actually seeking a teacher for three-year-old preschoolers. The phrase is ambiguous because two specific and distinct meanings can be applied to it in the given context. (Notice, however, that the *level* of ambiguity is dependent on the terms involved. "English teacher needed for pre-school" would normally not be considered ambiguous, though in certain contexts it could be understood to be seeking a teacher from England. But how about "Vietnamese teacher needed for preschool"?)

Vagueness, though, is a different problem. "Nurse needed for pre-school" is vague because there are many kinds of nurses, and the same job is certainly not open to them all: registered nurses, practical nurses, wet nurses, nannies, and so on. The problem is that the word "nurse" has many meanings, and so the ad's usage is **vague**. The more details that are supplied, the less vague a phrase will be. "Registered nurse needed for pre-school" would be less vague, "Registered nurses with pediatric experience needed for pre-school" would be even less so. Notice that, for almost every word or phrase, you can probably imagine some situation in which it would be vague. We can tolerate a certain level of vagueness in language, but it is the job of a critical thinker to minimize vagueness by ensuring the language used is appropriate for its context—that is, for its subject and its audience.

9. Conjunctions and Disjunctions
(“And” and “Or”)

The simplest deductions are those involving two or more things connected by “and” (a conjunction) or “or” (a disjunction), and are governed by the following rules:

“And” (and “but”): Affirm all, negate one.

- To affirm an “and” claim, all parts of the “and” must be affirmed as true.
- To negate an “and” claim, at least one part of the “and” must be negated as false.

“Or”: Affirm one, negate all.

- To affirm an “or” claim, at least one part of the “or” must be affirmed as true.
- To negate an “or” claim, all parts of the “or” must be negated as false.

Example 1. Consider the claim, “Pat and Juan have arrived.” If that claim is affirmed as true, we can conclude that both Pat and Juan have arrived, because all parts must be affirmed. If, however, the claim is false, then we can conclude that at least one of the terms must be negated: either Pat has not arrived, or Juan has not arrived, or neither has arrived.

Example 2. Consider the claim, “Farida or Marcia has won the race.” If true, then (because at least one part of the “or” must be affirmed) one of the following must be true: Farida has won, Marcia has won, or they both have won. If false, then neither Farida nor Marcia have won.

These rules always apply, even when the deductions are complicated by more elements (“Farida, Marcia, Pat, and Juan”), the use of negatives (“Farida and not Marcia”), or some combination of these. So, to affirm the claim “Farida and Pat but not Marcia or Juan have finished,” we would employ the following steps:

1. To negate the “or” (“not Marcia or Juan”), we would negate both parts, concluding that Marcia has not finished and Juan has not finished.
2. To affirm the “and” (“Farida and Pat”), we would affirm both parts, concluding that Farida has finished and Pat has finished.
3. To affirm the “but” (which operates logically as an “and”), we would affirm all parts, concluding that Farida has finished, Pat has finished, Marcia has not finished, and Juan has not finished. All these must be true in order for the claim “Farida and Pat but not Marcia or Juan have finished” to be true.

Inclusive and Exclusive “Or”

Sometimes, “or” is used in an **exclusive** sense. For example, you might read on a menu, “Soup or salad comes with the dinner.” This means, “soup or salad, **but not both**,” because the menu is describing what is included with the price of the meal. **However, if there is no contextual reason to think otherwise, assume every “or” is inclusive**—that is, “A or B or both.” The difference between the inclusive and exclusive “or,” then, has to do with cases in which “both” are true. Since “Soup or salad comes with the dinner” is exclusive, it places “soup **and** salad” outside the range of things that are included in the price of the meal.

Now suppose an advisor tells you that you can take English 7 **or** History 60 to satisfy a critical thinking requirement. Though, in this case, it’s clear that you don’t need to take both, that “or” is still **inclusive**, because if you did take both, you would still be satisfying the requirement: English 7 **or** History 60 **or both** satisfy the requirement.

As a result, the use of “and/or” is unnecessarily confusing and should be avoided, since “or” by itself, in the absence of any exclusionary language or context, means the same thing. Using “A or B or both” makes the possibilities clearer but, in most cases, a simple “or” will suffice.

Part II: Types of Arguments

10. Inductive and Deductive Reasoning

Many people distinguish between two basic kinds of argument: **inductive** and **deductive**. Induction is usually described as moving from the specific to the general, while deduction begins with the general and ends with the specific; arguments based on experience or observation are best expressed inductively, while arguments based on laws, rules, or other widely accepted principles are best expressed deductively. Consider the following example:

> *Adham*: I've noticed previously that every time I kick a ball up, it comes back down, so I guess this next time when I kick it up, it will come back down, too.
> *Rizik*: That's Newton's Law. Everything that goes up must come down. And so, if you kick the ball up, it must come down.

Adham is using *inductive reasoning*, arguing from observation, while Rizik is using *deductive reasoning*, arguing from the law of gravity. Rizik's argument is clearly from the general (the law of gravity) to the specific (this kick); Adham's argument may be less obviously from the specific (each individual instance in which he has observed balls being kicked up and coming back down) to the general (the prediction that a similar event will result in a similar outcome in the future) because he has stated it in terms only of the *next* similar event—the next time he kicks the ball.

As you can see, the difference between inductive and deductive reasoning is mostly in the way the arguments are expressed. **Any inductive argument can also be expressed deductively, and any deductive argument can also be expressed inductively**.

Even so, it is important to recognize whether the form of an argument is inductive or deductive, because each requires different sorts of support. Adham's inductive argument, above, is supported by his previous observations, while Rizik's deductive argument is supported by his reference to the law of gravity. Thus, Adham could provide additional support by detailing those observations, without any recourse to books or theories of physics, while Rizik could provide additional support by discussing Newton's law, even if Rizik himself had never seen a ball kicked.

The appropriate selection of an inductive or deductive format for a specific first steps toward sound argumentation.

11. Induction and Causal Arguments

As covered in the section on Inductive and Deductive Reasoning, inductive arguments are usually based on experience or observation. In effect, then, inductive arguments are all **comparisons** between two sets of events, ideas, or things; as a result, inductive arguments are sometimes called **analogical** arguments. The point of those comparisons, or analogies, is to establish whether the two sets under consideration, similar in a number of other ways, are also similar in the way of interest to the argument. Consider this example:

Mariko says, "Every time I've seen a red-tinted sunset, the next day's weather has been beautiful. Today had a red-tinted sunset, so tomorrow will be beautiful."

Essentially, Mariko is comparing one set of events (observed red-tinted sunsets and each following day's weather) with another (today's observed sunset and tomorrow's predicted weather). These sets are similar in an important way (red-tinted sunsets), and the inductive argument is that they will also be similar in another way (nice weather on the following day). In this case, Mariko is arguing from **particular** cases in the past to a **particular** case in the present and future, but she could also argue inductively from those **particular** cases to a **general** one, such as "It's always beautiful the day after a red-tinted sunset."

The strength of such an argument depends in large part on three of its elements:

4. how accurate and comprehensive the previous observations are;
5. how strong the causal link seems to be;
6. how similar the two cases are.

In Mariko's argument, to satisfy the first element, we would want to be sure that she's seen many such sunsets, and that "redness" and "beauty" have been judged consistently. To satisfy the second, we would want to feel confident that there is a strong correlation between weather patterns on successive days. To satisfy the third, we would want to know whether there are any significant differences between the observation of today's sunset and of the previous ones. A difference in season, a difference in geographical or topographical location, a difference in climate, or any other significant variation might affect the comparability of the two sets of observations.

In fact, we should always understand the second premise of an inductive argument to contain a claim like "**there is otherwise no significant difference**." The second premise of Mariko's argument, then, might read, "Today's sunset was red-tinted (and there were no significant differences between this and previous red-tinted sunsets)." Keeping such a disclaimer in mind is important, because this is where many inductive arguments are weakest.

Because we argue inductively from the particular to the general, such arguments are often called generalizations, or **inductive generalizations**. Other kinds of arguments with a similar format include causal arguments.

Causal Arguments

One of the most important uses for inductive reasoning is to argue causation. Consider the following example:

A bicyclist moves into the traffic lane in order to pass a truck illegally parked in the bike lane. The driver of a car approaching from the rear slams on her brakes in order to avoid hitting the bicycle. A following car fails to stop in time, and smashes into the back of the first. The insurance companies disagree about who should be held responsible, and they go to court to decide who caused the accident.

What arguments are likely to be made in court? The bicyclist's lawyer will probably claim that the illegally parked truck *caused* her client to swerve into the lane of traffic. The lawyer for the driver of the first car will probably claim that the bicyclist's actions *caused* her client to slam on the brakes. The lawyer for the second driver will probably claim that the first car's sudden stop *caused* his client to smash into its back.

None of these claims seems to fit the pattern of an inductive argument, because none of them seems based on observation or experience. But, in fact, they do fit that pattern. The bicyclist's lawyer, for example, is actually arguing that:

- Normally the bicyclist would have continued in the bike lane, but in this instance he swerved into the lane of traffic.

- The only significant difference between "normally" and "in this case" is the presence of the illegally parked truck.
- Therefore, the truck *caused* the bicyclist to swerve.

The lawyers for the drivers are making similar arguments: the first, that the only significant difference was the swerving bicycle; and the second, that the only significant difference was the suddenly braking car. Like inductive reasoning, then, these causal arguments are based on observed instances. (In this case, no observations are needed to convince us that the bicyclist would not normally have swerved or the first driver would not normally have braked suddenly. But if, for some reason, observations were necessary, we could design a study of automobile and bicycle traffic on that street, or survey drivers and bicyclists about their experiences, or in other ways provide evidence to verify the part of the premise describing the normal pattern of traffic. For more on this, see the section on Studies, Surveys, Polls, and Experiments.

These causal arguments, then, follow the form of an inductive argument with one important exception: whereas an inductive argument carries as part of its second premise the implication that **there is otherwise no significant difference**, these causal arguments carry the implication that **there is only one significant difference**: for the bicyclist, the truck; for the first driver, the bicycle; for the second driver, the first car.

How can we know that there is really only *one* significant difference? In real-life situations, we cannot usually be certain of that, since the world in which we live is a very complicated and intricate place. If, however, there is a strong likelihood of causation and there are no other apparent causes in evidence, then the argument will seem convincing. Two rules to remember in dealing with causation are:

7. The cause must precede the event in time. On one hand, arguments that have the effect before the cause are examples of the relatively rare fallacy of **reverse causation**. One the other, arguments whose **only** proof of causation is that the effect followed the cause are examples of fallacious post hoc reasoning.
8. Even a strong correlation is insufficient to **prove** causation. Other possible explanations for such a strong correlation include coincidence, reversed causation, and missing something that is the cause of **both** the original "cause" and and its purported "effect."

In the trial, for example, the second driver's lawyer could **not** argue that his client hit the first car **because** the first car stopped suddenly if reverse causation, post hoc reasoning, or a common cause is found. An example of reverse causation would be that the accident occurred **before** the first car began to stop, and it only came to a sudden stop **because** it was hit. An example of post hoc reasoning would be that the only connection between the stopping and the accident is that the car stopped first (say, Tuesday), and the accident happened later (say, Thursday). An example of a common cause would be that the reason the first car stopped suddenly **and** the reason that the second car hit it are the same: they were both side-swiped by a large recreational vehicle.

But what if, as the trial progresses, evidence is introduced to show that the bicyclist has a history of causing accidents by swerving in front of cars, or that the first driver has been involved in several accidents in which she caused her brakes to lock, or that the second driver was speeding and the street was slick? Such information could lead to very different causal arguments, where the implied claim does not concern "the only significant difference," but rather "the only significant commonality." The bicyclist's lawyer might argue, for example, that her client's swerving may have caused the first driver to brake suddenly, but that the *accident* was caused by the way in which the first driver hit the brakes, and that she has caused similar accidents that way in the past. The first driver's lawyer, on the other hand, might argue that the *accident* was caused not by her client's braking, but by the second driver's unsafe speed, and the slick condition of the road, and that these factors have often caused other accidents. Both lawyers would be using a causal argument based on "the only significant commonality."

Often, complex causal arguments use a mixture of "difference" and "commonality" reasoning, to show that the proposed cause is the only significant difference in cases where the effect did not occur, and the only significant commonality in cases where the effect did occur.

The strength of a causal argument, then, relies on three factors:

5. **how acceptable or demonstrable the implied comparison is** (for example, do we think that there is a basic similarity in most respects between the circumstances of this accident and those of the many other times bicycles and cars have traveled on this street safely;
6. **how likely the case for causation seems to be** (for example, do we think that a bicycle swerving into an car's lane can cause an accident?);

7. **how credible the “only significant difference” or “only significant commonality” claim is** (for example, do we believe that the illegally parked truck is the only significant difference between this case and the many other times bicycles and cars went down that street without an accident?).

12. Deductive Arguments

As explained in the Introduction to Induction and Deduction, an argument is inductive if its major premise is based on observation or experience, and deductive if its major premise is based on a rule, law, principle, or generalization. In general, there are two distinct ways of expressing a deductive argument: as a syllogism, or as a conditional. Any deductive argument can be expressed as either a syllogism or a conditional, though some arguments may seem to lend themselves more naturally to one form or the other. Similarly, tests for the validity of syllogisms and conditionals may appear quite different, but do essentially the same thing.

Syllogisms: The major premise of a syllogism states that something, Y, is or is not true for all or part of some group, X; the minor premise affirms or denies that some group or individual, Z, is part of X; and the argument then concludes whether that thing Y (from the major premise) is true or not true for that group or individual Z (from the minor premise). One form of a syllogism can be expressed by the following paradigm:

All X are Y

Z is X

Therefore, Z is Y

Consider the following example:

Everyone in class today received instructions for writing the essay. Mandia was in class today. Therefore, Mandia received instructions for writing the essay. You might think that "everyone in class today received instructions for the essay" sounds like an **observation**, but it is a **generalization**: no observer is identified, and no process of observation is recounted. By using a generalization, we focus attention more directly on the truth of an assertion (and less on the manner of its verification); this is especially effective when the generalization is widely accepted, or when there is strong evidence to support it.

We can restate the argument as follows:

[Major:] "Receiving instructions" is true for all of the group "in class today."

[Minor:] "Mandia" is a member of the group "in class today."

[Conclusion:] "Receiving instructions" is true for "Mandia."

Notice that, twice, the phrase in the original example, "received instructions for writing the essay," became in the restatement, "receiving instructions." There are two reasons for this. First, a restatement of an argument should eliminate or shorten unnecessary terms, to make the argument more comprehensible. Here, we shortened "instructions for writing the essay" to "instructions"; if significant, the phrase's original form can be resubstituted in the conclusion.

Second, in order to avoid confusion, it is always best to **use a state-of-being verb** (for example, forms of the verb "to be") in the restatement of an argument, and convert the original verbs to other parts of speech. In this case, "received" has become a participial phrase, "receiving instructions," that functions as a noun.

Conditionals: The other common form of a deductive argument, a conditional, expresses that same reasoning in a different way. The major premise is, If something is true of P, then something is true of Q. The minor premise either affirms that it is true of P, or denies that it is true of Q. In the former case, the argument concludes that the something is true of Q; in the latter, that something is not true of P. One form of a conditional is expressed by the following paradigm:

If P then Q

P

Therefore, Q

The above example could be given in the form of a conditional as follows:

If Mandia was in class today, he received instructions for writing the essay. Mandia was in class. Therefore, he received instructions for writing the essay.

In the form of the paradigm above, this conditional can be restated as follows:

[Major:] If "in class" is true, then "received instructions" is true.

[Minor:] "In class" is true.

[Conclusion:] "Received instructions" must be true.

Notice that a conditional seems to use only two terms (P and Q), while a syllogism uses three (X, Y, and Z). But the third term is actually there. In our example, it is Mandia who is "in class," and Mandia who "received instruction."

Summary. Consider this example:

Jerzy claims that all his test scores have been good, and so his course grade should be good, too. We can express that argument as a syllogism or a conditional:

Syllogism:		**Conditional:**
All good tests get good grades.		If good tests, then good grades.
Jerzy's are good tests.	OR	Good tests.
Therefore, Jerzy gets a good grade.		Therefore, good grade.

These two arguments reach the same conclusion, and their minor premises are similar, but their major premises *appear* to be rather different. In fact, "All good tests get good grades" and "If good test then good grade" are just two ways of expressing a relationship between good test scores and good course grades.

13. Options

Critical thinking concerns the processes by which we make decisions, and the most basic decisions are made between two choices. We can better understand the consequences of the choices we make, and learn to make better choices, by employing the concepts of critical thinking.

Making a choice involves the apparently simple operation of either affirming one possibility (saying "yes" to it), or denying another (saying "no" to it). Creating a string of such choices, however, can quickly get complicated, and such a binary string ("yes-yes-no-no-no-yes") is actually the basis for computerized computations, where the options are usually expressed as zeros and ones ("110001"). If we go a little further, and establish relations between the choices using conjunctions and disjunctions, we have created a Boolean string: "a and b or (c and not d)."

Let's say you are visiting Avshi, who offers you the use of a car.

►Avshi might ask, "Do you want the red car or not?" In this case, you have been given two options: red or not red. Driving the blue car is part of "not red," but so is declining both cars. If you are seen driving "red" (that is, when "red" is true), the implication is that you have not chosen "not red," and if you are seen driving anything but "red," the implication is that you have not chosen "red." **When you have only two options, both of which cannot be true and both of which cannot be false, you are faced with contradictions, or contradictory choices.**

►Avshi might also ask, "Do you want the red car or the blue car first?" Since "first" makes it clear that the "or" here is exclusive (for more on this, see the "And" and "Or" Introduction), you have been given three options: "red," "blue," and "neither." In this case, if you are seen driving "red" (that is, if "red" is true), the implication is that you have not chosen "blue" or "neither." But the implication of "not red" isn't as clear: we can't conclude that you have chosen "blue" because "neither" is also an option. **When you have two options ("red" and "blue"), and a third option that neither of the first two are true ("neither"), you are faced with contraries, or contrary choices.**

►And someone else might ask, "Which car or cars are you going to drive while you are here?" Now you have four different options: "red," "blue," "both," and "neither." In this case, if you are seen driving "red," we can't determine whether you might also drive "blue" at another time, because "both" is an option; and if you aren't driving "red," we can't conclude whether you have chosen "blue," because "neither" is an option. **When you have two options ("red' and "blue"), and two more options (that "both" of the first two are true, and that "neither" of the first two is true), then you are faced with open or unrestricted choices.**

As you can see, those three questions have very different implications. We can summarize the three different possibilities for an option between two things as follows:

►**Contradictions**: both cannot be true, and both cannot be false.
►**Contraries**: both cannot be true, but both can be false.
►**Choices**: both can be true, and both can be false.

In confronting options, then, your job is first to determine whether you are dealing with a contradiction, a contrary, or an open choice, and then to understand the consequences of that.

Example 1. My options are A or B, and I choose "not B." What can you conclude about "A"?
►If A and B are contradictories, you can conclude that "A" is true.
►If A and B are contraries or open choices, you cannot conclude anything, because either "A" is true or "neither A nor B" is true.

Example 2. My options are A or B. I have chosen "A." You can only conclude that "not B" is true if you know that A and B are either contradictory or contrary.

Example 3. My options are A or B. I have chosen “not A.” You can only conclude that “B” is true if A and B are contradictory. If they are contrary or open choices, “neither” is a possibility.

Note: In common speech, words paired as “opposites” are sometimes contradictories and sometimes contraries. Often, this is determined by the context. “Night” and “day,” for example, may be understood as contradictory if “night” is the time between sunset and sunrise, and “day” between sunrise and sunset. On the other hand, if “twilight” is recognized as a time that is neither “night” nor “day,” then they are only contrary. We usually accept “male” and “female” as contradictory for humans, but contraries or just choices for other kinds of animals, like snails, some of which are asexual or hermaphroditic. In fact, there is always a range of definitions, depending on the context the terms are used: for gender identities, from physical appearance to genetic composition; for “night” and “day,” from the common to the meteorological and astronomical. **The only way to be sure that two terms are contradictory, therefore, is to use the “A and not-A” format.** Thus, “night” and “not-night” are certainly contradictory, whatever “night” and “day” may be. (And even here, common usage may undermine the meanings. Many people, for example, assume that not everyone falls into the categories of the “haves” and the “have nots.”)

14. Conditional Arguments

The first premise of a **conditional argument** can be expressed in the form "**If** p, **then** q," where "p" is the **antecedent** and "q" is the **consequent**. The first premise establishes the condition—the relationship between the antecedent and the consequent. Consider the following examples:

- If Chinua arrives late, he will miss the bus.
- Chinua will miss the bus if he comes late.
- Chinua, if he arrives late, will miss the bus.

Notice that the word order can change, but the sentence retain that same meaning, as long as the same phrase is introduced by "if." Logically, all three can be expressed by the claim, "**If** Chinua arrives late, **then** he will miss the bus." For economy, we might shorten that to "**If** arrive late, **then** miss bus." In this case, p=arrive late, and q=miss bus.

The second premise of a valid conditional argument does one of two things: it affirms the antecedent (p), or denies the consequent (not q). Thus, the two valid second premises for the conditional above are: "he arrived late" (p), and "he did not miss the bus" (not q). And each of these valid conditional arguments has a valid conclusion:

If arrives late **(p)**, **then** miss bus **(q)**.

Arrives late **(p)**.

Therefore, miss bus **(q)**.

OR

If arrives late **(p)**, **then** miss bus **(q)**.

Not miss bus **(not q)**.

Therefore, not arrive late **(not p)**.

In other words, if the original conditional is true, we can draw the following valid conclusions: Chinua arrived late and therefore missed the bus; or Chinua did not miss the bus, and therefore he must not have arrived late. These two valid conditional arguments are expressed by the following paradigms:

(Modus Ponens/Affirming the Antecedent)

If p, **then q**.

P.

Therefore, **q**.

OR

(Modus Tollens/Negating the Consequent)

If p, then q.

Not q.

Therefore, **not p**.

These are the only two valid forms for a conditional argument. The only valid possibilites are a second premise of **p**, concluding **q**, and a second premise of **not q**, concluding **not p**.

Example 1. "If Chinua arrives late, he will miss the bus. And he does arrives late. Therefore, he misses the bus." This is a **valid** argument, because it fits one of the two forms for a valid conditional (in this case, *modus ponens*):

If p (arrives late), then q (misses bus).

P (arrives late)

Therefore, Q (misses bus).

Example 2. "If Chinua arrives late, he will miss the bus. And he does miss the bus. Therefore, he must have arrived late." This is an **invalid** argument, because it does not fit one of the two valid forms. In a valid conditional, the second premise must be either **p** or **not q**. In this case, the second premise ("miss bus") would be **q**, so no valid conclusion can be drawn. We say this second premise "affirms the consequent," which is invalid. (This may *sound* like a good argument, but it is easy to see why it is not, because the conditional says nothing about what might happen when Chinua does not miss the bus. Perhaps he arrived on time, or perhaps he got there late and the bus was delayed—we have insufficient information to conclude anything.)

Example 3. "If Chinua arrives late, he will miss the bus. But he does not arrive late. Therefore, he did not miss the bus." This is an **invalid** argument, because it does not fit one of the two valid forms. In a valid conditional, the second premise must be either **p** or **not q**. In this case, the second premise ("not arrive late") would be **not p**, so no valid conclusion can be drawn. We say this second premise "negates the antecedent," which is invalid. (Again, this may *sound* like a good argument, but it is easy to see why it is not, because the conditional says nothing about what will happen if Chinua arrives on time. Perhaps he did catch the bus, perhaps he fell asleep and missed it anyway—we have insufficient information to conclude anything.)

Example 4. "If Chinua arrives late, he will miss the bus. But he does not miss the bus. Therefore, he did not arrive late." This is a **valid** argument, because it fits one of the two valid forms (in this case, *modus tollens*):

> If p (arrives late), then q (misses bus).
>
> Not q (not miss bus).
>
> Therefore, not p (not arrive late).

15. Conditional Chain Arguments

As we have seen in the section on Conditional Arguments, the two valid forms of a conditonal are:

(Modus Ponens/Affirming the Antecedent)

If p, **then q**.

P.

Therefore, **q**.

OR

(Modus Tollens/Negating the Consequent)

If p, then q.

Not q.

Therefore, **not p**.

Such arguments can be developed further by linking them in a **chain** of conditionals, **where the conclusion of each argument is the second premise of the next argument**. Consider, for example, the argument:

> "**If** Serge signs the contract, **then** he will have to fulfill its terms. And **if** he has to fulfill those terms, **then** he will have trouble paying his other debts. Serge signed the contract. **Therefore**, he will have trouble paying his other debts."

This argument can be represented as follows:

If P (signs), then Q (fulfill).

P (signs).

Therefore, Q (fulfill).

The first conditional affirms the antecedent, and is thus valid.

And

If Q (fulfill), then R (trouble).

Q (fulfill).

Therefore, R (trouble).

This conditional's antecedent matches the conclusion above, and is also valid.

Such chains can go on indefinitely, provided each link makes a valid argument by using the conclusion of the previously link as the antecedent of its conditional premise:

1. If P then Q.
2. If Q then R.
3. If R then S.
4. If S then T.
5. If T then U.

And so on. In this chain, when P is affirmed, we can conclude (by *modus ponens*), that Q, R, S, T, and U are all true; and when U is negated, we can conclude (by *modus tollens*), not-T, not-S, not-R, not-Q, and not-P. Such a "chain reaction" of conclusions seems quick and easy, but take care to ensure that each of the links is in the proper form before accepting the results.

Chain arguments can be further complicated in two ways: by introducing into the chain "only if" and inverse conditionals. Here is one example of each:

Chain with "Only If" Conditional

1. If P then Q.
2. If Q then R.
3. **R only if S.**
4. If S then T.

Chain with Inverted Conditional

1. If P then Q.
2. If Q then R.
3. **If not S then not R**.
4. **If S then T**.

In both examples, **affirming P affirms Q, R, S, and T**, and **negating T negates S, R, Q and P**. That's because "R only if S" and "If not S then not R" are both equivalent to "If R then S."

6. Twisted Terms: *"Only If"* Conditionals

In the section on Conditionals, we saw that the the claim, "If P, then Q," resulted in two valid conclusions: when P is true, Q is true; and when Q is **not** true, P is **not** true. Thus, an argument based on the conditional premise, "The team will win if Yankl scores," can reach the valid conclusions: "when Yankl scores, the team wins"; and "when the team does not win, Yankl does not score."

But the results of a very similar conditional are quite different. Consider, "The team will win **only if** Yankl scores." Clearly, this suggests that "when the team wins, Yankl scores," and "when Yankl does not score, the team does not win." Notice that these conclusions are the **converses** of those made when the conditional had no "only" in it. As a result, we can say that "The team will win **only if** Yankl scores," is logically equivalent to "Yankl scores **if** the team wins," or "**If** the team wins, **then** Yankl scores." Thus, "P only if Q" is equivalent to "If P then Q."

Notice that the "only" need not appear immediately before the "if" in the premise to have this effect, providing that "only" is being used as an **adverb** and not as an **adjective**. Thus, "The team will win **only if** Yankl scores" is logically equivalent to "The team will **only** win **if** Yankl scores," but not to "The team will win **if only** Yankl scores," in the sense that "Yankl and no one else scores." In the previous paragraph, the original conditional was shown to be equivalent to "**If** the team wins, **then** Yankl scores"; but this does not indicate that "Yankl and no one else scores," only that "at least Yankl scores." In other words, the "only" in "only Yankl" is an adjective, and therefore does not produce the "only if" effect. "The team will win **if only** Yankl scores" means that "**If** Yankl and no one else scores, then the team will win."

Be careful, however, because the usage of "only" can sometimes be ambiguous. While "The team will win **if only** Yankl scores" seems fairly clearly to mean "Yankl and no one else," what about the conditional, "The team **might** win **if only** Yankl **would** score"? Now the "only" seems to be part of the subjunctive mood expressed by "would score," and suggests neither "only if Yankl scores," nor "if Yankl and no one else scores."

And there are other words and phrases in English that have similar effects. "None but the brave deserves the fair," for example, might be expressed in a conditional as "Fair-deserving only if brave." Another sort of transformation involves "unless." To express "There can be no courage unless you're scared" as a conditional, we would have to say, "If there's courage, then you are scared," dropping (or adding) a negative in the antecedent, and changing "unless" to "then." The little-used term "lest" has an even more dramatic consequence: "Answer not a fool according to his folly, lest you also be like him" expressed as a conditional would be, "If you don't want to be like a fool, then don't answer him according to his folly"; and "Answer a fool according to his folly, lest he be wise in his own eyes," would be "If you don't want a fool to be wise in his own eyes, then answer him according to his folly."

The point is that your representation of a statement as a conditional must accurately reflect the meaning of the original, and sometimes that requires considerable thought. Such problems in meaning aside, in the most basic cases, remember that **P only if Q** is equivalent to **If P then Q**, and so, in a way, "only if" can be replaced by "then."

Part III

Fallacies

18. Introduction to Fallacious Appeals

We often make legitimate appeals in support of arguments. For example, to support a statement about the relationship between energy and mass, Danielle might appeal to Albert Einstein's theories as an authoritative source. To support a claim dealing with guns and gun control, Janelle might appeal to the Bill of Rights. And to support an argument on immigration, Claudelle might appeal to the humanity or generosity of her audience. As long as Einstein is an authority on Danielle's topic, as long as the Bill of Rights deals with Janelle's topic, and as long as the generosity of her audience is directly related to Claudelle's topic, each of these appeals would be perfectly acceptable.

However, what if Danielle had appealed to Einstein as an authority on rap music, or if Janelle had used the Bill of Rights to support a claim about which store has the best prices, or if Claudelle had appealed to the generosity of the judges in evaluating her performance in gymnastics? We would probably have a puzzled reaction, since these appeals would seem to have little or nothing to do with the claims they were used to support.

The problem is that fallacious appeals are not always as obvious as these last three, and it necessary for the critical thinker to determine, in each case, whether an appeal is appropriate or not. Generally speaking, fallacious appeals can be divided into two groups: misdirected appeals and emotional appeals.

In a **misdirected appeal**, an otherwise legitimate appeal is misapplied by being used to support an unrelated claim. Danielle's use of Einstein, who was an authority but not on rap music, and Janelle's use of the Bill of Rights, which guarantees some things but not which store has the best prices, are examples of misdirected appeals.

By itself, an **emotional appeal** is never a legitimate strategy in an argument, because it is based on emotions rather than verifiable or evaluative support. Claudelle's appeal to the generosity of her audience in an argument about immigration, for example, would be appropriate as long as she was discussing that generosity as a value related to the subject. However, an appeal to the generosity of the judges at a gymnastic meet is merely a play on their emotions (probably an appeal to their pity); anyway, the value of generosity has nothing to do with the evaluations the judges would render. Thus, Claudelle's appeal to the judges' generosity would be a fallacious emotional appeal.

The following are some of the most common fallacious appeals. Popular variations on the names are listed following the link.

Misdirected Appeals

A. Appeal to Authority, or Appeal to Questionable Authority
- ►Appeal to Information

B. Appeal to Common Belief, or Appeal to Belief, Appeal to Popular Belief

C. Appeal to Common Practice, or Appeal to Tradition
- ►Two Wrongs Make a Right

D. Appeal to Indirect Consequences, or Slippery Slope, Domino Theory
- ►Appeal to Wishful Thinking

Emotional Appeals

E. Appeal to Fear, or Scare Tactics, Appeal to Force

F. Appeal to Loyalty, or Peer Pressure, Bandwagon, Ad Populum

G. Appeal to Pity, or Sob Story

H. Appeal to Prejudice, or Appeal to Stereotypes

I. Appeal to Spite, or Appeal to Hatred, Appeal to Indignation

J. Appeal to Vanity, or Apple Polishing

Misdirected Appeals

A. Appeal to Authority. Ideally, we reach our decisions by reviewing information and arguments, and coming to our own conclusions. But because knowledge is very specialized, none of us has the time and ability necessary to understand fully all the fields in which we need to make informed decisions. As a result, we often rely on the opinions of experts—people who have the knowledge necessary to evaluate very specialized information. In accepting or rejecting expert opinion, we usually forgo some or all of the usual analysis of evidence and claims, relying on the expert's explanations or evaluations of the material for us. Obviously, then, we need to be confident of the expertise of the individual on whom we are relying.

As the name suggests, a misdirected appeal to authority usually cites some person or thing (a book, for example) as a source to be trusted on a subject, when in fact that person or thing is **not** authoritative on that specific subject. As a result, this fallacy is also known as an **appeal to questionable authority**. One common way to make such an illegitimate appeal more persuasive is to appeal to a recognized authority on a matter outside the area of that authority's expertise.

Celebrity endorsements of commercial products or political positions are often used as fallacious appeals to authority. Just because a person is successful or knowledgeable in one area—say, acting, music, or sports—is no reason to accord his or her claims or opinions added weight in an unrelated area—such as health care, diet, or investments. There is nothing wrong with using a celebrity to attract attention to a cause or product, but the decision about whether the product or cause is indeed worthwhile should be made without regard to the celebrity endorsement.

Appeal to Information. This fallacy is related to the appeal to questionable authority, and may be best remembered as an appeal to questionable information. The fallacy functions by getting you to assume the information presented is creditable, when that may be in question. You have already read about some forms of an appeal to questionable authority, in the section on statistics.

* * *

B. Appeal to Common Belief. As explained in the section on Statements, claims made in argumentation can be divided into those of verification, evaluation, and advocacy. Surveys of common beliefs and popular opinions are a legitimate way to support some evaluative statements, but they can never be used to argue the accuracy of most statements of verification. Such fallacies are also called appeals to **opinion**, to **belief**, and to **popular belief**. Consider the following claims:

1. Spitting on the sidewalk is illegal.
2. Spitting on the sidewalk is disgusting.

Now consider two ways of substantiating each of these claims: looking in a book, and taking a public opinion poll. In the case of legality, which is a claim of verification, we can readily imagine finding conclusive support in the form of a statute in a law book. But even if 100% of the people responding to a poll said spitting was illegal, it might not be, because legality is determined by laws enacted, not people's opinions. In the other case, however, it seems there can be no definitive answer. Whether we look in a book or do a survey, something is disgusting only if you think it so; and if enough people agree with you, then that opinion is generally accepted in your culture or society.

The point is that using popular opinions to support a claim that must be verified in another manner is a fallacious **appeal to common belief**. Supporting an evaluative statement with factual evidence would be just as fallacious, but much less common. We might call that an **appeal to plausible facts**.

* * *

C. Appeal to Common Practice. Your mother has probably said it to you more times than you can remember: "If everyone else jumped off a bridge, would you jump off the bridge, too?" Well, mothers can be great critical thinkers, and this is one of the best replies to a fallacious appeal to common practice, in which an action is justified because "everyone is doing it." In a sound argument, the action must be justified on its own merits, and what others are doing, and the conclusions they may have reached, are of little or no consequence. Just because "everyone is doing it" (a claim that is often unsupported, exaggerated, or vague in the first place), doesn't make it right to do. Consider the following examples of fallacious appeals to common practice:

- It's ok to copy someone else's homework. Everyone does it once in a while.
- You can pretty well ignore the speed limit in California. Everyone else does.
- Why can't I have my tongue pierced? All the other kids in school are doing it?
- It's ok to cheat on your taxes. I saw a survey that showed more than half of all taxpayers lie about something on their returns.

Appeal to Tradition. Another form of "common practice" is a fallacious appeal to tradition. Instead of using the justification, "Everyone is doing it," in appeal to tradition, the rationalization is, "We've always done it that way." So, for example, everything from two-hour lunches to discrimination on the basis of race or gender can be explained away because "we've always done it that way." Traditions can be very important to us, but it's hard to imagine a harmful action that could be justified solely by the fact that it is traditional.

Two wrongs make a right is a fallacy closely related to appeal to common practice. In this case, the argument is it's acceptable to do something, not because other people are doing it, but because they are doing other things just as bad. Notice that "two wrongs" carries the implicit assumption that the action is **wrong**, but its commission is acceptable in the circumstances, while in "common practice" the suggestion is that a questionable action is made **right** by the frequency of its commission. Notice also that claim of the other's "bad" action is often unsupported, exaggerated, or theoretical—not that its verification would make a second wrong right. In addition, there is often an element of retribution in "two wrongs"—it's not just that other people are doing something wrong, but that they are doing it to **you**, that seems to excuse what, in another situation, you would likely recognize as unacceptable. Here are a few examples:

- I'm not telling the checker that she forgot to charge me for those oranges—this store has been gouging me for years.
- Sure, I'm going to keep those tools I borrowed from Harold. Hell, he'd do the same thing in my position.
- I'm going to cut the jerk ahead of me off, the same way he just cut me off!
- Sure, this prison is cruel and unusual punishment. These guys are criminals, after all.

* * *

D. Appeal to Indirect Consequences. In the fallacy of an appeal to indirect consequences, also known as a slippery slope or domino theory, remotely possible but usually very negative effects are presented as the automatic consequences of a course of action or belief, with the idea that the sheer negativity of those possible effects will be sufficiently persuasive to ensure the rejection of that course of action or belief. In other words, if I can make it seem that your decision, however justified in itself, will produce certain and unavoidably negative outcomes, you will probably change that decision. The issue in a fallacious appeal to indirect consequences, therefore, is how certain and unavoidably negative these effects are. Let's consider some examples of arguments about smoking.

- Jay says that Maya should quit smoking because it leaves an unpleasant odor on her breath, hair, and clothes.

- Kay says that Maya should quit smoking because it has been associated with serious illness and death.

- Ray says that Maya should quit smoking because the inability to overcome an addiction is indicative of a personality unable to meet the stresses and responsibilities of a job or a relationship, and eventually Maya will end up broke, unhappy and alone.

Jay's consequence—the odor—is certainly the most automatic and unavoidable (though smokers are sometimes unaware of the smell themselves, and things can be done to minimize it). Though the consequence is negative, Jay's argument is not fallacious, and Maya should make her decision here on the relative importance to her of smoking and stinking.

Kay's consequences are more dire—illness and death—and more remote. These consequences don't *always* happen to smokers, and even if they do happen to Maya, the onset may be years off (depending, perhaps, on how much Maya smokes and for how long). Yet there is an impressive body of scientific evidence that almost everyone is aware of, which establishes a causal link between smoking and serious illness. At the very least, then, when dealing with Kay's argument, Maya would have to confront the strong probability that smoking is at least increasing her chances of contracting a serious illness significantly, and make her decision accordingly.

No one wants to end up "broke, unhappy and alone," but Ray's argument is obviously the most tenuous of the three. Notice the steps necessary to accept Ray's argument: that the connections are automatic, first between an addiction and a personality disorder, then between having that disorder and succumbing to pressure, then between succumbing to pressure and losing one's job and personal relationships, and finally between losing those relationships and ending up broke, unhappy, and alone. Those many questionable steps are what gives this fallacy its popular names, "slippery slope" and "domino theory," because once you begin accepting its tenuous connections, it's downhill or unstoppable from then on. Ray's argument, then, is a good example of a fallacious appeal to indirect consequences.

Of course, not everything with a long series of consequences is a fallacy; you must learn to differentiate between a <u>chain argument</u> and a fallacious appeal to indirect consequences. Both can have the form "If P then Q, then R, then S, then T . . ." but a chain argument is built on plausible causation and is confirmed a step at a time. In a slippery slope fallacy, the plausibility of its causal links is ignored, and the focus is entirely on the dire results at the end.

* * *

Emotional Appeals

Emotional appeals all have two things in common:

1. They attempt to elicit an emotional response that will serve as the basis of any decision made, <u>instead</u> of presenting an argument and relying on its soundness.
2. As a result, they are <u>never</u> acceptable in an argument, though they can be quite effective in arousing non-rational responses.

Fallacious appeals to emotions are effective because it's easier for most people <u>not</u> to think critically, but to rely on their gut reaction; and it's easier for the person making the appeal to excite his listeners' emotions than to construct a persuasive argument. As a result, those who try to persuade us most often—politicians and advertisers— tend to rely on emotional appeals in order to motivate us to do things that we might not for purely rational reasons.

Fallacious appeals can target almost any emotion, but some are more common than others. In this section, we will be focusing on seven different ones: appeals to <u>fear</u>, <u>loyalty</u>, <u>pity</u>, <u>prejudice</u>, <u>spite</u>, and <u>vanity</u>, and the special case of <u>sex appeal</u>.

* * *

E. Appeal to Fear. Fear and love are two of the strongest emotions, and this sort of non-rational persuasion is usually designed to tap into both of them, by threatening the safety or happiness of ourselves or someone we love.

As a result, it's often called **scare tactics** or **appeal to force** because the threats of force are intended to scare us into agreement or action. Consider the following appeals:

► "Gosh, officer, I know I made an illegal left turn, but if you give me a ticket, I'll have to call my friend the mayor and have a long talk."

► "Gosh, officer, I know I made an illegal left turn, but if you give me a ticket, you better make sure your family is in a really safe place."

► "Gosh, officer, I know I made an illegal left turn, but if you even start to give me a ticket, I'm going to shoot you with this gun."

Notice that the first threat is the most veiled, carried in the implication that the speaker has a powerful friend that can adversely affect the officer's career. The second threat is also veiled—the speaker never says he or she will <u>do</u> anything, and in some situations the advice to ensure the safety of one's family might be considered downright neighborly. But the second appeal is, in other ways, more powerful than the first, because it threatens the officer's <u>family</u> with <u>violence</u>. The threat in the third example is so direct—the speaker has apparently pulled a gun on the officer—that it might not be considered a fallacy at all. Certainly caution would be the best response in each of these cases but, generally speaking, most of the threats encountered in critical thinking are less direct and less violent than these examples.

Remember that, while all appeals to fear involve negative outcomes, not all negative outcomes necessarily derive from fallacies. When the doctor tells you to change your diet or you'll die young, and when the dentist tells you to floss better or you will lose your teeth, they are probably not engaging in a fallacious appeal to fear. Instead, they are explaining to you the demonstrable consequences of your actions, not as a threat but as information upon which they hope you will act.

* * *

F. Appeal to Loyalty. Since humans are social beings, one of our strongest emotions involves attachment to a group, and there are several different ways to appeal to that emotion. One is the general **appeal to loyalty,** which operates on the notion that one should act in concert with (what is claimed to be) the group's best interests, regardless of the merits of the particular case being argued. Chauvinistic slogans, like "My country, right or wrong," are good examples of this sort of non-rational emotionalism, and such appeals are often known by the Latin name for this fallacy, **ad populum**, meaning that it is direct "to the people." But appeal to loyalty can utilize one's attachment to things other than a country, because we also feel loyalty to our friends and family, schools, cities and towns, teams, favorite authors and musicians, and so on.

A variant on the appeal to loyalty is the fallacious use of **peer pressure**. In this case, one's agreement is sought, not on the basis of what is good for the group as in appeal to loyalty, but on the basis of what others in that group would or do think. Peer pressure, then, usually requires a closer relationship with the group connection being exploited than does appeal to loyalty, though both involve the (often implicit) knowledge of what is expected by the group. **Bandwagon**, another variant of appeal to loyalty, is different because it doesn't involve that knowledge of what action is expected by the group. Instead, "getting on the bandwagon" is an expression which indicates that an individual has willingly begun to support a group's goals or arguments or beliefs, merely to be part of a large group, especially if its members are perceived as somehow successful or "winners." Thus, voting for someone because you've read or heard that candidate was by far the most popular, or supporting a ballot initiative because you've read or heard it was supposed to pass overwhelmingly, is an example of bandwagon.

Consider these three examples:

► "Gosh, officer, I know I made an illegal left turn, but we cops have to stick together."

► "Gosh, officer, I know I made an illegal left turn, but what would they say about you down at the stationhouse if they knew you were giving out tickets to other cops?"

► "Gosh, officer, I know I made an illegal left turn, but you've got to get with the program. Everyone else lets other cops off with just a warning."

"Sticking together," in the first example, rather than reaching a conclusion based on the merits of the case, shows how appeal to loyalty works. Wondering what others will think, especially those in a defined group who are in close contact with you, is an example of peer pressure. Finally, doing something because everyone else is doing it is an example of bandwagon. Notice, incidentally, that bandwagon differs from the misdirected appeal to common practice, in that common practice's "everyone is doing it" is given as the reason why the thought or action is <u>proper</u>, but in the bandwagon fallacy there is no necessity for the thought or action to be considered proper, only that the individual would think or do it in order to become part of that large group.

* * *

G. Appeal to Pity. A fallacious appeal to pity, also known as a **sob story**, is different from a simple (and perfectly legitimate) appeal to pity in one significant way: it is used to replace logic, rather than to support it. As far as critical thinking goes, it can be perfectly legitimate for someone to say, "Please give me some money to buy food. I haven't eaten in days." Certainly, this would be an appeal to pity, but as long as the appeal is made in such a way as not to preclude logical consideration of the situation (such as whether the request is appropriate for the problem, whether you can reasonably afford or provide whatever is requested, and so on), it need not be fallacious. When the fallacy does occur, it is usually exhibits either a greatly exaggerated problem or an inappropriate request. Most of all, however, a fallacious appeal to pity uses emotion in place of reason to persuade. Consider these examples:

► "Gosh, officer, I know I made an illegal left turn, but please don't give me a ticket. I've had a hard day, and I was just trying to get over to my aged mother's hospital room, and spend a few minutes with her before I report to my second full-time minimum-wage job, which I have to have as the sole support of the seventeen members of my family."

► "Gosh, officer, I know I made an illegal left turn, but please don't give me a ticket. If you do, they'll suspend my license, I'll lose my insurance, I won't be able to work, and my kids will go hungry."

In neither case are there any reasons given as to why the individual should escape punishment, or why the "pitiful" condition caused the illegal left turn. In the first example, if the description is accurate (often a question in a fallacious appeal to pity), the individual certainly has a difficult life, but none of that means that normal traffic laws should be suspended. The second example seems to mix an appeal to pity with an **appeal to indirect consequences**, making this a "slippery slope sob story" in which receiving the ticket will be the first step in a terrible decline of fortunes. In fact, the first step was the illegal left turn, and there's no reason to expect the consequences solely of getting the ticket to be as dire as suggested.

One oddity about an appeal to pity—fallacious or otherwise—is that it often fails because the emotion is mostly on the side of the one making the argument. If perceived as such, the desire to be pitied, for good reasons or bad, can turn off a listener's emotions, rather than elicit them. Often, a dispassionate but accurate accounting of one's plight is more effective than a tear-filled and self-pitying narrative of the wrongs one has suffered.

* * *

H. Appeal to Prejudice. A prejudice is a predisposition to judge groups of people or things either positively or negatively, even after the facts of a case indicate otherwise. This fallacy is also called an **appeal to stereotypes**, but be sure to distinguish this appeal to a pre-existing prejudice from stereotyping, the sort of generalizations which create stereotypes.

By appealing to a prejudice in the listener, the person making the argument attempts to ensure a favorable reaction. Most often, such an appeal works on negative images, and extreme cases can be classified as so-called "hate speech" when directed against a group defined by race, ethnicity, or gender. However, some appeals to prejudice are devoid of the hatred that is a requisite for a different emotional fallacies—apppeal to spite. Consider this example:

►"Gosh, officer, I know I made an illegal left turn, but there ought to be special laws for those of us proud to be American and driving American cars on American streets, instead of making us follow the same rules as those foreign-made cars that have ruined the economy and put so many of us good Americans out of work."

Conceivably, this statement could be made without hatred, though perhaps some measure of indignation is necessary. Instead, our scofflaw has mixed prejudice with **wishful thinking** to produce the image of how the world would be if people with a prejudice against foreign-made cars were in control.

* * *

I. Appeal to Spite. Appeals to **spite**, to **hatred**, and to **indignation** attempt to tap into the animus a person feels about an individual or group of people or things. They differ from appeal to prejudice in the sense that prejudice works on a pre-existing belief, which may be positive or negative, but spite can be elicited by the attempt at persuasion itself, and is always negative. Of course, we can imagine a case in which there is an appeal to both spite and prejudice. But consider the following example of appeal to spite alone:

►"Gosh, officer, I know I made an illegal left turn, but you know how it feels when you are unappreciated and your work is ignored, while someone else is given the rewards that should really be yours! It seems like there are signs saying "No this" and "No that" everywhere—but just for you—and at some point you just have to end that cycle of mistreatment and show the world you can't be pushed around any more."

This isn't an appeal to pity, because the speaker is inviting the officer into joining him or her in outrage, rather feeling any pity. And it isn't an appeal to prejudice, because the basis for the anger here is more frustration than anything else (though it may also be a combination of various emotions).

* * *

J. Appeal to Vanity. Also known as **apple-polishing**, the strategy behind this fallacy is to create a predisposition toward agreement by paying compliments. The success of the strategy depends on a combination of the vanity of the target and the subtlety of the compliment, and it is usually more effect when the compliment is somehow related to the issue at hand. Consider these two examples:

►"Gosh, officer, I know I made an illegal left turn, but you certainly look handsome in your uniform."

►"Gosh, officer, I know I made an illegal left turn, but it was certainly perceptive of you to notice. You deserve a commendation."

Admittedly, for either of these appeals to succeed in the attempt to avoid a ticket, the officer would have to be remarkably vain. The second example would seem slightly more subtle and relevant, and therefore perhaps more effective, or at least less embarrassing when the officer writes the ticket anyway.

* * *

K. Sex Appeal. Perhaps the most familiar of all emotional appeals, the appeal to (or of) sex is firmly rooted in our biological urges. Like all appeals to emotion, sex appeal has a perfectly acceptable function: it is a powerful reason for making a date, for example. But is it such a good reason for buying a car?

Before answering that, we need to make clear what we mean by "sexy." We think a person is sexy if he or she appeals to our sexual desires. An object can be considered sexy if it heightens or increases the sex appeal of a person (real or hypothetical); in that sense, a sheer negligee, a well-tailored suit, or a stylish car can all be sexy accessories. So, if it is important to you for a car to make you feel sexy, then its sex appeal might be a good reason for buying a specific car. (Of course, it might also be a good reason to take a hard look at your values, and try to put the shallowness of our material culture behind you!)

So there are at least two types of sex appeal when it comes to automobile advertising. Sexy styling, while possibly shallow, is nevertheless a legitimate consideration for some in buying a car. However, a second kind of sex appeal—say, the cleavage of the model in a car ad—is an illegitimate appeal to emotions, which functions by trying to excite someone in a way that impacts on rational decision-making. And it works! As a result, that is exactly the sort of advertising we will be getting, until we collectively refuse to be persuaded by celebrity endorsements, sexy models, and other sorts of emotional manipulations, and demand intelligent and informative ads.

You can, no doubt, imagine many scenes in which sex appeal is used to avoid a ticket. Let's consider this one:

► "Gosh, officer, I know I made an illegal left turn. Let me get my license for you."

"What are you doing, ma'am?"

"Oh, it's okay. I keep my license tucked away here in my brassiere."

Notice that, in appeal to vanity, the speaker makes the most of someone else's appearance, while in sex appeal the persuader (often wordlessly) trades on his or her own features. Note, too, that no offer of sex (or anything else) is being made here—whatever suggestiveness there may be in where the woman keeps her license. That is important, for sex appeal as well as all other emotional appeals, because **once the attempt at persuasion goes beyond a simple appeal to the emotions, and involves a tangible reward or exchange, then it ceases to be a fallacy, and becomes a bribe**.

19. *Ad Hominem* Fallacies

One of the most common non-rational appeals is an *argumentum ad hominem*—or, as the Latin phrase suggests, an "argument against the person" (and not against the ideas he or she is presenting). Our decisions should be based on a rational evaluation of the arguments with which we are presented, not on an emotional reaction to the person or persons making that argument. But because we often react more strongly to personalities than to the sometimes abstract and complex arguments they are making, *ad hominem* appeals are often very effective with someone who is not thinking critically. Consider a few examples:

- A political candidate is gaining support by proposing a tax change. So her opponent argues that the candidate herself would be one of the chief beneficiaries of that tax change.

- Your doctor tells you to lose some weight. But why should you listen to a doctor who is himself overweight?

- A friend has recommended a new investment opportunity, but your significant other rejects the recommendation with the remark, "How could you possibly value the advice of that idiot?"

In each of these cases, there is an argument (concerning taxes, health, or investments); and in each, the argument is given less importance than something about the person making that argument. And that's what is wrong with *ad hominem* appeals. After all, if the tax proposal is an improvement, if the medical diagnosis is sound, if the investment opportunity is worthwhile—then what difference does it make who is presenting the argument—or even *why*?

Ad hominem fallacies take a number of different forms, though all share the fact that they attempt to re-focus attention, away from the argument made and onto the person making it. And remember—**it doesn't really matter whether the terms of the attack are true or false**. What matters is whether the argument is acceptable, not the person arguing it. After all, even if Adolf Hitler says so, 2 + 2 still equals 4.
Among the most frequent *ad hominem* appeals are attacks on:

- **personality, traits, or identity:**
    - "Are you going to agree with what that racist pig is saying?"
    - "Of course she's in favor of affirmative action. What do you expect from a black woman?"

- **affiliation, profession, or situation:**
    - "What's the point of asking students whether they support raising tuition? They're always against any increase."
    - "Oh yeah, prison reform sounds great—until you realize that the man proposing it is himself an ex-con."

- **inconsistent or contradictory actions, statements, or beliefs:**
    - "How can you follow a doctor's advice if she doesn't follow it herself?"
    - "Sure, he says that today, but yesterday he said just the opposite."

- **source or association for ideas or support:**
    - "Don't vote for that new initiative—it was written by the insurance lobby!"
    - "You can't possibly accept the findings of that study on smoking—it was paid for by the tobacco industry."

The point is that each **argument** must be evaluated in its own right. Information or suspicions about vested interests, hidden agendas, predilections, or prejudices should, at most, make you more vigilant in your scrutiny of that argument—but they should not be allowed to influence its evaluation. Only in the case of **opinions**, expert and otherwise, where you must rely not on the argument or evidence being presented but on the judgment of someone else, may personal or background information be used to evaluate the ideas expressed. If, for example, a used car vendor tries to prove to you that the car in question is being offered at lower than the average or "blue book" price, you must ignore the fact that the vendor will profit from the sale, and evaluate the proof. If, on the other hand, that used car vendor says, "Trust me, this is a good deal," without further proofs or arguments, you are entitled to take into account the profit motive, the shady reputation of the profession, and anything else you deem to be relevant as a condition of "trust."

20. Fallacious Generalizations

Generalizations can be a valid method of argument. Inductive reasoning, in particular, is based on the ability to generalize from repeated experiences or observations. The soundness of an inductive generalization can usually be determined by asking the following questions:

1. Do we have a sufficient number of instances to draw a conclusion?
2. Is the breadth of the conclusion drawn supported by the evidence?
3. Are the terms of the conclusion consistent with the terms of the evidence?

Fallacies result if any of these questions can be answered in the negative.

A **hasty generalization** is one in which there is an insufficient number of instances on which to base the generalization. Consider the following examples:

1. Jana has been to San Diego several times, and the sky was always blue and the temperature ideal. The weather must be perfect in San Diego all the time.
2. Tina bought a used camera while she was up in Portland, and got a great deal. Portland must be a good place to buy used cameras.
3. I read where there have been no reported cases of HIV infection in Liberty Lake. The people of Liberty Lake must be free of the HIV virus.

In the first two examples, generalizations were made on the basis of little evidence—several days in San Diego, one camera purchased in Portland. These clearly provide an insufficient basis for the conclusions they are used to support, and are therefore examples of hasty generalizations.

The third example is a little different. There, a generalization is made on the basis of **no** evidence at all. The lack of evidence to the contrary should never be used as sufficient grounds for any generalization. For example, the absence of a suspect's fingerprints on the murder weapon is not sufficient in itself to prove his innocence, nor is the lack of any evidence of life in soil samples taken so far on Mars sufficient in itself to prove that no life exists there. This is a special case of hasty generalization, usually known by its Latin name, **argumentum a silentio**, or **argument from silence**, because instead evidence to support the argument, all we hear is silence.

The problem in each of these cases should be obvious: without more data, we have no way of knowing if the evidence presented is representative or not. Maybe Jana happened each time to visit San Diego during unusually good weather, maybe Tina was really lucky to get a good deal on the camera, maybe people are reluctant to reveal that they are HIV-positive in Liberty Lake. Without sufficient support for the generalization, these are just anecdotes.

A **sweeping generalization** is one in which there seems to be sufficient evidence offered to draw a conclusion, but the conclusion drawn far exceeds what the evidence supports. Consider these examples:

1. The profit margin on HP's printer line has been a steady 25% for two years. We can assume, then, that the profits company-wide have also been 25%.
2. The poll from Orange County shows the governor winning in a landslide. I guess he will also win across the state just as easily.

In each example, the conclusion drawn far exceeds what the evidence would support. For all we know, the printer line is part of HP's profitable personal computer division, and we might be able to extend the findings to similar products in HP's line, but not to the full line itself without a great deal more information. In the second example, we could certainly conclude that the governor will win in Orange County, and perhaps we might be willing to conclude that the governor should be favored in **similar** counties, though the nature of the similarity may not, at first, be very apparent—if geographical, demographic, political, and economic, and so on. But assuming that the entire state is somehow similar to Orange County, which is an assumption that you would have to accept to make this argument, is stretching the evidence of similarities well beyond the limit.

The third question about a generalization asks about consistent terms. Consider the following examples:

1. I used only delicious ingredients, so this sauce must be delicious.
2. The 49ers are the best team, so they must have the best players.

The problem in both is that non-equivalent terms have been **substituted**: the parts (ingredients) for the whole (sauce) in the first example, and the whole (team) for its parts (players) in the second. Notice how this fallacy usually involves the replacement of a **plural noun**, such as “ingredients” and “players,” with a singular, **collective noun**, such as “sauce” and “team.” And, generally speaking, the whole (the collective noun) is often more or less than the sum of its parts (the plural noun). Substituting the whole for its parts, the sauce for its ingredients, is sometimes called the **fallacy of composition**. Substituting the parts for the whole, or the players for the team, is sometimes called the **fallacy of division**.

21. Post Hoc Reasoning

One of the rules of causal arguments is that the cause must precede the effect in time. In other words, for A to cause B, it is **necessary** for A to precede B in time. But it is not **sufficient**. Just because A precedes B in time—and even if A precedes B every time—does not prove that A causes B. Arguing that "A preceded B, and therefore A caused B" is a fallacy called **post hoc** or **false cause** reasoning. The former term is short for the Latin phrase, **post hoc ergo propter hoc**, meaning "after this, therefore because of this." Consider the following examples:

1. Whenever Fyodor strikes the flint with iron, he makes a spark.
2. Whenever John thinks he is going to hiccup, he takes a deep breath.
3. Whenever Nkrumah enters this line of code, his program crashes.
4. Alison always wins whenever she wears her lucky headband.
5. The barometer drops whenever it is going to rain.

In the first case, the apparent cause (striking the flint with iron) occurs before the apparent effect (the spark), as is true in both causation and post hoc reasoning. To argue that this is **not** merely post hoc, then, requires some **causal connection** between the striking and the spark. Since one of the physical properties of flint is that it produces a spark when struck by iron, we can conclude that striking the flint with iron **caused** the spark. Notice that this is only valid if we assume that we have accounted for all relevant details. If, for example, we also know that a live electric wire is arcing near the iron, the cause of the spark may be in doubt.

In the second case, it may seem at first as though the hiccup is causing John to take a deep breath, and therefore that the effect (breath) actually **precedes** the cause in time. But what really causes John to take that breath is his **thinking** that he is about to hiccup.

The third case may be our first example of post hoc reasoning. Inserting the code precedes the crash, but to know that it **causes** the crash Nkrumah would have to have a relevant explanation of how the crash occurs. Otherwise, it is just as possible that a bug somewhere else in the program is causing the crash, but that the crash only occurs once this line is entered because the only way that the section with the bug in it is accessed is by this line.

Alison may be superstitious, but is she wrong to believe that her headband causes her to win? Since there is probably no likely physical explanation of the causal link between winning and the headband (such as, "she can see better because her hair is out of her eyes"), we may be inclined to consider this a post hoc fallacy. And it remains a post hoc fallacy even if we consider a psychological explanation: like Dumbo's feather, Alison's headband gives her confidence, and that confidence enables her to win. Because such a psychological explanation seems **secondary**, it needs to be discussed explicitly before the conclusion, that the headband caused the winning, can be accepted, and even then it would probably be one of many "indirect" causes.

Notice that many superstitions are post hoc fallacies, and are often phrased so vaguely that they will almost inevitably be fulfilled in the normal course of events. Bad luck, for example, may happen to someone who walks under a ladder, but good and bad things happen to almost everyone with regularity, and there is nothing to link the act (walking under the ladder) and the supposed consequence (some particular instance of misfortune).

The reason the barometer drops is that the atmospheric pressure it measures has dropped. And an atmospheric low often leads to rain. So there is a common cause for the barometer drop and the rain, but it would be a post hoc fallacy to argue that the barometer change **causes** the rain. If that were true, we could avoid rain by physically forcing a barometer's indicator higher.

22. Fallacy: Straw Man

> *Politician:* My opponent believes that higher taxes are the only way to pay for needed improvements. She never met a tax she didn't like. But I have a better idea: let's cut waste in government first.

Why are politicians always so willing to tell you what the other side thinks? One reason is that, in explaining someone else's views, we have a chance to oversimplify and even falsify them. In the example above, is it really likely that the opponent **prefers** raising taxes to cutting waste in government? Probably, her position is much more complex than that, and makes better sense. But in oversimplifying her position, this politician makes it seem the choice between them is obvious. And that is the purpose of this technique, which we call "straw man" (like a scarecrow) because it relies on the **creation of a false image** of someone else's statements, ideas, or beliefs.

A "straw man" is rarely based on actions, instead of comments or beliefs. Usually actions are too unambiguous to suffer the oversimplification of a "straw man," and simple mischaracterization is not a fallacy, but a weakness in the support of a claim. For example, claiming someone has voted for raising taxes, when the vote was really in favor of a bill raising some taxes but cutting many more, would not be a "straw man" in itself, but might be used in combination with misstatements of the person's comments and policies to create a false-image fallacy.

Politics provides lots of examples of the "straw man" fallacy, some fairly subtle. In the 1988 vice-presidential debate between Dan Quayle and Lloyd Bentsen, Quayle made the mistake of deflecting questions about his youth and inexperience with the observation that John F. Kennedy was even younger when he ran for president. Then Bentsen, in a famous retort that was the most telling moment of the debate, said to Quayle, "I knew Jack Kennedy. Jack Kennedy was a friend of mine. And, Senator, you're no Jack Kennedy." This proved to be an effective and memorable remark—but did Quayle ever say he **was** a "Jack Kennedy"? Did he really intend to compare himself to Kennedy, or was he using Kennedy merely as an example that one's age doesn't necessarily determine one's qualifications? Bentsen, obviously a consummate debater, was able to create a false image of his opponent's remarks with the man still standing there in front of a national television audience.

One person's account of the statements or views of another is not always a case of a "straw man" fallacy. But you can judge such an account in the same way you judge any authority or expert testimony: by who that authority is, by the apparent accuracy of the account, and—in the case of straw man—by the likelihood that the person being discussed would agree, for the most part, with the description of his or her statements or views.

23. Fallacy: Shifting the Burden of Proof

Scully: Your sister was abducted by aliens? Mulder, that's ridiculous!

Mulder: Well, until you can prove it **didn't** happen, you'll just have to accept it as true.

The truth may be out there, but who has the job of producing it in an argument? In the section on "Validity, Truth, and Soundness," we discuss the concept of a burden of proof, which is defined there as "how much each side of a dispute needs to prove in order to win someone's agreement." Sometimes, however, whoever is carrying the heavier burden attempts to shift that onus onto the other side—as Mulder does above. In claiming that his sister was abducted by aliens, he carries a much greater burden of proof, because we normally consider alien-abduction stories as incredible; as a result, it is up to Mulder to produce proof of his claim. But in the dialogue above, he **shifts** that burden to Scully, creating the fallacious impression that, if Scully can't prove it false, Mulder's alien-abduction story must be true. On the contrary, since Mulder is making an incredible claim, it is up to him to support it.

In easily verifiable claims, the person initiating the claim normally assumes the burden of proof. Not doing so, however, should probably not be considered a fallacy. The fallacy occurs whenever someone shifts the burden of proof to avoid the difficulty of substantiating a claim which would be very difficult to support.

24. Fallacy: Circular Reasoning

What's the difference between a valid deductive argument and a fallacy? In the case of the fallacy of **circular reasoning**, the difference is not be as obvious as you might expect. In the fallacy of circular reasoning, which is often called **begging the question**, you **assume** to be true what you are supposed to be **proving**. But that's also true for all valid deductions, where the conclusion (what you are trying to prove) is derived from the premises or assumptions. This difference is that, in circular reasoning, the conclusion is contained in **a single premise or assumption**, while in a deductive argument the conclusion is derived from **both** premises. Consider the following exchanges:

<u>Deductive Reasoning (Valid)</u>

> *Sports Fan #1:* What makes you say Australian Rules Football is the most exciting sport in the world?
>
> *Sports Fan #2:* Because it is the fastest and highest scoring form of football, and whatever is the fastest and highest scoring form of football must be the most exciting sport in the world.

<u>Circular Reasoning (Fallacious)</u>

> *Sports Fan #1:* What makes you say Australian Rules Football is the most exciting sport in the world?
>
> *Sports Fan #2:* Because it is.

In both examples, the conclusion has been assumed in the premises. But the first argument follows a valid pattern: If P (fastest and highest scoring), then Q (most exciting). Aussie Rules Football is P (fastest and highest scoring), therefore Aussie Rules Football is Q (most exciting). But in the second example, the one for circular reasoning, the conclusion has been assumed entirely (or almost entirely) in a single premise. As a result, the conclusion of a circular argument can be seen as just a **restatement** of its only premise. It's like saying, "A is B, therefore A is B."

Often, however, circular reasoning is more subtle than this: it depends on an assumption not stated but assumed. Consider the famous argument of the French philosopher, René Descartes: "I think, therefore I am." Descartes has begged the question here, because when he said "I think," he'd already implied "I am" (or how else could he think?). Yet his fallacy continues to persuade people, over three hundred years later.

25. Fallacy: Loaded Questions and Complex Claims

1. *Your father:* Did you enjoy spoiling the dinner for everyone else?
2. *Your mother:* Well, I hope you enjoyed making a fool of me in front of all my friends.
3. *Your boss:* Can you begin to appreciate this wonderful opportunity I'm making available to you?
4. *Your significant other:* Have you finally stopped flirting with Dana?
5. *Your critical thinking instructor:* Aren't you ashamed about how little effort you've made in this class?

Complex claims and questions—that is, ones that combine two or more questionable terms—present a special problem, if they are constructed in such a way that agreement **or** disagreement with one term seems to imply agreement with the second. In the first example above, the reply, "No I didn't," can be taken to mean, "I didn't enjoy it, but I did spoil the dinner," when it may actually be intended as a denial that the dinner was spoiled.

Questions like the one in the first example are usually called **loaded questions**, because, like loaded dice, they seem to produce a predictable outcome: as long as the response to a complex question or claim is simple, usually just "yes" or "no," then the person responding seems to be assenting to something he or she normally would not.

The impulse to give a simple response is strongest in reply to certain questions, and so loaded questions are the more common form of this fallacy. But complex claims can have the same effect, as in the second example above. You might protest, "Mom! No, I certainly didn't," but that would only sound as though you made a fool out of her in front of her friends, and didn't even enjoy it!

The relationship between the speaker and the responder, and the situation in which the question is asked, greatly affects the "success" of a loaded question. But just as important is that the question must be constructed in a way that clearly prompts a "yes" or "no" answer, and that the least agreeable element of complexity be buried in the sentence. Consider the third example. Since you would want to appear properly appreciative to your boss, you might answer this question affirmatively before considering whether such a response would commit you to agreeing that the opportunity is, in fact, wonderful, and that your boss has, in fact, made it available to you.

In the same way, the fourth example seems to demand a quick denial, but saying simply "No," suggests not only that you have been flirting with Dana, but that you are continuing to do so. But would you ever answer "yes"?

Finally, the fifth example shows that critical thinking instructors are not above fallaciously promoting a little guilt to get students to study harder. Answering the question as asked, with "yes" or "no," would only accept or deny the claim that you are ashamed, but in either case it would also seem to acquiesce in the notion that you haven't made much of an effort.

The solution to this fallacy is simple: **A complex question or claim requires a complex response.** Do not allow the question to dictate your answer. Instead, without prefacing your response with "yes" or "no," indicate whether you agree or disagree with the characterization implied by each term in succession: "Dad, I didn't mean to spoil the dinner, I don't think I did, and I certainly wouldn't have enjoyed it if I thought I had"; "Mom, I hope I didn't make a fool of you, in front of your friends or at any other time, and I certainly wouldn't have enjoyed it had I done anything that might make you think that"; "Boss, I do appreciate the opportunity, but I just don't think it's very wonderful"; "Honey, I wasn't flirting with Dana, so I can't stop something I wasn't doing"; "Professor, aren't you ashamed of yourself, fallaciously attacking my self-esteem with an intentionally loaded question?" Sometimes, answering a loaded question with another loaded question is the best reply.

26. False Dilemma (Either-Or Fallacy, Black and White Fallacy).

As explained in the section on options, whenever you are presented with two possibilities, it is crucial to establish whether those possibilities are **contradictions, contraries, or choices**. Presenting two options as if they were contradictions or contraries, when in fact they are not, is the common fallacy of **false dilemma**—so called because the "dilemma," or hard choice between two options, is "false," because other options than the two offered are possible. This fallacy is also known as the "either-or fallacy" because it makes you think that your options are limited to either one or the other. Consider the following "patriotic" examples:

1. America: love it or leave it.
2. My country right or wrong.
3. Better dead than red.

All three examples simplify the issues they concern. "America: love it or leave it" offers only two options, but there are plenty of others. Staying but not loving it, and leaving but still loving it, are only two of the many possibilities. Notice the difference between this false dilemma and the similar claim, "America: if you don't love it, you ought to leave it." The latter is a statement of advocacy, and while the options seem to be the same (loving or leaving), the result is quite different. "You ought to leave it" does not imply this is the only alternative, only that it is the most **proper** alternative. The claim thereby suggests there are good reasons for advocating the option of "leaving," instead of limiting consideration, as does the fallacy, to "leaving" as the **only** other option.

The second example, "My country right or wrong," is **not** a false dilemma. The phrase means something like, "It's my country, whether the country acts properly or not." There are no options involved; and this example serves as a good reminder not to assume that every claim containing an "or" is necessarily an option, let alone a false dilemma.

Finally, "Better dead than red," a Cold War slogan meaning that someone would rather die fighting than live under Communism, is another example of a false dilemma. There are, no doubt, some instances where one must choose between those two alternatives, and no others; context is often necessary to make a definitive judgment on a fallacy. But most contexts in which the phrase was used had many other options.

As you can see, you must be especially careful any time an argument seems to be presenting you with only two options. Yet the way such attempts at persuasion are worded, we often feel compelled to respond in those terms. Imagine someone asking, "Are you with us or against us?" You might be tricked into deciding between those two options, but the best response would be to say, "Wait a minute! Those are **not** the only two possibilities."

Your first response, then, should be to establish whether A and B, the two options you've been given, are either contradictory or contrary in the context. The following questions should help:

►Does rejecting A necessarily mean accepting B? If so, A and B are **contradictory**.

►Does accepting A necessarily mean rejecting B? If so, A and B are either **contrary or contradictory**.

But a simpler way would be to ask:

►Are any other pertinent responses possible?

If there are, you are dealing with a false dilemma.

27. The Unfair Fallacy

1. *Student:* Elder’s essay was better, because he gave both sides of the issue. Oppenheimer’s was more one-sided, so it wasn’t as persuasive.
2. *Poll Results:* When asked whether they believed the Republicans’ estimate of $3 billion, or the Democrats’ estimate of $6 billion, most Americans gave a figure somewhere in between.

It is important to be fair in making judgments, but equal treatment of good and bad arguments makes no sense. Just because there are two sides to every dispute doesn’t mean that there is always something worthwhile to say on both sides. In effect, to require someone to be “fair” by presenting both sides of a dispute, as in the first example, or by splitting the difference between two sides, as in the second, is to make a judgment about the dispute before evaluating the validity and soundness of the arguments being made—and that, by definition, is a fallacy.

We can distinguish between two kinds of “unfair fallacies,” corresponding to the two examples above:

►False Equity

►False Compromise

The fallacy of **false equity**, or evenhandedness, can be committed either by someone making an argument, or someone analyzing one. While it is often a good strategy to cover both sides of an argument (without, of course, oversimplifying one side or the other into a “straw man”), such a strategy is never a necessary requirement of a good argument; and we also should not be swayed by someone simply because he or she does cover both sides. For example, in a debate on legalizing murder, would we be any more likely to reject the anti-murder argument just because the debater found nothing good to say about murder? Or would we be any less likely to reject the pro-murder argument just because the person making it finds a few nice things to say about non-violence?

The fallacy of **false compromise** usually occurs when we don’t know or care much about the terms of the debate. In that case, we are often willing simply to split the difference, rather than learn enough to make an informed judgment. That solution may be expedient, but it’s not necessarily the right one. If Johnny thinks that two plus two equals four, and his friend Petey thinks they equal six, splitting the difference and saying they equal five is obviously erroneous. Without looking at the arguments being made, we can never rule out the possibility that one side is completely right, and the other side is completely wrong. If the issues under debate are too complicated or specialized for us to make an informed decision, then we should **suspend judgment**, rather than create a false compromise.

Part IV

Reasoning in Context

28. Introduction to Statistics

You've probably heard the saying, attributed to Mark Twain in the United States, to Benjamin Disraeli in England, and to numerous others in various languages around the world, that there are three kinds of lies: lies, damned lies, and statistics. Of course, Mark Twain never said half of the things that are attributed to him, and he certainly didn't originate this. We just like to associate popular sentiments with famous figures. In this case, the popular sentiment reveals a deep distrust of statistics.

In fact, the problem is not really with statistics themselves, but with the way we use and understand them. By themselves, statistics mean nothing: they serve merely as evidence to support a claim. And, as with all evidence, we must evaluate both the accuracy and the application of all statistics. In other words, we need to ask whether a statistic is true, and whether it supports the argument.

Unfortunately, many people are persuaded by the mere use of statistics. Consider your own reactions: what if we had written above, "Mark Twain never said 50% of the things that are attributed to him." "50%" means exactly the same thing as "half," yet using a number instead of a word may make the statement sound more authoritative or more definite. Anyway, who could possibly know how many sayings are attributed to Mark Twain, in order to derive a ratio such as this? In this case, we understand "half" as implying simply that "a lot" of the things attributed to Mark Twain did not originate with him; but the apparent concreteness of "50%" suggests there must be more evidence behind that statistic. Of course, there isn't. Statistics, like all evidence, can be erroneous, misrepresented, manufactured, and ambiguous. The evaluation of statistics, then, begins with an understanding of what statistics are and how they are generated.

The term **statistics** refers to **quantitative data**, that is, information that has been measured or calculated, and can be expressed as a numerical value. As such, statistics can sometimes bring a sense of clarity to very complex problems. But that clarity often comes at the cost of oversimplification, and in order to guard against this there are some basic questions you should ask whenever dealing with statistics.

A. Is the statistic absolute or relative?

An **absolute** statistic is one that gives the total number; a **relative** statistic presents that information in terms of some other kind of reference. Consider, for example, the following statement:

- There were 117 deaths attributed to drunken driving in the county last year.
- Every three days last year, someone died due to drunk driving.
- Last year, 10% fewer people were killed in the county by drunk drivers.

The first statement is uses an absolute statistic; the other two employ relative ones. The second one relates the death rate from drunk driving to the number of days in a year, the third to the rate from the previous year. Because each of these usages contributes slightly different information, they are all valuable expressions of the same statistic.

The problem is that we are often given only **one** sort of statistic—the one that is most favorable to the position of the person or group making the argument. Consider these very different statements:

- We have to do something about the crime rate! It doubled last year.
- Crime remains low here. There were only two burglaries committed last year.
- Crime is out of hand. Last year, everyone was directly affected by a serious crime.

Each of these claims is based on a single statistic: the first and third are relative figures, the second absolute. But a little more information might significantly affect our reaction to these statistics. What if, for example, the area being discussed had only two residents: the previous year, there was only one crime, a robbery; this year, there was two crimes, both robberies; and both residents were robbed. "Doubling the crime rate," a relative expression, seems like a lot, until you find out that in absolute terms it only went from one to two. And the absolute number of "two burglaries" sounds low, until you find out that it means everyone in the area was robbed.
The examples above illustrate how statistics can be presented in very misleading ways. Without further information, we might have accepted either of the first two as convincing evidence of the crime rate. The presentation of either relative or absolute statistics on their own should certainly increase your skepticism; in that case, it is important to imagine how more information or another kind of presentation might affect the slant. But important details can be left out even when a statistic is given both relative and absolute expressions, so you should not let your guard down even when a figure is given multiple presentations.

B. Is the statistic individual or collective?

An easier problem to deal with is whether the statistic given is an **average** or a **cumulative total—** that is, whether it applies to each individual in a group, or to the group collectively. Consider these claims:
- Students put in more hours of study than their professors.
- Fans of professional sports earn more money than the players do.
- Children under 16 earn millions of dollars annually.

In each of those examples, the statistic offered is **collective**. Since there are twenty times more students than professors, it's not hard to believe that students **as a group** put in more hours than do their professors. And, although professional athletes earn high average salaries, since there are thousands of fans for each player, it should be obvious that the fans **as a group** earn more. Finally, while it is rare for a child under 16 to earn a million dollars, **as a group** children no doubt earn far in excess of that amount.

As with relative and absolute statistics, the best solution for any problem with individual or collective figures is to insist on as much information as possible. If you are unsure about whether a statistic is to be applied individually or collectively, and that statistic is of central importance to the strength of an argument, it is probably best to suspend judgment.

C. How were the statistics generated?

Statistics can be generated in two ways: by enumeration, and estimation. **Enumeration** requires a direct counting or measuring of the entire subject, while **estimation** studies only part of the subject, and then approximates what the results would have been if they had been based on the whole. Obviously, enumeration produces more reliable figures, but it is often impractical or impossible to deal with extremely large or diverse or distant subjects.

If, for example, we wanted to know the average number of credits earned by a student at San Jose State University last semester, we might simply have the computer that keeps track of such data calculate the result. Since that result would be an average based on the record of every student at SJSU during the semester, it would be an **enumeration**.

But what if the computer were not available? Then we might try asking each and every student but, with nearly 30,000 students, this enumeration would be a long and expensive task, especially taking into account students from last semester that are no longer attending SJSU and would need to be identified, located, and contacted off-campus. Instead, we might try a process of **estimation** known as **sampling**. Rather than ask every student, we could as a **representative sample** of the students who attended last semester, and then estimate the accuracy of our results when applied to the whole, based on the size and representativeness of our sample. So, if we sampled a group of 1,000 students, who were representative of the whole in every way we could imagine, including major, year in school, age, gender, race, marital status, number of children, weekly hours of work, amount of financial aid, and so on, we could assume that our results would closely approximate the results we might have obtained by enumerating the entire student body.

D. If an estimation, what is the margin of error?

Whenever we rely on a sampling technique to create an estimate, we take the risk that our results do not accurately represent the whole. Ways to minimize these risks will be covered in a later section, on surveys and experiments, but nothing can make those risks disappear entirely. Those risks are usually expressed as a range, and that range is called the **margin of error** or the **confidence interval**. What this all means is that **the results of a sample-based estimation are repeatable 95% of the time within the margin of error**.

Let's imagine a poll of 1000 likely voters showing 54% supporting Clinton, 46% supporting Dole, and a margin of error of plus or minus 3%. That means that we can be 95% sure that Clinton is favored by 51-57% of likely voters, and Dole is favored by 43-49%. Notice that we cannot be sure where in the range represented by the margin of error the true figure should be: it is just as likely that Clinton is leading 57% to Dole's 43%, or that Dole is just two percent back, at 49% to 51% for Clinton, as it is that the initial figures of 54% to 46% are accurate. In fact, all we can really conclude is that, if the difference between two results is **greater than the margin of error**, then that difference is **statistically significant**, and if the difference is less than the margin of error—no matter how big that difference may be—then it is statistically insignificant.

The most important factor in figuring the margin of error is the sample size. As the size goes up, the margin of error decreases. Usually, a sample size of 500 produces a margin of error of about plus or minus 5%; doubling the sample size to 1000 will knock a couple of percentage points off the margin or error; choosing a sample of only 100 will put the margin of error well over plus or minus 10%. Had our sample size in the Clinton-Dole poll above been smaller, for example, the margin of error would have been larger. At a confidence interval of plus or minus 4%, the difference between 54% and 46% becomes statistically insignificant, and we cannot say, within 95% accuracy, who is leading between the two.

It is also important to remember that the margin of error is not based on the whole sample, but on the number of individuals in a group whose answers are being considered together. Thus, in the Clinton-Dole example above, if exactly half the 1000-person sample were women and we were looking at the difference between the way men and women were voting, then the size of the sample group would be 500 for men and 500 for women, and the margin of error would go up accordingly.

Too often, those using surveys and estimations fail to give the margin of error or ignore its significance. In such cases, it will be up to you to determine whether consider the information at all, or suspend judgment on the argument because the evidence has been presented in an unreliable form.

29. Averages

On one hand, there is the joke on Garson Keillor's Prairie Home Companion that, in Lake Wobegone, "all the men are strong, all the women are beautiful, and all the children are above average." On the other hand, in defense of an admittedly mediocre nominee for the U.S. Supreme Court a few years ago, one senator argued that there ought to be at least one justice that was just average, because that's what most Americans are. Fortunately (or, more often, unfortunately), "averages" are one of the most manipulated concepts in statistics and, as we will see, it may be quite possible for most (if not all) children to be "above average," while at the same time even more likely that almost no one is, in fact, "average."

As we saw in the section on statistics, confusion sometimes arises over whether a particular figure represents a cumulative total for the whole group, or the average for each individual in the group. Just knowing the figure is an average, however, does not necessarily eliminate confusion, because there are several different kinds of "averages":

Mean. Generally, to find the average of a list of figures, we total the list and then divide that total by the number of figures on the list. So, to find the average of 6, 10, 6, 2, and 6, we first total the list (30), then divide that total by the number of figures on the list (5). 30 divided by 5 equals 6, which is the average. Or, more accurately, that is the mean average of that list. The mean is the most common kind of average; but just because no information to the contrary is offered, you should not assume that every average is a mean average.

Median. The second most common sort of average is a median, which you identify by putting the figures in a list in ascending (or descending) order. The middle number on the list is then the median. Using the list above, for example, we would first put the numbers in ascending order (2, 6, 6, 6, 10), and then count up or down three to find the median, which would be 6.

Mode. The third way to figure an average looks at frequency of occurrence. Once again, the figures on the list are put in ascending (or descending) order. The figure that has recurred the most often is the mode. In the list above (2, 6, 6, 6, 10), the mode is 6.
In the example used above, the average for this particular list was the same, whether mean, median, or mode, but that is unusual. For example, for a list of 1, 2, 3, 7, 7, the mean is (20 divided by 5) is 4, the median is 3, and the mode is 7. But the point in having three very different ways to measure averages is that, depending on the situation, one may be much more informative than the other two. Most often, the most informative average is the mean, but not always.

Let's take the case of the number of children in the average American family. Of course, the definition of "family" has undergone considerable revision in the last fifty years. We don't have time to get into that issue right here, but it's a good reminder that problems in using statistics often have nothing to do with the actual process of gathering or interpreting those figures. For example, until quite recently, the State of California enumerated as "out-of-wedlock" any birth in which the mother's surname was not the same as the father's—despite the fact that for decades a large percentage of women have preferred not to change their names when married. The result was an inflated total for babies born to unmarried parents—and a statistic that could be used as evidence of extramarital sexual activity, or (according to some) a level of immorality, that did not in fact exist.

But let's get back to the number of children in the average American family. That figure has recently been given as 2.1. Comedians like to tell jokes about the one-tenth of a child, but the decimal makes it clear that this figure is a mean—and, to express it accurately, we should say "the average number of children in the American family." Notice that this does not mean that half of the families have more than 2.1 children and half have less, but that half of all children are in families above and below that mark. In fact, the vast majority of families have less than 2.1 children.

How is that possible? Because there can be no less than 0 children per family, but as many as 15 or more, we say that the population under study is skewed toward the upper end. A graph made of the number of children per family would not produce a nice, symmetrical bell curve, but one that starts high on the left (at 0), goes up a little (at 1 and 2), and then tails off gradually as it moves to the right (and as the number of children increases). So, while this mean average gives us an accurate picture of the distribution of children according to family size, it does not help much if we are interested in distribution of families. In other words, if we want to find the size of the "average American family," that is, the number of children that half of U.S. families have more than, and half less, we might use a median average.

And while we are on American family life, we can see the same sort of problem with another often-cited statistic, the one about half of all marriages ending in divorce. In fact, most people that get married never get divorced—even in California! This statistic is based on another skewed population: its graph would be at the highest point on the left (at 0), and taper off as the number of divorces increases. To see how this works, let's say that 60% of all people who get married never divorce, 10% get married twice, 10% get married three times, 10% get married four times, and 10% get married five times. For every one hundred married people, then, the once-married would have been involved in 60 marriages, the twice-married in 20 marriages, the thrice-married in 30 marriages, those married four times in 40, and the last group in 50 marriages. That's a total of 200 marriages, 100 of which ended in divorce, and 100 of which did not. So you can see that the same information can be used to support what seem to be conflicting claims: that half of all marriages end in divorce, and that most married people (60%) never get divorced. (Please note that, to simplify this example, I have not taken into account those that divorce and never remarry, nor have I bothered to adjust the figures to reflect the fact that each marriage involves two people. And, incidentally, because of the skewing created by those who remarry many times, the real percentage of married couples that never divorce is actually higher than 60%.)

So, when faced with a statistical average, what is a critical thinker to do?

Remember that statistics, like other sort of evidence, are only used to support claims being used as premises in an argument. The first issue is always the argument's validity, and only once that has been established should you consider its soundness. Solid support will make the premises seem stronger, and the argument more persuasive, but you should always be a little skeptical if that support comes in the form of a statistic, especially a statistical average.

In the case of an average, you should try to determine whether you are dealing with a mean, median, or mode, and how appropriate each of those would be in expressing the information under consideration.

Unfortunately, we often must make judgments without having total confidence in the evidence on which they are based. If you have good reason to doubt the accuracy of a statistic, then suspend judgment on the argument while pursuing that information. However, if the statistic comes from what you consider a reliable source, and if you have no reason to doubt it, then quibbling about it simply because it is a statistical average is probably counterproductive.

So, having considered the statistic offered, the authority of its source (if given), the appropriateness of the (likely) averaging method, and the validity and soundness of the argument it is being used to support, if you find no reason to reject that figure, or to suspend judgment while investigating further, then accept the evidence.

A. Which of the following averages most likely reflect enumeration and which estimation?

1. The Dow-Jones Industrial Average?
   a. Enumeration. b. Estimation.

2. Average rainfall?
   a. Enumeration. b. Estimation.

3. Opinion polls?
   a. Enumeration. b. Estimation.

4. Batting average in baseball?
   a. Enumeration. b. Estimation.

5.Life expectancy?
   a. Enumeration. b. Estimation.

6. Average salary for a given occupation?
   a. Enumeration. b. Estimation.

B. Which of the following averages are most likely a mean, a median, or a mode?

7. Average housing price in Santa Clara County?
   a. Mean. b. Median. c. Mode

8. College grade point average?
   a. Mean. b. Median. c. Mode

9. High school achievement or aptitude test averages?
   a. Mean. b. Median. c. Mode

10. Average annual inflation rate?
   a. Mean. b. Median. c. Mode

30. Statistical Studies and Experiments

A. Polls, Studies and Experiments: Sampling Phase

As we saw in the section on statistics, statistical support for claims can be generated either by enumeration (counting each instance in an entire population), or by estimation (counting each instance in only a subset of the entire population). Though enumeration is always the more accurate of the two, it is far from perfect, especially as the size of the population increases. In the United States, the best known example of enumeration in a large population is probably the national census, which takes place every decade, and which is usually considered to be full of errors. Since, however, the Constitution specifically requires enumeration, and since a more accurate count might have political consequences (for example, representation in the U.S. House of Representatives is based on the census), we continue to use the very expensive and time-consuming method of enumeration. It is possible that we could get just as accurate a picture of the U.S. population more quickly and cost-effectively through estimation, but the assumptions involved in devising that estimation would be even more subject to political pressure and influence.

When large populations are involved, estimation is usually employed. (Even the U.S. Census, which by law counts the population by enumeration, uses estimation to produce most of its analysis of American society.) Estimation involves two stages: first, selection of the group or population to study, and then the investigation itself, which involves collection and analysis of information.

The selection stage is roughly equivalent in all forms of estimation. The process of selection is, first, to identify the group or population that the estimation will describe (the target), and then to select from that target a smaller but representative group (the sample). In theory, if the sample is fully representative of the target, then what is true of the sample is true of the target. Unfortunately, there are few situations in which a fully representative sample can be obtained, such as checking the specifications on a mass-produced engine part. As a result, researchers have devised methods for selecting samples sufficiently representative of the target to make estimations about it. These methods can be divided into two types:

Random sampling. The most reliable way of choosing a sample that will prove representative of its target is to select that sample randomly—that is, by some method which will eliminate the biases and expectations of the researcher. In the example of the mass-produced engine part above, samples could be taken at random off the production line and checked for compliance with set specifications. Note that this "randomness" does not necessarily imply a lack of order—measuring every twenty-third part, for example, could still be considered a random sample. In fact, an ordered process of sampling helps eliminate the influence of the person doing the sampling, who may be influenced by qualities (position on the belt, time of day, and so on) that would skew or make more unrepresentative the sample.

While random sampling is theoretically the most reliable way of producing a representative sample, it is all but impossible to do in a human population. Let's take an example: in order to study voting patterns in San Jose, a polling group chose its sample randomly from the white pages of the telephone book, calling up every twenty-seventh name. This sounds like a random sample, but is it? If we have as a target anyone living in San Jose, this method has already eliminated all those whose names are not listed in the phone book, because either they do not have a phone, they have an unlisted phone number, they have moved to the area recently, or there was an error in producing the phone book. Not only does this begin to seem a pretty large segment of the population of San Jose that has been excluded, but it also seems to comprise elements of the general population whose voting patterns might conceivably be different from those whose names do appear in the white pages.

Even if we adjust our target to study the voting patterns of those listed in the San Jose phone book, that "random" sampling method might still not prove to be random. Why? Well, having chosen its sample, the polling group begins to make its calls and — no surprise — a large percentage of those asked refuse to take the time to answer the series of questions. This means two things. First, it means that those that do respond are self-selected; that is, they are in the sample not just because they were chosen "randomly," but because they themselves chose to participate. The motivation for people to participate in such surveys varies, but one reason is probably because they feel strongly about one or more issues involved, and individuals who self-select because of strong feelings about the subject of the estimation can be said to bias the sample. This is also true of those who refuse to participate, some percentage of whom refuse not simply because they are too busy, but because they are indifferent to the issues, not interested in expressing their views (perhaps because they are controversial), or for some other substantive reason self-selected out. Many polls are conducted in this way, but the possibilities of a biased sample are very strong.

Adjusted sampling. Let's go back to the phone book example above. Having realized that their sample was self-selected and therefore biased, the researchers could still use their survey results if they found some way to make their sample more representative. To do so, they could identify those factors that they thought would influence the subject they are studying. So, in the case of voting patterns in San Jose, they may use such categories as income level, race or ethnicity, gender, education, party affiliation, and occupation in order to create a profile of each member of the sample. Then, by comparing those profiles with established information about the target population in general, they could choose, from among their original sample, a smaller sample that is very representative of the target, at least in the categories they have identified.

So, even though it may seem a contradiction in terms, sometimes the best way to prevent a biased sample, when a truly random process is unavailable (which is usually the case in human populations), is to adjust for it by a very un-random selection process of matching the sample to the target in significant ways. But there are dangers inherent in this option as well. After all, the researchers obviously do not understand everything about the topic under study, or else they would not be researching it. So the first problem is that they may not recognize all the significant categories affecting the outcome, and if they are unaware of one or more, they cannot adjust for them. (Imagine using an adjusted sample to study the increase in lung cancer over the past hundred years if you were not aware of the impact of smoking on the disease. Since your sample would not then be adjusted to reflect the proportion of smokers in the general population, your results would probably not be able to identify smoking as the source of much of the increase.) A second problem is that allowing researchers to select the members of the sample group opens the door for the sorts of errors that human involvement often brings, from the unintentional to the unethical. A good estimation will have safeguards built into it to prevent or limit these problems. As a result, the results of any estimation are only as reliable as its design.

We have seen that one of the central areas of concern for any estimation is the way in which the sample is selected. The next section will continue this discussion, by distinguishing between polls, studies and experiments, and by looking at how the results of estimations should be interpreted.

B. Polls, Studies and Experiments: Investigation Phase

The investigation phase of estimation can take one of three forms: polls, studies, or experiments. As you read in the last section, all three of these begin with a rather similar process of identifying the target population, and then selecting a representative sample from that target. After that, polls, studies, and experiments become quite different.

The differences between polls, studies, and experiments are easy to spot.

In experiments, the researchers themselves actively control something related to the sample group, either by introducing it where there was none before, or by removing it where it once existed. Experiments always move from cause to effect, by manipulating the suspected cause, and then gathering data about the results of that manipulation.

Generally speaking, samples in experiments tend to be smaller than in other forms of estimation, and that sample is divided further into at least two groups: the experimental group and the control group. The manipulation of the suspected cause only occurs in the experimental group. Because it is difficult to trace effects to a single cause, it is important to have a second group, the control group, which is statistical similar to the experimental group, and which undergoes all the experiences of the experimental group except the introduction or removal of that single cause under study.

In cases of a medical experiment, for example, where researchers know that some patients respond favorably to any medication, at least at first, when the experimental group is given a pill containing the drug under study, the control group is often given a harmless sugar pill, with no active ingredient, in order to simulate the taking of medication as it occurs in the experimental group. Those sugar pills are known as placebos, a term that can be generally applied to any neutral activity or stimulus introduced in the control group for the sake of reproducing the experiences of the experimental group; and the tendency of subjects to respond favorably to any treatment, including sugar pills, is known as the placebo effect.

In studies, the researchers only passively collect data, whether they record the data from their own observations or analyze existing records. On one hand, because they do not involve the active control of a suspected cause, studies can only show correlation, never causation. On the other, studies have the flexibility of moving from the effect back to its cause, as well as from the cause forward to its effect.

Studies, then, are largely statistical analysis. They do not have the component of direct manipulation, as do experiements, and they usually do not need to rely on the statements of individuals, as do polls. Depending on the design of the study, a control group—that is, a second sample group similar to the first but missing the factor under study—may be used in order to help strengthen the causal arguments, which will be discussed briefly below.

In polls, researchers rely on what people say, rather than studying a phenomenon itself. Polls are the most common type of estimation, and require the least amount of investigative effort because, once the sample is chosen, pollsters simply ask that sample questions and record the responses. Unlike experiments and studies, polls can only be conducted on human populations, since only humans can communicate their responses. (Exceptions such as signing apes, talking parrots, and clicking cetaceans suggest that polls may be done among non-human species in the future, but not yet.) Unfortunately, polls must rely on the veracity of their subjects—and humans are notorious liars, especially on subjects of enough consequence to warrant study, such as sexual practices, food consumption, voting preferences, spending habits, and so on.

Sometimes, polls do not seem to identify a correlation. Asking likely voters whom they favor, for example, does not appear to be involved with correlation or causation. However, pollsters are usually looking for patterns that associate the relevant qualities of their adjusted sample (such things as age, race or ethnicity, gender, education, party affiliation, occupation, income, and so on) with the results of their poll.

Since all forms of estimation are usually looking to show either correlation or causation, they all employ causal reasoning, such as you read about in the section by that name at the beginning of Part 3. Arguing that one factor is the difference or the commonality between sample groups that show a particular outcome is the whole purpose of estimation; and usually both forms of causal reasoning (difference and commonality) need to be employed in order to demonstrate the causation or correlation convincingly.

Polls, studies, and experiments usually produce results that have, at best, a 95% chance of being repeated if the estimation were run again. In addition, as you read in the section on statistics, the results of all estimations are limited by a factor called the "margin of error," which depends largely on the size of the sample used. The results of estimations cannot be precise, but must be expressed within the range of the margin of error. If, for example, George W. Bush received 49% percent of support in a Florida opinion poll during the last election, and the opinion poll has a margin of error of plus or minus 3 percentage points, then we can be 95% sure than Bush's actual support at that time in Florida was somewhere between 46% (49-3) and 52% (49+3). Note that it is just as likely, in this example, for Bush's actual support to be 46% or 52%, or any other figure within that range, as it is to be 49%.

Also note that, to be statistically significant, the difference between two results (say, the support for Bush and John Kerry) must exceed that margin of error. If, in the same poll, Kerry received support from 46% of likely voters, and Bush received 49% of likely voters, and if that poll had a margin of error of plus or minus 3 percentage points, then Kerry's results should actually be tabulated as falling between 43% and 49%, while Bush's should fall between 46% and 52%. Because of the overlap of these ranges, however, and despite the apparent 3% lead which Bush seemed to enjoy, we must conclude that there is no statistical significance between Bush's 49% and Kerry's 46%.

Exercises

Exercise #1: Syllogisms (Answer Key: p. 78)

1. All dogs are cute, and all puppies are dogs; therefore all puppies are cute.
2. All apples are yummy and some oranges are apples, so some oranges are yummy.
3. All pizzas are tasty and some cheeses are pizzas; therefore cheeses are tasty.
4. All adults are smart and some kids are adults, so some kids are smart.
5. Some grapes are green and some red are grapes, so some red are green.
6. All flowers are white and all daisies are flowers, so all daisies are white.
7. No workers are happy people. Some happy people are successful. So some successful people are not workers
8. Some dogs are loud. All animals are dogs. So some animals are loud.
9. All stars are bright. All bright things are beautiful. All beautiful things are bright.
10. No friends are mean people. All mean people are annoying, so some annoying people are not friends.
11. Some goats are snails, but not all people are goats; so not all people are snails.
12. All monkeys are primates. Some gorillas and chimpanzees are not monkeys; therefore some gorillas and chimpanzees are not primates.
13. Jorge and Paige went to the mall; Greg was not with Jorge and Paige. Therefore Greg was not only not with Jorge and Paige, but he was also not at the mall.
14. Scorpions are deadly, and French men are afraid of scorpions, so French men are deadly.
15. The world is suffering from global warming. Global warming is preventable, so world suffering is preventable.
16. All suns give light. No shadows give light, so shadows are suns.
17. All games are deadly and boring. All electronics are games, so all electronics are deadly and boring.
18. No dogs are cats. No birds are cats. So, no birds are dogs.
19. All game players are fighters. Some people are game players. So, some people are not fighters.
20. No puppets are fakers. Some fakers are boring people. So, some boring people are not fakers.
21. All Marvel characters wear spandex. Some heroes are Marvel characters, so therefore some heroes wear spandex.
22. Eating mushrooms makes people become super. Mario eats some mushrooms, so therefore it made him super.
23. No car racers are slow drivers. Some slow drivers are annoying, so some slow drivers are not car racers. Valid.
24. All people who say "Do'h!" are stupid. Homer Simpson is stupid and he says "Do'h!" What can you conclude?
25. When a person touches a Starman and eats a mushroom, they become invincibly stronger. Mario became invincibly stronger, so he touched a Starman and ate a mushroom.
26. None of the girls are on the baseball team. Some of the soccer team are girls. So no one on the soccer team is on the baseball team.
27. All of the lights left on the house are from Christmas. No wreaths are left from Christmas. So none of the lights are wreaths.
28. No disc jockeys are jocks. Some jocks are hockey players. So some hockey players are not disc jockeys.
29. All the neighbors are gardeners. Some of the horseback riders are neighbors. So some of the horseback riders are gardeners.
30. No horseback riders are wearing helmets. Some that are wearing helmets are novice riders. So some novice riders are not horseback riders.
31. Some people are singers. No singer is poor. Therefore, some people are not poor.
32. All girls like dresses. No dress is alike. Therefore, all girls are alike.
33. Some rings are gold. All gold things are expensive. So, some rings are expensive.
34. All change is good. All good things have no evil. Therefore, all change has no evil.
35. Some boys don't cry. All cries are heard from above. So, some boys are heard from above.
36. No rabbits are reptiles. Some reptiles are cold blooded. Therefore, some cold blooded animals are not rabbits.
37. All cats are black. Some animals are cats. So, all animals are black.
38. Some heels are comfortable. Some shoes are comfortable. Therefore some shoes are heels.
39. No vegetarians are meat consumers. Some meat consumers are healthy humans. Therefore, some healthy humans are not vegetarians.
40. All chocolates are delicious treats. Some candies are chocolates. So, some candies are delicious treats.
41. All cows eat grass and make milk. Chickens are not milk-makers. Therefore, chickens are not grass-eaters.
42. Some gods are crazy. All gods are mean. Therefore, some mean gods are crazy.
43. No SJSU student goes to Gold's Gym or Jenny Craig. Richard Simmons goes to Gold's Gym.

Therefore, SJSU students are not Richard Simmons.

44. April Fools Day is my birthday. Today is not my birthday. Therefore, April Fools day is not today.
45. Homework is annoying. Peter is annoying. Therefore, Peter is Homework.
46. Some shoes are Nikes. No Nike is too ugly. Therefore, some shoes are not too ugly.
47. All basketball players are tall. Bruno is a basketball player. Therefore, Bruno is tall.
48. Some candies are chocolate. No chocolate is purple. Therefore, some candies are not purple.
49. All drivers are licensed. Pablo is a driver. Therefore, Pablo is licensed.
50. All weightlifters are strong. Bill is not strong. Therefore, Bill is not a weightlifter.
51. All rain is wet. Some acid is rain. Therefore, some acid is wet.
52. All monkeys are human and Mike has a monkey, so Mike is human.
53. Some cannibals are not vegetarians. All humans are cannibals. Therefore, some vegetarians are not human.
54. All men are from Mars. My Mom is a man. So, my Mother is from Mars.
55. No man can milk a cat, but some cats produce milk, so some milk is man.
56. No police officers are NRA members, and some NRA members are sharpshooters. Therefore, no sharpshooters are police officers.
57. All Californians are drug users. Some drug users are surfers. So all surfers are Californians.
58. No bellhops are luggage carriers. Some luggage carriers are concierges. All bellhops are concierges.
59. No men are nurses. No nurses are doctors. So, no men are doctors.
60. All basketball players are fast runners. No gymnasts are basketball players. So no gymnasts are fast runners.
61. All humans are smart. Some brains are human. Therefore, some brains are smart.
62. All bartenders are fast and no person is quick, so no people are bartenders.
63. Some mice are white and some rats are mice, so some rats are not white.
64. Some people are not nice and no drama queens are nice. Therefore, no drama queens are people.
65. All cows are white and black and no elephant is white and black, so no elephants are cows.

Exercise #2: Syllogisms (Answer Key: p. 80)

1. Chairs are not tables, and some tables are made out of wood, so some things made out of woods are not chairs.

2. Pianos are a musical instrument, but other musical instruments include flutes, so some flutes are not pianos.

3. Singers are dancers, and the Beatles are singers. Therefore, they are dancers.

4. Some singers are dancers, and some dancers are girls, so some girls are dancers

5. All dancers are singers but I am not a singer. Therefore I'm not a dancer

6. Some men are cheaters, and cheaters are jerks, so some men are jerks.

7. All ladies are beautiful, and I am a lady. Therefore I'm beautiful.

8. Some teachers are students. No students are graduates, so some teachers are not graduates.

9. All students are smart. I am a student, therefore I am smart.

10. All employees are underpaid. He is an employee, therefore he is underpaid.

11. All cars are expensive. No bike is a car. No bike is expensive.

12. All graduates get a high paying job. She is a graduate so she gets a high paying job.

13. Many people are kind.
Some people are honest.
Most who are kind are not honest.

14. No movie is perfect, but some movies are interesting, so some interesting movies are not perfect.

15. All trees are green. Some trees are tall, so some green things are tall.

16. Avocados are not fruits. Some fruits are not delicious, so some not delicious things are not fruits.

17. All animal lovers hate fur, and some people are animal lovers, so some people hate fur.

18. All monkeys are not gorillas, and some gorillas are chimpanzees; therefore, no chimpanzee is a monkey.

19. Good basketball players always have good hand-eye coordination. Jeremy is not a good basketball player; therefore, Jeremy doesn't have good hand-eye coordination.

20. Every good football team wins a super bowl. The Raiders did not win the super bowl; therefore, the Raiders are not a good football team.

21. Cars are sometimes painted yellow. Yellow cars are always fast; therefore, some cars are fast.

22. Potatoes aren't fruits. Some fruits are sour, so, some sour things are not potatoes.

23. Impalas are not Fords, and some Fords are cars. Therefore, some cars are Impalas.

24. Some computers are not slow, and all computers are helpful. Therefore, some helpful computers are not slow.

25. All humans are mortal, and all Mexicans are humans, so all Mexicans are mortal.

26. All dogs are mammals, and Fluffy is a dog, so Fluffy is a mammal.

27. Some people are not dumb, but all people are loud, so some loud people are not dumb.

28. All dogs are white. Bobo is a dog, so Bobo is white.

29. All dogs have spots. Bobo does not have spots. Therefore, Bobo is not a dog.

30. All dogs are white. Bobo is white, so Bobo is a dog.

31. All dogs have spots. Bobo is not a dog, so Bobo does not have spots.

32. Some dogs are white. No hound is white, so some hounds are dogs.

33. Some dogs are not white. No hound is white, so some hounds are dogs.

34. All food is healthy. No candy is healthy, so no candy is food.

35. All food is healthy, and candy is food, so candy is healthy.

36. Some food is healthy. Candy is healthy, so candy is food.

37. All people are nice. Bob is a person, so Bob is nice.

38. Some apples are red, and no red thing is round. Therefore, some round things are not apples.

39. The boys are not tall, and all tall things are opposites. Therefore, some opposite things are not boys.

40. Few babies are not wonderful at night. No babies are fun. Therefore, some fun things are not wonderful.

41. Some women are mothers, and some mothers are married. Therefore, some women are married.

42. All cats are felines, and some cats are black. Therefore, some felines are black.

43. Some clocks are digital, and no digital clock is wound. Therefore, some clocks are not wound.

44. Some birds are flyers, but all birds are egg layers, so all flyers are egg layers.

45. No fish is a runner, and some runners are mammals. Therefore, no fish is a mammal.

46. Some houses are homes. No home lacks a family, so some houses do not lack a family.

47. Superman is an alien, and some aliens are Kryptonians, Therefore, Superman is a Kryptonian.

48. Some Christians are Catholic and no Catholic is a Jew. Therefore, no Christian is a Jew.

49. All almonds are nuts, but no nut is a fruit. Therefore, no almond is a fruit.

50. Some bees are queens, and no queen is a worker, so some bees are not workers.

51. Some computers aren't good, and all Dells are computers. Thus, some Dells are not good.

52. All pink cookies are spoiled, but no Oreos are spoiled. Thus, no Oreos are pink cookies.

53. Some things that are expensive are good quality, but not all books are expensive, so good qualities things are books.

54. Some expensive things are good, and some books are not expensive, so some good things are books.

55. All coffee lovers are Starbucks fanatics, and all Starbucks fantatics are Folger lovers. So Folger lovers are coffee lovers.

56. All cowboys are strong. Some farmers are strong, so cowboys are farmers.

57. Cotton sweaters are soft, and no soft things are rough, so no cotton sweaters are rough.

58. Some tables are metal, and some tables are painted. Therefore, some painted tables are metal.

59. Some square buildings are earthquake proof, but no triangular building is square, so no earthquake-proof building is triangular.

60. All models are thin. Some models are not tall, so some thin models are not tall.

61. All athletes are healthy. Tiger Woods is an athlete. Therefore, Tiger Woods is healthy.

62. Some students do their homework. No one who does his or her homework is stupid. Therefore, some students are not stupid.

63. Some telephones are wireless. John's telephone is not wireless. Therefore, some telephones are not John's.

64. No purple people eater is real. David is not real. Therefore, David is a purple people eater.

65. All good chocolate should be eaten. See's is good chocolate. Therefore, See's should be eaten.

66. All Texans are Republicans. No Republican is a liberal. Therefore, all Texans are not liberals.

67. Some teachers are also students. No students get enough sleep. Therefore, some teachers don't get enough sleep.

68. No frog is a prince. Princes are human. Therefore, no frog is human

69. All rock bands are loud. The Rolling Stones are a rock band. Therefore, the Rolling Stones are loud.

70. Some men are not husbands. All husbands are fathers. Therefore, some men are not fathers

71. Some cameras are not digital. All digital cameras are expensive. Some expensive cameras are not digital.

72. Some dogs are not prize winning dogs. Prize winning dogs are pure bred. So, some dogs are not pure bred.

73. Many headphones are comfortable. No comfortable are heavy. So, some headphones are not comfortable.

74. Most jewelry is expensive. All expensive jewelry is desirable. So, some jewelry is desirable.

75. No computers can express emotion. Most emotion is not logical. Therefore, no computer is logical.

76. Some people are successful. Some successful people are not rich. So, some people aren’t rich.

77. All keys are small. Some small things are easy to lose. So, some keys are easy to lose.

78. Some cars are not fast. Fast cars are nice to look at. Therefore, some cars are nice to look at.

Exercise #3: Syllogisms

1. All students who received a 1600 on their SATs are genuises. I didn't receive a 1600 on my SAT, so I'm not a genius.

2. Anyone who does the homework will get a passing grade on the test. I did my homework. Therefore, I will get a passing grade.

3. All women can be mothers, but I am not a woman, so I can't be a mother.

4. All encyclopedias are books, and all books contain information, so all encyclopedias contain information.

5. All living things grow, but rocks don't, so rocks are not alive.

6. All oranges are orange, so an apple is not an orange.

7. Only adolescents experiment with drugs. I am an adult, so I don't experiment with drugs.

8. All artists are imaginative, and I am imaginative, so I must be an artist.

9. All boxers work out hard, but I don't, so I must not be a boxer.

10. All stressed people are busy, and I am always busy. Therefore, I am stressed.

11. All computers are complicated, but a Mac isn't complicated, so it must not be a computer.

12. All dirty things need washing. My care needs washing, so it must be dirty.

13. All runners are in good shape. Shab is not a runner, so Shab is not in good shape.
14. All birds are black, but bluejays aren't birds, so bluejays aren't black.

15. All dogs are cute. No cat is cute. So no cat is a dog.

16. All human beings are liars, so Katie is not a human being.

17. All horses are four-legged, but no English student is, so no English students are horses.

18. Some humans like music, but no animals do. So no animal is human.

19. No oranges are juicy, although some apples are. Therefore, some apples are not juicy.

20. All birds are animals, and some birds are blue jays. So blue jays are animals.

21. Some students are working during spring break. All students are looking forward to the time off. Therefore, even those who are working look forward to the time off.

22. All registered cars can be driven. Some cars can't be driven, so they must not be registered.

23. Only registered cars can be driven. some cars can't be driven, so they must not be registered.

24. Many leaves are green. This is a leaf. It must be green.

25. Most students that don't like living in Joe West Hall want to move into apartments. Some of those that enjoy living in Joe West don't want to move into apartments. So no resident that likes living there wants to move.

26. No singers have a private life, but some actors do. Therefore, singers are not actors.

Exercise #4: Syllogisms

1. Create a syllogism with the following conclusion:
    a. Only seniors can graduate.
    b. Critical Thinking is a wonderful course.
    c. A tie is like kissing your sister.

2. Create a syllogism with the following premise:
    a. Only seniors can graduate.
    b. Critical Thinking is a wonderful course.
    c. A tie is like kissing your sister.

Determine the validity of each of the following:

3. Sociology is in the field of social science, and so is psychology. So psychology is just a kind of sociology.

4. All mimsies are borogroves, and no mimsies are in the wabe. So no borogroves are in the wabe.

5. Only mad dogs and Englishmen go out in the noonday sun, so John (who is neither mad nor canine) must come from England.

6. All creationists are religious, and all fundamentalists are religious, so all creationists are fundamentalists.

7. Any piece of software that is in the public domain may be copied without permission or fee. But that cannot be done in the case of software under copyright. So copyrighted software must not be in the public domain.

Exercise #5: Conditionals (Answer Key, p. 82)

1. Your instructor says, "If you get 70% or better on the final examination, you will pass the course." What can you conclude if

a. you get 75% on the final exam?
b. you pass the course?
c. you don't pass the course?
d. you get 65% on the final exam?
e. you don't take the final exam?

2. Your instructor says, "You will pass the course only if you get 70% or better on the final examination." What can you conclude if

a. you get 75% on the final exam?
b. you pass the course?

3. If graduating seniors at Stanford do better on the Graduate Record Examination than graduating seniors at Berkeley, then we might think that Stanford graduates are academically superior to Berkeley students. But from other reliable measurements, we know that Berkeley graduates are at least equal to Stanford grads academically. So what can we conclude from all this?

4. If people trust you, then you'll have a lot of friends. If you have a lot of friends, you'll be a well-adjusted individual. And if you are well-adjusted, you'll be a happy camper.

a. What does it say about you if you are *not* well-adjusted?
b. Can you be a happy camper if you don't have any friends?
c. If people don't trust you, can you ever be well-adjusted?

5. Bill said he was going out celebrating tonight if the Spartans won today. What can we conclude if

a. Bill stays home?
b. the Spartans win?
c. Bill goes out?
d. the Spartans lose?

6. Fees at San José State might remain the same next year, but only if the economy improves in California and the state's tax revenues increase. So I guess we can expect another rise in our fees.

7. The Twins are a better team than the A's. The Twins hitters have higher averages, their pitchers have better records, and their fielders less errors. The only category the A's lead in is games won.

8. If you are admitted to San José State, then you should be able to register in the classes you need for graduation. And if you can register in the classes you need, you should graduate in four years. And if you graduate in four years, you can be proud of yourself.

a. Mary wasn't admitted to San José State, so she isn't feeling very proud of herself.
b. Mary isn't proud of herself. Therefore, she must not have been admitted to San José State.
c. Jon didn't graduate in four years. Therefore, he can't be proud of himself.
d. Jon didn't graduate in four years. He must not have been admitted to San José State.
e. You weren't able to register for the classes you needed, so I guess you won't be able to graduate on time.

9. If you do well on this assignment, then you probably understand deductive reasoning, or at least conditional premises.

a. You understand deductive reasoning.
b. You aren't doing well on this assignment.
c. You don't understand deductive reasoning, but you do understand conditional premises.

Exercise #6: Conditional Arguments (Answer Key p. 82)

1. If there aren't any accidents, then I get to class on time. But today I didn't get to class on time. So there must have been an accident.

2. Joe said he would call if he needs a ride, and he didn't call, so I guess he doesn't need a ride.

3. All red cars are fast so, if you have a red car, then it is fast.

4. If your parents didn't have any children, neither will you. And you don't have any children.

5. If everything is coming your way, you are in the wrong lane. And everything is going your way.

6. If Michael finishes his painting, he will receive an A in the class. What can be concluded if Michael receives an A in the class?

7. Dean Martin said, "You're not drunk if you can lie on the floor without holding on." What can you conclude if you are drunk?

8. The doctor told Mike that he would call him only if the test results came out positive, but the doctor never called, so I guess the results must have been negative.

9. Whenever I come to school at 10:00 am, I can't find a parking space. But today I did find a parking space, so I must have come after 10:00 am.

10. John, if he studies, will pass the exam. Can John pass the exam without studying?

11. If you drink and drive, you should go to jail. Well, I saw the driver next to me drinking a soda. Should he go to jail?

12. If the girls had left for spring break, they would have gone to Mexico. But they stayed home. Therefore, they did not go to Mexico.

13. If I step on the brakes, the car will stutter or die. The car died because I stepped on the brakes.

14. If I step on the brakes, the car will stutter or die. I must not have stepped on the brakes, because the car did not die.

15. The salesman said, "If you buy a used car it will give you trouble, but if you buy a new car, then it won't give you any trouble." What can you conclude if the car gives you trouble?

16. The dog barks only if the door bell rings. And if the dog barks, then there is someone at the door. So, if the door bell rings, is there someone at the door?

17. I knew that if I studied for that course, I would do well in it, and if I did well in the course, I would raise my GPA. But I didn't study for the course, so obviously I didn't raise my GPA.

18. If you buy a ticket, you'll see a good game. And if you see a good game, you'll either enjoy yourself or not. But if you do enjoy yourself, then you'll come back again. What can you conclude if you don't enjoy yourself?

19. If I have two quarters, then I have fifty cents. And if I have fifty cents, then I can by a soda or a candy bar. But if I buy a soda, then I did not buy a candy bar. What can I conclude if I buy a candy bar?

20. If you are a graduating senior, then you must have taken 100W. And you can only take 100W if you pass the WST. And if you take the WST, then you must have passed Engl 1B. And If you take Engl 1B, then you must have passed Engl 1A. What can you conclude if you have not passed Engl 1A?

21. If the neighbors are noisy, they're having a party. If they are having a party, then they are having fun. If there is no band, though, they aren't having fun. But if there is a band, people are dancing.

Exercise #7: Conditionals with "only if," chains, and conjunctions (answer key on p. 83)

<u>"Only if" conditionals</u>

1. Una chooses a rose only if it is pink. Una chooses a rose; therefore, it will be pink.
2. Maho brings back the book with her only if one is not heavy. The book is not heavy, so Maho brings the book back with her.
3. Tomatoes will be red only if we have enough sunlight. We did not have enough sunlight. Therefore tomatoes are not red.
4. Ox tails taste good only if you simmer them for a long time. You simmered ox tails for a long time. Therefore, they taste good.
5. We requested the same spending level as last year: therefore, our budget will be approved.
6. Mary's computer is connected to a network; therefore, Mary receives email messages.
7. If you all come to my house, we can have a party. Not all of you came, so we cannot have a party.
8. If I eat, I will be satisfied. I'm not satisfied, so I didn't eat.
9. If I have a pc, I can produce a good graphic paper. I cannot produce a graphic paper, so I don't have a pc.
10. Bob will get fat only if he overeats. Bob does not overeat. Therefore he does not get fat.
11. My cat will live only if it gets medicine. My cat got medicine, therefore it lived.
12. The team will win only if Brian scores a goal. Brian did not score a goal. Therefore, my team did not win.
13. Shane will drink only if he is with his parents. Shane was not with his parents, therefore he did not drink.
14. The frog will eat a squirrel only if it is VERY hungry. The frog ate the squirrel, therefore the frog was hungry.
15. Lisa can only wear red if it's Monday. Lisa is not wearing red, therefore it is not Monday.
16. If Marty has no money, he can only watch TV. Marty is not watching TV, therefore he has money.
17. I only go for a run if it is sunny. I did not run, therefore it is not sunny.
18. If I eat junk food, I can only eat marshmallows. I did not eat marshmallows, so what can you conclude?
19. I can not jump only if I do not clap. I jump, therefore I clapped.
20. He will get sick only if he stays out in the rain. He did not stay out in the rain. Therefore he did not get sick.
21. Only he will fail if he does not do his part of the work. Only he failed. Therefore he did not do his part of the work.
22. His watch will get wet only if he swims with it on. His watch got wet. Therefore he swam with it on.
23. She will lose her glasses only if she forgets them somewhere. She did not lose her glasses. Therefore she did not forget them somewhere.
24. Only he will choke if he eats that one apple. He ate that one apple. Therefore only he choked.
25. I am late to class only if I take a nap. I take a nap, so I'm late to class
26. I will add salt to the steak only if it's tasteless. I add salt when the steak is tasteless.
27. I will add salt to my steak only if it's tasteless. It isn't tasteless, so I didn't add salt.
28. The steak will be tasteless only if I add salt. I add salt when the steak is tasteless.
29. I will pass this class only if understand conditionals. I understand conditionals, so I pass the class.
30. I get out of bed only if I have something to do. I have something to do; therefore I get out of bed.
31. I go fishing only if I have a pole; I do not have a pole, and therefore I do not go fishing.
32. I eat sushi only if I have soy sauce and wasabi to go with it. I have no soy sauce; therefore I eat no sushi.
33. I finish my homework only if it is due. My home work is due, therefore finish it.
34. I go outside only if I need to. Today I don't need to go outside for anything, therefore I don't go outside.
35. I hate going to class only if I'm hungry. I'm hungry; therefore I hate going to class.
36. Only if I'm sleeping I will not hear you. I do not hear you, so I'm sleeping.
37. God exists only if I believe in him. I believe in god; therefore he exists.
38. I'm depressed only if I'm not happy. I'm depressed; therefore, I'm not happy.
39. Life is wonderful only if everything is going my way. Life isn't wonderful, so nothing is going my way.
40. I get wet only if it rains, and I get wet.
41. I get tired only if I have not gotten sleep. I have not gotten sleep.
42. John likes work only if he uses the computer. John does not like work.

43. Sam will clean his room only if he gets 5 cookies. Sam gets 5 cookies.
44. Richard will cook only if he does not do the dishes. Richard will not cook.
45. If the car has a lot of horse power, it will go fast. The car does not go fast; therefore it does not have a lot of horse power.
46. If someone is blind, he will lose things easily. He is blind; consequently he will lose things easily.
47. Killers will go to jail if they are found guilty. Killers are always found guilty; therefore they will go to jail.
48. They will be left blank if you don't fill in the spaces. You did not fill in the spaces; therefore they were left blank.
49. If a scale breaks, there must be a big person standing on it. The scale did not break, consequently there must have been a big person standing on it.
50. I will turn in my homework only if the teacher asks for it. The teacher asked for the homework, so I turned it in.
51. The vet will give the dog a shot only if the dog has allergies. The vet gave the dog a shot, so the dog has allergies.
52. I will put on my raincoat only if it is raining. I did not put on my raincoat, so it is not raining.
53. She eats ice cream only if she is sad. She is not sad, so she did not eat ice cream.
54. He wins the game only if he gets this question right. He gets the question right, so he wins the game.

Chain arguments

1. If I make cake, it will be a chocolate cake.
If I make a chocolate cake, then I make some raspberry sauce to serve with it.
If I make some raspberry sauce, I need to go to a market.
If I need to go to a market, then I ride my bike.
If I ride my bike, then the bike should not have a flat tire.
The bike has a flat tire. Therefore I will not make cake.

2. If I graduate, I can get a job.
If I get a job, I will get paid.
If I get forget my key, I cannot drive.
If I cannot drive, I need help.
What can you conclude if I don't need help?

3. If I eat, then I will be full.
If I am full, then I will have energy.
If I have energy, I will play well.
If I play well, my team will win.
If my team wins, I will be happy.
I am happy, therefore I can conclude that I ate, I was full, I had energy, I played well, and my team won.

4. I can go to the park only if it is warm. And if I go to the park then I can rollerblade. I did not rollerblade, therefore it is not warm.

5. If he does not buy the photography equipment then he will not be able to take pictures.
If he cannot take pictures then he cannot do the assignment.
If he does not do the assignment then he cannot turn it in.
He does not turn it in only if he will not get a grade.
Only he will fail if he does not get a grade.
What can you conclude if (a) he doesn't buy the photo equipment, and (b) if he got a grade?

6. If I go out tonight then I'll bring my purse.
If I bring my purse then I'll have my pepper spray with me.
If I have my pepper spray with me then I'll be tempted to use it.
I'm going out tonight; therefore, I'll be tempted to use my pepper spray.

7. If I don't do my homework then I will be in trouble.
If I will be in trouble then I will be mad.
If I will be mad then I will yell.
If I will yell then my neighbors will complain.
What can you conclude if I don't do my homework?

8. If I love you, then you will love me. If you love me, you must be crazy. If you are crazy, you will never be loved. If you will never be loved, then I must be confused about love. What can you conclude if I am not confused about love?

9. If I eat this strawberry, I will get sick.
If I get sick, I will have to take medicine.
If I take the medicine, I will feel drowsy.
If I feel drowsy, I will go to bed.
If I go to bed, I will turn off the light.
What can you conclude if I did not turn off the light?

Conjunctions and Disjunctions in Conditionals

1. If Steve is hungry then he will eat all his food and drink all his milk. Steve did not drink all his milk; therefore Steve was not hungry.
2. If the girls don't dance then they both must leave. Rachel did not go home; therefore both Natalie and Rachel danced.
3. If Johnny can't knock down all the pins then he can't win the teddy bear or a clown. Johnny won a teddy bear, therefore he was able to knock down all the pins.
4. If Cathy goes to the dance then she got all A's or has a date. Cathy does not have a date, therefore she does not go to the dance.
5. If the waves are big then the swimmers and the surfers are in the water. The surfers did not go swimming therefore the waves were not big.
6. He will get a stomach ache only if he eats the candies and the desserts. He did not eat the candies. Therefore he did not get a stomach ache.
7. If he reads a book then he can only read a textbook or a library book. He did not read a textbook. Therefore he did not read a book.
8. He gets dizzy only if he spins around and goes in circles. He gets dizzy. Therefore he spins around.
9. His game character will die only if he gets distracted or moves away from the computer. He did not get distracted or move away from the computer. Therefore his game character did not die.
10. He will win the rpg game only if he use the cheats and the walkthroughs. He won the rpg game. Therefore he used the cheats and the walkthroughs.
11. If I wake up late, then I'll either drive to school, or take the light rail. I didn't drive to school, nor did I take the light rail; therefore I must not have woken up late.
12. If I eat too much cake, then I'll be a little piggy and I'll have a stomach ache. I ate too much cake, therefore I'm a little piggy and I have a stomach ache.
13. If I hear ABBA on the radio, then I'll either sing along at the top of my lungs, or I'll dance until I can't anymore. I'm not singing, or dancing, so I must not be hearing ABBA on the radio.
14. If I play video games, or surf the net for more than an hour, then I start sweating profusely. I've been playing video games for the last 6 hours, therefore I'm sweating profusely.
15. If I go to the park and feed the ducks, then I'll get really depressed. I went to the park, but I didn't feed the ducks, and therefore I didn't get depressed.
16. If I am hungry then I will eat a banana and a strawberry. I will eat a banana and a strawberry.
17. If Kelly visits New York then she will go to Broadway or Wall Street. She did not go to Broadway or Wall Street.
18. If I study then I have an exam on Monday and Tuesday. And I study. Therefore, I have an exam on Monday and Tuesday.
19. If Sammy trips then he will cry and scream. He does not cry. Therefore, Sammy trips.
20. If Aden paints then he will have to let it air dry or dry it with a fan. He did not let it air dry or dry it with a fan. Therefore, Aden did not paint.
21. If you order an entree, you get french fries and dinner bread. He ordered an entree, so he got french fries and dinner bread.
22. If he buys the DVD player, he will get a movie or CD-ROM for free. He did not get the movie or the CD ROM, so he didn't buy the DVD player.
23. If she gets $5, she will buy a sandwich or a slice of pie. She did not buy the sandwich.
24. If she gets her driver's license, she will get a VW Beetle or a Ford Mustang. She got a VW bug.
25. If he goes to the tattoo shop, he will get a tattoo of a flame and a tattoo of a dragon. He did not get the tattoo of a dragon.

Exercise #8:

1. I can graduate only if I pass Math, English, and History. I've only passed History and Math. Can I graduate?

2. All overweight police officers eat doughnuts. So if you know a police officer who eats doughnuts, he's overweight.

3. All men are created equal. Women are not men. Therefore, women are not created equal.

4. If more people voted during election time, we might see a change. They don't, so we won't.

5. All female students at Berkeley are feminists, and feminists are uptight. Therefore, female students at Berkeley are uptight.

6. Because I am shy, I do not talk much in class. You are not shy, so I guess you talk a lot in class.

7. In order to get a car, he needed to earn a 3.5 GPA this semester. Fortunately, he got that 3.5.

8. Joe will be promoted to supervisor only if he passes a written test and goes through an interview. Joe didn't pass the test or take the interview.

9. Politicians lie constantly. Otherwise, they wouldn't be politicians.

10. Drug users shouldn't become teachers. They all have bad morals, and anyone with bad morals should not become a teacher.

11. Most Republicans don't support abortion. Mr. Bush is not a person who supports abortion,. Therefore, Mr. Bush must be a Republican.

12. I understand good books, but *Zen and the Art of Motorcycle Maintenance* isn't a good book. So I don't understand it.

13. If John gets a tutor, his grades will improve. What can we conclude if John's grades improve?

14. All statements beginning with the word "all" are untrue. The first premise here begins with "all," so the first premise must be untrue.

15. If the sign were larger and labelled more clearly, I wouldn't need my glasses to read it. But I do need my glasses.

16. If one can't understand conditional arguments, one can't expect to pass critical thinking. I understand them, so I'm going to pass this course.

17. One cause of ulcers is stress. The doctors say I have an ulcer. I must be under stress.

18. If I step on the brakes, the car will slow down or stop. The car stopped because I stepped on the brakes.

19. If you complete the assignment, you will receive ten points. John received only five points because his work was incomplete.

Exercise #9: Student Examples
(Answer Key: p. 86)

1. Because he's stupid, Jake doesn't do his homework. You don't do your homework, so you must be stupid.

2. If I'd worn a sweater today, I'd stay warm. But I forgot to wear my sweater, so I'll probably be cold.

3. If you love eating sweets, you'll develop cavities. But, since you didn't develop cavities, you must not love eating sweets.

4. If I get enough sleep, I'm not tired in the morning. I didn't get enough sleep, so I am tired.

5. All SJSU students drive to school, because all SJSU students own cars, and anyone who owns a car drives it to school.

6. If people guilty of a crime go to jail and John went to jail, then it is obvious that he committed a crime.

7. I said I'd go out tonight only if it's your birthday, and I didn't go out. What can you conclude?

8. If you want to lose weight, you have to exercise or eat less. Joe couldn't eat less. Can he lose weight?

9. If more than half of the people of Quebec voted to secede from Canada, then Quebec would become an independent country. But only 49.5% voted to secede, so Quebec will remain a part of Canada.

10. The CHP gave tickets to everyone who was speeding. I got a ticket, so I guess I was speeding.

11. If chocolate causes pimples, and all teenagers eat chocolate, then all teenagers have pimples.

12. I only enjoy reading romance novels. Since Stephen King writes horror novels, I won't enjoy reading his novels.

13. Only residents with a maximum of 2 dogs or 2 cats are obeying the law. Sam has 6 cats, so Sam in not obeying the law.

14. If school ends by 5:00 pm, or the traffic is light, I get home before it gets dark. School ended at 6:00 pm today, but there was no traffic. So I should make it home before dark.

15. Only mistreated animals are aloof and unfriendly. My cats have been treated very well, so they must be neither aloof nor unfriendly.

16. Whenever I don't study for my Psychology exams, I don't pass. I studied for this Psychology exam. Will I pass?

17. If I drink coffee, I stay awake. I didn't have any, so I fell asleep.

18. If he pages me, he needs a ride to school. He hasn't paged me yet, so he doesn't need a ride to school.

Exercise #10: Student Examples

1. Many employers want to hire smart and hard workers. But some students aren't hard workers, so employers don't want to hire them.

2. Good essays require thought and rewriting, but some students don't use either of these. That's why there are few good essays.

3. Graduating from college requires determination and will power, and many students don't have enough determination. Therefore, many students don't graduate.

4. All students are hard workers, but some students are not passing. That means that some hard workers are not passing.

5. No apples are seedless, although some watermelons are seedless. Hence, some watermelons are not apples.

6. Most runners are healthy, but no sick people are healthy. Therefore, no sick people are runners.

7. All comedians are funny, and some comedians are not men, so some funny people are not men.

8. Not all engineering students graduate from SJSU. No SJSU graduate has ever worked at Loral. Therefore, there are some engineers that haven't worked at Loral.

9. My family does not like country music, so no one that likes country music is related to me.

10. All legal immigrants have green cards. Some immigrants don't have green cards. Therefore, some immigrants are illegal.

11. Interesting syllogisms are hard to think up. Some of these syllogisms were easy to think up, so they must not be very interesting.

12. Some kids don't like ice cream, and Jerry doesn't like ice cream, so Jerry must be a kid.

13. Many of my books are heavy. Here's one of them. It must be heavy.

Exercise #11: Universal Syllogisms
Answer Key: p. 87

1. All sports cars are expensive. A Corvette is a sports car. Therefore, a Corvette is expensive.

2. All sports car are fast, but some cars aren't sports cars, so some cars aren't fast.

3. All pitbulls are vicious. Terriers are not pitbulls. Therefore, terriers are not vicious.

4. All classes require books. I have a physics class. Therefore, I need a physics book.

5. All good dogs go to heaven. Cece is in heaven. Therefore, she was a good dog.

6. All homework sucks. Chemistry is homework. Therefore, chemistry sucks.

7. All teeny-boppers are bratty. No college kid is a teeny-bopper. Therefore, no college kid is bratty.

8. All birds can fly, and an ostrich is a bird, but ostriches can't fly.

9. All birds can fly. Flying fish can fly. Therefore, flying fish are birds.

10. All birds with wings can fly, and ostriches have wings, so ostriches can fly.

11. All sodas are bubbly. Pepsi is bubbly. So Pepsi is a soda.

12. All candies are sweet. Dark chocolate isn't sweet, so candy isn't dark chocolate.

13. Dogs attack if they feel threatened. I walked right by one and it didn't attack. So I guess it must not have felt threatened.

14. Syllogisms are easy. Our homework consists of syllogisms. Therefore, our homework is easy.

15. Arnold is always in action films. *T2* had Arnold in it. So *T2* was an action film.

16. All mathematicians have sloppy penmanship. Dr. Ordinario is a mathematician. So Dr. Ordinario must have sloppy penmanship.

17. All lemons are yellow, and a lime is not a lemon, so is it yellow?

18. All beds are comfortable to sleep in, and chairs aren't beds, so chairs aren't comfortable to sleep in.

19. Fans need electricity, and water makes electricity, so fans need water.

20. All plants are green, and dogs aren't. So dogs aren't plants.

21. If it is winter, then I am freezing. But it's not winter, so I am not freezing.

22. In order to smell good, you must bathe. Julie doesn't smell good, so she must not bathe.

23. Cars are very fast, and snails aren't cars, so snails aren't fast.

24. Cigarettes cause cancer. Smokers love cigarettes, so they will develop cancer.

25. All guns are dangerous, and all guns are weapons, so all weapons are dangerous.

26. All athletes are guys, and my sibling plays soccer, so is my sibling male or female?

27. Arizona beat the Giants every game, and the Cubs beat Arizona every game, so the Cubs should beat the Giants every game.

28. Small shells are ugly, and beaches have lots of small shells, so beaches are ugly.

29. Certain pilots are extremely smart, and no male is extremely smart, so no male is a pilot.

Answer Key for Exercise #1: Syllogisms

1. Valid.
2. Valid.
3. Invalid. Since the conclusion says “cheeses are tasty,” we understand that to mean “all cheeses are tasty,” making “cheeses” distributed in the conclusion and not in the premise, so this is invalid.
4. Valid.
5. Invalid. Both the premises are in the form “Some A are B,” and we know that neither term is distributed in that form, so the middle term, “grapes” is not distributed in either premise, making this invalid.
6. Valid.
7. Valid.
8. Invalid: the middle term is not distributed.
9. Impossible to say whether this is valid or not, since we can’t tell which are the premises and which the conclusion. If the third claim is supposed to be the conclusion, then this is invalid: “beautiful” is distributed in the conclusion and not in the premise.
10. Valid
11. Since “not all A are B” is NOT one of the four forms of a claim, we must convert the second premise and conclusion to a proper form. This sounds like “some people are not goats” and “some people are not snails,” which would make this invalid, because “snails” is distributed in the conclusion and not the premise.
12. Invalid: “Primates” is distributed in the conclusion and not the premise, so this is invalid.
13. Invalid form. The first premise is “Jorge and Paige are mall-goers,” and the second “No Greg is Jorge and Paige-accompanier,” so there is no middle term.
14. Invalid form – same problem as in the previous example. You must convert claims containing active verbs. The second premise here is “All French are scorpion-fearers,” so there is no middle term.
15. Invalid form.
16. All suns are light givers. No shadows are light givers, so shadows are suns. Invalid. It does not pass the second rule since there is a negative premise but the conclusion is not negative when it should be.
17. Valid.
18. Invalid. Does not pass the second rule. There are two negative premises, which is not allowed.
19. Invalid. Does not pass the third rule since a term is distributed in the conclusion (fighters) and not in a premise.
20. Valid.
21. Valid.
22. Valid.
23. Valid.
24. Since there is no premise or conclusion identifier here, and the second and third claims are connected by “and,” they must be the premises. So, this is invalid because “Do’h-sayers” is distributed in the conclusion and not in the premise.
25. The middle term, “stronger,” is not distributed in either premise, so it is invalid.]
26. “No girls are baseball-players and some soccer-players are girls, so no soccer-players are baseball-players.” Both terms are distributed in the conclusion, and neither is distributed in the premises, so this is invalid.
27. Valid.
28. Valid.
29. Valid.
30. Valid.
31. Valid.
32. Invalid: There is only one negative claim—in a premise, but not also in the conclusion. Also, if we get rid of the active verb, the first premise becomes “All girls are dress-likers,” so there is no middle term.
33. Valid.
34. Whether this is valid depends on what you think “All good things have no evil” means, since that isn’t in the form of a claim. It might be “All good things are no-evil-havers,” “No good things are evil-havers,” or “Some good things are not evil-havers.” In this case, as long as the conclusion is interpreted the same way, all three would be valid.
35. Invalid. There is a negative premise and no negative in the conclusion. But we should have recognize this as invalid before we got that far, since the first premise is “Some boys are not criers” and the second is “All cries are heard” which gives us four terms. Remember to convert active verbs as your first step.
36. The middle term is distributed in at least one premise. Since there is a negative premise, the conclusion has to be negative, and it is. In the conclusion, both terms are distributed so it satisfies that rule as well. Therefore this is a valid argument.
37. “Animals” is distributed in the conclusion, but not in the premise, so this is invalid.
38. Invalid. The middle term is not distributed in either premise.
39. Valid.
40. The middle term (chocolates) is distributed in the second premise, there are no negatives so we skip that rule, and there is no distributed term in the conclusion, so this argument is valid.

41. Invalid. A valid conclusion would be “Chickens are not cows.”
42. Valid
43. You only need to affirm one for an “or” (see the section on “Conjunctions and Disjunctions”). What this means is, “No SJSU student goes to Gold’s Gym and no SJSU student goes to Jenny Craig. Simmons is a Gold’s-goer. Therefore Simons is not an SJSU student.” Valid.
44. Valid.
45. The middle term is not distributed, so this is invalid.
46. Valid
47. Valid.
48. Valid.
49. Valid.
50. Valid.
51. Valid.
52. But your first step in analyzing an argument should always be to convert active verbs. Here, “Mike has a monkey” would become “Mike is a monkey-owner,” meaning that there is no middle term, and making this invalid. What would be the difference if the second premise stated, “Mike is a monkey”?
53. Invalid—middle term must be distributed in at least one premise.
54. Valid).
55. Again, the first problem is the active verbs, “milk” and “produce.” There are five, not three, terms here, so we don’t even have to worry about applying the rules.
56. “Sharpshooters” is distributed in the conclusion and not the premise. Invalid.
57. The middle term (drug users) is not distributed in either premise. Invalid.
58. Invalid: negative premise but no negative conclusion.
59. Invalid: two negative premises.
60. “Fast runners” is distributed in the conclusion and not the premise. Invalid.
61. Valid.
62. If we assume that “fast” and “quick” are equivalent, then this is valid.
63. Invalid: middle term (mice) is not distributed.
64. “People” is distributed in the conclusion and not in the premise. Invalid
65. Valid.

Answer Key: Exercise #2

1. Valid: Some chairs are not tables, and some tables are wood things. So some wood things are not chairs.

2. Invalid: the second premise is probably “All flutes are instruments,” so the middle term is not distributed.

3. Valid.

4. Invalid: middle term not distributed.

5. Valid.

6. Valid.

7. Valid.

8. Valid.

9. Valid.

10. Valid.

11. Invalid: expensive distributed in conclusion and not premise.

12. Valid.

13. Invalid: middle term not distributed.

14. Valid

15. Valid

16. Valid. The second premise would be “Some Y (fruits) are Z (not delicious),” making the conclusion “Some Z (not delicious) are not fruits.” The middle term, “fruits,” is distributed in the first premise, there is a negative premise and conclusion, and “fruits” is distributed in the conclusion and the premise.

17. Valid.

18. Invalid: “chimpanzee” is distributed in the conclusion but not the premise.

19. Invalid: “coordination” is distributed in the conclusion and not the premise.

20. Valid

21. If “Cars are sometimes painted yellow” means “Some cars are yellow cars,” and if "Yellow cars are always fast" is the same as "All yellow cars are fast," then this is valid.

22. Valid

23. Invalid: negative premise, but not conclusion.

24. Valid

25. Valid

26. Valid

27. Valid

28. Valid

29. Valid

30. Invalid: middle term not distributed.

31. Invalid: “Spots” distributed in the conclusion and not the premise.

32. Invalid: negative premise, but no negative conclusion.

33. Invalid: negative premise, but no negative conclusion.

34. Valid

35. Valid

36. Invalid: middle term not distributed.

37. Valid

38. Invalid: apples is distributed in the conclusion and not the premise.

39. Valid

40. Valid

41. Some A are B
Some B are C
Therefore, some A are C
Invalid: Middle term (B) is not distributed in at least one of the premises.

42. All A are B
Some A are C
Therefore, some B are C
Valid: There are no negative claims, and no term in the conclusion is distributed, thus the terms do not need to be distributed in the premises. The middle term (A) is distributed in the first premise.

43. Some A are B
No B is C
Some A are not C
Valid: The conclusion is negative with one negative premise. The term distributed in the conclusion is distributed in at least one premise. The middle term (digital) is distributed at least once.

44. Some A are B
All A Are C
Therefore, all B are C
Invalid: The term distributed in the conclusion (flyers) is not distributed in the premise.

45. No A is B
Some B are C
Therefore, No A is C
Invalid: The term distributed on the conclusion (mammals) is not distributed in the premise.

46. Some A are B
No B is C
Therefore, Some A are not C
Valid: The conclusion is negative and one premise is negative. The distributed term in the conclusion is distributed in the premise. The middle term (home) is distributed in at least one premise.

47. All A is B
Some B are C
Therefore, A is C
Invalid: The middle term (alien) is not distributed in at least one premise.

48. Some A are B
No B is C
Therefore, no A is a C
Invalid: The distributed term in the conclusion (Christian) is not distributed in the premise.

49. All A are B
No B is C
Therefore, no A is C
Valid: The negative conclusion has at least one negative premise. The distributed term in the conclusion (Fruit) is distributed in the premise. The middle term is distributed in at least one premise.

50. Some A are B
No B is C
Therefore, some A are not C
Valid: The negative conclusion has one negative premise. The distributed term in the conclusion (Workers) is distributed in the premise. The middle term is distributed in at least one premise.

51. Invalid: Middle term (computer) is not distributed.

52. Valid

53. Invalid: negative in premise but not conclusion.

54. Invalid: negative in premise but not conclusion.

55. Invalid: "Folger lovers" distributed in the conclusion and not the premise.

56. Invalid: middle term not distributed.

57. Valid.

58. Invalid: middle term not distributed.

59. Invalid, "Earthquake-proof" is distributed in conclusion but not in the premise.

60. Valid

61. Valid

62. Valid

63. Valid

64. Invalid: negative premise, but no negative conclusion.

65. Valid.

66. What does "all Texans are not liberals" mean when you put it in the form of a claim—"Some Texans are not liberal," or "No Texans are liberal." But it doesn't matter to the validity here, because "liberal" is distributed in both the conclusion and the premise, and so is "Texans" in the case of "No Texans." If it's "Some Texans," it's not distributed in the conclusion, so we don't have to check whether it is distributed in the premise.

67. Valid

68. Invalid: "human" is distributed in the conclusion and not in the premise.

69. Valid.

70. Invalid: "fathers" distributed in the conclusion and not in the premise.

71. Valid.

72. Valid.

73. Invalid: "comfortable" is distributed in the conclusion and not the premise.

74. Valid.

75. Invalid, because you forgot to change the active verb in the first premise, so there are actual two different terms: "emotion-expressers" in the first premise and "emotion" in the second.

76. Invalid: middle term is not distributed.

77. Invalid: middle term is not distributed.

78. Valid.

Answer Key to Exercise #5

1. If 70% or better (P) —» pass (Q).
   a. P, therefore pass (Q).
   b. Q . . . invalid.
   c. Not Q, so not 70%+ (Not P).
   d. Not P . . . invalid.
   e. Not P . . . invalid

2. Only if: If pass —» 70% or better
   a. Q . . . invalid.
   b. P, therefore 70% or better (Q).

3. If better GRE (P) —» academically superior.
   Not Q (not academically superior).
   Therefore, Not P (not better on GRE)

4. Chain Argument: If trust (P) —» friends (Q)
If friends (Q) —» well-adjusted (R)
If well adjusted (R) —» happy (S)
   a. Not R, therefore Not Q and Not P.
   b. Yes. (Not Q, therefore Not R is only valid conclusion.)
   c. Yes. (P, therefore Q, R, and S.)

5. If win (P), then go out (Q).
   a. Not Q, therefore no win (Not P).
   b. P, therefore go out (Q).
   c. Q . . . invalid.
   d. Not P . . . invalid.

Answer Key to Exercise #6

1. Valid: If (no accidents) then (on time)
   Not (on time)
   So, not (no accidents)= accident

2. Valid: If ride then call
   No call
   So, no ride

3. Notice the "if" and "then" are *not* part of the conditional.
   Valid: If red then fast
   Red
   So, fast

4. Watch the "not"
   Invalid: If (not parents) then (not you)
   Not you (affirming the consequent)

5. Notice the difference between "coming your way" and "going your way"—especially important when you are driving.
   Invalid: If coming then wrong lane.
   Not coming (negating the antecedent)

6. Nothing: affirming the consequent.

7. "If on floor, then not drunk." Having "drunk" as the second premise is Not Q, so you can conclude Not P, "You can't lie on the floor without holding on."

8. Only if
   Invalid: If call then positive
   No call (negating the

9. The form is valid:
   If 10 then (no space)
   Not (no space)
   So, not 10
But "not 10" is different from "after 10," so this is invalid. The person might have come before 10.

10. Yes: "without studying" negates the antecedent, so we can't know if John will pass the exam or not.

11. The problem here is that "drinking" and "drinking soda" are two different things, so this argument is invalid.

12. Invalid: If go, then Mexico
   Not go (negating the antecedent)

13. Or
The form here is valid:
   If brake, then stutter or die
   Brake
   So, stutter or die
But we can't conclude it died because someone stepped on the brakes. Maybe it only stuttered because of the brakes. *Even if the car did die, we can't conclude the cause was stepping on the brakes unless we know that the car did not also stutter.*

14. Or
   Invalid: negating "stutter" here does not negate "stutter or die." For an or, negate all, affirm one.

15. This is not a chain argument, but two separate conditionals, and only the second one is valid:
   If new, then (no trouble)
   Not (no trouble)
   Not new
So you can conclude that you didn't buy a new car, but you can't conclude that you did buy a used car.

16. Again, not a chain:
   If dog barks then bell rings
   If dog barks then someone
You can conclude nothing from the bell ringing (affirming the consequent).

17. Chain Argument
Invalid: If study then do well
   If do well, then raise GPA
"Didn't study" would be negating the antecedent.

18. Chain Argument and Or
Invalid: If ticket then good game
   If good game then enjoy or not

If enjoy then come back.

"Not enjoy" is insufficient to negate the consequent of the second conditional, because for an <u>or</u> you need to negate all or affirm one.

19. <u>Or</u>

You did not buy a soda.

Valid: If soda, then not candy.

No (not candy)

So no soda.

But "no soda" is insufficient to negate "soda or candy" because you have to affirm one or negate all for an <u>or</u>.

20. <u>One-Way Chain</u>. Note that you can't pass 1B if you don't take it, but taking it doesn't mean you pass it.

Valid: If senior then taken 100W

If taken 100W, then passed WST

If taken WST, then passed 1B

If taken 1B, then passed 1A

Not passed 1A negates taken and passed 1B, taken and passed WST, taken 100W, and senior.

21. <u>Inverted Chain</u>

Valid: if noisy then party

if party then fun

if no band then no fun

if band then dancing

Noisy, so party and fun, which equals "not (no fun)" so "not (no band)," which equals band, so dancing.

<u>Answer Key to Exercise #7</u>

"Only if" conditionals

1. Valid.
2. Invalid.
3. Valid.
4. Invalid.
5. This and the next exercise give only a second premise and a conclusion. But, as long as we can create a suitable conditional premise, the argument is valid. In this case, the conditional must be "If we request the same spending level as last year, then our budget will be approved." Supply the conditional that makes the next one valid.
6. Valid.
7. Invalid.
8. Valid.
9. Valid.
10. Valid.
11. Affirming the consequent—invalid.
12. Valid.
13. Valid.
14. Valid.
15. Invalid: negating the antecedent.
16. Valid.
17. Invalid: "I did not run" would be negating the antecedent (not p).
18. Valid: if p $\rightarrow$ q, not q, therefore not p. "Only marshmallows" in this case means "marshmallows and nothing else," so treat it as a conjunction, and negating "marshmallow" negates q.
19. Invalid: "I jump" is not p, so no conclusion is possible.
20. Valid.
21. Invalid. Note that this is not an "only if" argument. We could restate it as "If he does not do his part of the work, then he'll be the only one to fail." That's different from "He will fail only if he does not do his part of the work."
22. Valid.
23. Invalid.
24. Valid. Note that this is not an "only if" argument. We could restate it as "If he eats the apple, then he'll be the only one to choke." That's different from "He will choke only if he eats the apple."
25. Invalid: P→Q, Q therefore P.
26. Invalid: P→Q, Q therefore P. Note that "when," like "if," indicates a premise, so "the steak is tasteless" is the premise, not the conclusion here.
27. Valid: P→Q, not Q therefore not P.]
28. Valid: affirming the antecedent.
29. Invalid: P→Q, Q therefore P.
30. .Invalid: affirming the consequent.
31. Valid: negating the consequent.
32. Valid: modus tollens.
33. Invalid: affirming the consequent.
34. Valid: modus tollens.
35. Invalid: affirming the consequent.
36. Valid.
37. Invalid: affirming the consequent.
38. Valid.
39. Invalid: negating the antecedent. Plus, there's the problem of whether "not everything" is the same as "nothing."
40. Valid argument: affirming the antecedent. Conclusion: therefore, it rained.
41. Invalid argument: affirming the consequent.
42. Invalid: negating the antecedent.
43. ! Invalid: affirming the consequent.
44. Invalid argument: negating the antecedent.
45. Valid.
46. Valid.
47. Invalid: affirming the consequent.
48. Valid.
49. Invalid.
50. Invalid.
51. This is valid because it follows the format: "P therefore Q."
52. Invalid.
53. This is valid because it follows the format: "not Q therefore not P."
54. Invalid: affirming the consequent.]

<u>Chain arguments</u>

1. Valid—but don't forget that you also conclude that "I won't make a chocolate cake, I won't make raspberry

sauce, I won't need to go to a market, and I won't ride my bike."

2. "I can drive and did not forget my key."

3. Invalid: affirming the consequent. You can't conclude anything from "I am happy."

4. Valid: not q, therefore not p. Note that you cannot conclude "I didn't go to the park."

5a. He does not buy the photo equipment. Therefore he cannot take pictures.
He cannot take pictures. Therefore he cannot do the assignment.
He cannot do the assignment. Therefore he cannot turn it in.
He cannot turn it in. Therefore he will not get a grade.
He does not get a grade. Therefore only he will fail.
Valid.

5b. He got a grade. Therefore he turned it in.
He turned it in. Therefore he did the assignment.
He did the assignment. Therefore he took pictures.
He took pictures. Therefore he bought the photo equipment.
Valid.

6. Valid: modus ponens. But remember that you can also conclude, "I'll bring my purse, and have my pepper spray with me."

7. Valid argument: conclusion of previous link is the antecedent of the next premise. Conclusion: "I will be in trouble, I will be mad, I will yell, and my neighbors will complain."

8. Valid. Conclusion: I don't love you, you won't love me, you aren't crazy, you will be loved.

9. Therefore, I did not go to bed, I did not feel drowsy, I did not take the medicine, I did not get sick, and I did not eat the strawberry.

<u>Conjunctions and Disjunctions in Conditionals</u>

1. Valid: p → q.
2. .Two problems. First, is "leaving" and "going home" the same thing? More importantly, "the girls don't dance" means "Natalie and Rachel don't dance," and since it is an "and," to negate that you only need to negate one. So the conclusion here is invalid: you can only conclude that at least one of them danced.
3. Invalid: the rule for an "or" is "affirm one, negate all," but only one has been negated here, so that's cannot be "not q."
4. Invalid: have to negate all parts of "or."
5. Valid: not q → not p, and only one part must be negated for "and."
6. Valid.
7. Invalid. Note that this is an "only if" conditional, "He can read a textbook or a library book only if he reads a book."
8. Valid. This affirms an "and," so we could conclude both that "he spins around" and "he goes in circles," but it's not invalid to state just one or the other as a valid conclusion, as long as you don't imply that the one stated is the only conclusion possible.
9. Valid.
10. Valid.
11. Valid: modus tollens.
12. Valid: modus ponens.
13. Valid: modus tollens.
14. Valid: modus ponens.
15. Invalid: negating the antecedent.
16. Invalid: affirming the consequent.
17. Valid argument: negating the consequent and negating all. So you can conclude, "Kelly did not visit New York."
18. Valid argument: affirming the antecedent and affirming all.
19. Invalid: this does negate the consequent by negating one of an "and," but the conclusion given here is P, when it should be Not P.
20. Valid argument: negating the consequent and negating all.
21. This is a valid argument, because all are affirmed.
22. This is a valid argument, because all are negated.
23. Nothing can be concluded, because ONE thing cannot be negated in a disjunction - all must be negated. She could have bought the pie, or bought neither.
24. Invalid: affirming the consequent.

25. Valid, and we can conclude that he did not go to the tattoo shop, but no conclusion can be drawn about whether he got the tattoo of the flame.

Answer Key, Exercise 8:

1. Only, and:
If graduate, then Math, English and History.
Not English = Not Q, so not graduate (Not P).

2. All overweight (X) are doughnut eaters (Y).
Z is a doughnut eater (Y) . . . invalid.

3. All men (X) are equal (Y).
No woman (Z) is man (X) . . . invalid.

4. If vote (P), then change (Q).
Not vote (Not P) . . . invalid.

5. Double All: All feminists (X) are uptight (Y).
All females (Z) are feminists (X).
Therefore, all females (Z) are uptight (Y).

6. If shy (P) —» not talk (Q).
Not shy (Not P) . . . invalid

7. If GPA (P) —» car (Q)
P, therefore car (Q).

8. Only, and:
If promoted (P) —» passed and interviewed (Q)
Not Q, therefore not promoted (Not P).

9. If politician (P) —» lie (Q).
Not lie (Not Q), therefore not politician (Not P).

10. No Y is Z = No Z is Y Conversion
All users (X) are immoral (Y)
No teachers (Z) are immoral (Y)
Therefore, no users (Z) are teachers.

11. No Republican (No X) is supporter (Y)
No Bush (No Z) is supporter (Y) . . . invalid.

12. All good books are understood.
No Zen is good . . . invalid.

13. If tutor —» improve.
Improve . . . invalid.

14. All "alls" are untrue.
That is "all"
Therefore, that is untrue.

15. If larger and labelled —» no glasses.
Glasses (Not Q), so either not larger or not labelled (Not P).

16. If not understand (P) —» not pass (Q)
Undeerstand (Not P) . . . invalid.

17. Some ulcers are stress-caused.
Z is an ulcer
Z may be stress caused.

18. If brake —» slow or stop
Braked (P), therefore stopped.
This is invalid because of the "or": the might only have slowed down when braked.

19. If complete —» 10 points.
Not complete . . . invalid.

Answer Key to Exercise #9

1. AC: Since the argument shifts from "Jake" to "you," the major premise must be more general:
If stupid (P)—» no homework (Q)
Even so, the second premise, "You don't do your homework," affirms the consequent (Q), and so the argument is invalid.

2. NA: If sweater (P) —» warm (Q)
No sweater (Not P) . . . invalid

3. NC: If sweets (P) —» cavities (Q)
No cavities (Not Q), so no sweets (Not P)

4. NA: If sleep (P) —» not tired (Q)
Not sleep (Not P) . . . invalid

5. Double "All":
All Car owners (X) are school drivers (Y)
All SJSU (Z) are car owners (X)
So, all SJSU (Z) are school drivers (Y)

6. AC: If guilty (P) —» jail (Q)
Jail (Q) . . . invalid

7. Only if: If go out (P) —» birthday (Q)
Not go out (Not P) . . . invalid

8. If lose (P)—» exercise or eat less (Q)
Must negate *both* for or, and this only negates *one*, so "not eat less" is *not* Not Q. Therefore, invalid.

9. If >50% (P) —» secede (Q)
49.5% = Not >50% = Not P . . . invalid

10. All speeders (X) are ticket receivers (Y)
I (Z) am a ticket receivers (Y) . . . invalid
Note: this doesn't say that CHP didn't give tickets to reckless drivers, too, only that they did give them to all the speeders.

11. All chocolate eaters (X) are pimply (Y)
All teenagers (Z) are chocolate eaters (X)
So, All teenagers (Z) are pimply (Y)

12. If romance (P) —»enjoy (Q)
Not romance (Not P) . . . invalid

13. All lawful (X) are maximum 2 and 2 (Y)
Sam (Z) is 6 = Sam is not 2, and to negate the *and* we only need to negate one, so this is
No Z is Y, so No Z is X = Sam is not lawful.

14. Or:
If 5:00 or no traffic (P) —» home by dark (Q)
No traffic = P, because we only have to affirm one of the *or*. Therefore, Q, home by dark.

15. Only, and:
All aloof and unfriendly (X) are mistreated (Y)
No my cats (Z) are mistreated (Y)
So no my cats are aloof and unfriendly.
Note: They might be aloof, or they might be unfriendly. All we can conclude here is that they are not *both*, since negating an *and* negates only one.

16. NA: If not study (P) —» not pass (Q)
Studied (Not P) . . . invalid

17. NA: If coffee (P) —» awake (Q)
No coffee (Not P) . . . invalid

18. NA: If page (P) —» need ride (Q)
No page (Not P) . . . invalid

Answer Key, Exercises 11

1. All X (sports) are Y (expensive).
Z (Corvette) is X (sports)
Therefore, Z (Corvette) is Y (expensive).
Valid.

2. All X (sports) are Y (fast).
Some Z (cars) are not X (sports).
"Some Z" makes this into a *non-universal syllogism.* It is not valid, but we won't know why until later in the semester.

3. All X (pitbulls) are Y (vicious).
NO Z (terriers) are X (pitbulls).
Invalid. Doesn't fit the form. Second premise should be No Z is Y.

4. All X (classes) are Y (book-requirers). (change verb to "to be")
Z (physics) is X (class).
Therefore, Z (physics) is Y (book-requirer).
Valid. Ok, we needed to massage the "I have a physics class" a little, but doesn't this accurately represent what is intended by that argument?

5. All X (good dogs) are Y (heaven-goers). (changing verb)
Z Cece is Y (heaven-goers).
Invalid. Second premise should be Z is X.

6. All X (homework) is Y (suckable). (changing verb
Z (chemistry) is X (homework).
Therefore, Z (chemistry) is Y (suckable).
Valid

7. All X (teeny-boppers) are Y (bratty).
No Z (kid) is X (teeny-bopper).
Therefore, no Z (kid) is Y (bratty).

8. What's the conclusion here? The two claims linked by a conjunction ("but") are almost always the premises, leaving "All birds can fly" as the conclusion.
All X (ostriches) are Y (birds),
No X (ostriches) are Z (fliers) = No Z are X. (convertible)
Invalid—because the second premise should be No Z is Y.

9. All X (birds) are Y (fliers).
All Z (flying fish) are Y (fliers).
Invalid. Second premise should be Z is X.

10. All X (birds) are Y (fliers).
All Z (ostriches) are W (winged).
Invalid, since it introduces a fourth term. If this had said Z is X (ostriches are birds), however, we could then have concluded that Z is Y (ostriches are fliers).

11. Invalid. Second premise should be Z is X.

12. Valid. If it doesn't "sound right," your problem is probably with the first premise, because not all candy is sweet, apparently.

13. Dogs attack if they feel threatened. Does this mean "if threatened, then attack" or "if attacked, then felt threatened"? Apparently the first. Thus,
All X (threatened) are Y (attackers).
No Z (one) is Y (attacker).
Therefore, no Z (one) is X (threatened).
Valid.

14. Syllogisms are easy.
Homework is syllogisms.
Therefore, homework is easy.
Valid.

15. All X (Arnold films) are Y (action).
Z (*T2*) is X (Arnold film).
So Z (*T2*) is Y (action).
Valid.

16. Valid.

17. All X (lemons) are Y (yellow).
NO Z (lime) is X (lemon).
Invalid. The second premise should be No Z is Y. But that means the answer to "Is a lime yellow" is "Possibly," since we have no valid conclusion.

18. Invalid. The second premise should be No Z is Y, but here is it No Z (chair) is X (bed).

19. The problem here is that when you change the verb, you end up with "electricity-needer" in one premise and "electricity-maker" in the other, so there is no valid syllogism here.

20. Valid.

21. Valid. The first premise here would be "All X (winter time) is Y (freezing time)."

22. Invalid. The second premise should be No Z is Y, or "Julie doesn't bathe."

23. Invalid, and for the same reason as #22. Should be "Snails aren't fast, so snails aren't cars."

24. Invalid. Changing the verbs changes the terms. See #19.

25. Invalid. Second premise is "All X are Z."

26. Valid. As long as we know that all soccer players are athletes, then we can conclude the sibling is male.

27. Invalid. Changing verb makes "Arizona" in one premise and "Arizona-beater" in the other.

28. Invalid: verb change. Later we will see this as a fallacy.

29. "Certain" is "some," so this is a non-universal syllogism.

Readings

Brain-Teasers

Introduction

The following are logical problems, or "brain-teasers," which contain the information needed for their solutions, but present it in indirect but **relational** ways. Consider the following relational statements:

- The red book belongs to Ludmilla's brother.
- Ivan is Ludmilla's brother.
- Ludmilla has only one brother.

From this, of course, we can conclude that the red book belongs to Ivan, but it takes three bits of information to link "red book" and "Ivan." Each statement establishes relationships by creating or limiting a category. "The red book belongs to Ludmilla's brother," for instance, shows that the owner of the book falls into the category of "brothers of Ludmilla." The second statement gives us one member of that category, and the third statement limits the category to that one member. This example is simple enough that you probably were not conscious of the categorical thinking you employed in solving it, but the greater complexity of the following problems makes it important to attack them step by step, category by category.

1. The Singles Bar

While sitting in a club where all single men tell the truth and all married men lie, a woman is approached by three men. She asks the first guy if he is married, but the music is so loud that she can't hear his answer. So she turns to the second guy, who tells her, "The first guy said, 'I am married,' but he really is single." Then she turns to the third guy, who says, "The second guy is single." Determine the marital status of each of the three men.

2. Not Entirely Identical Twins

A man is sitting with two women, seemingly identical twins. One of the women always tells the truth, the other always lies, but the man does not know which one is which. The women have served him a pair of drinks, one of which contains a tasteless, odorless, but deadly poison, the other the cure for a fatal disease he has contracted. Before choosing which glass to drink, the man may ask one question of one of the women. Can you formulate a question that would guarantee the safety of the drink chosen?

3. The Flower Show

Jasmine, Rose, and Lily each had an entry in the county fair's flower competition. Coincidentally, the flowers they entered were a jasmine, a rose, and a lily, but not in that order—in fact, none of the three competitors entered her namesake flower. If, in addition, you know that Jasmine did not enter a rose, can you figure out which flower each woman entered?

4. The Dorms

Three women—named Dana, Alex, and Jean, all Business majors—signed up for a critical thinking class at San Jose State at the same time as three men—also named Dana, Alex, and Jean—did. The three men are majoring in English, Engineering, and Nursing, though not necessarily in that order. Given the following information, can you assign the correct name to each of those majors?

1. Jean lives in San Francisco with her mother.
2. The Engineering major lives on the peninsula, exactly halfway between San Jose and San Francisco.
3. Alex is joined in studying at San Jose State by both of her brothers.
4. The woman who lives nearest the Engineering major has three times as many brothers as he does.
5. The women with the same name as the Engineering major lives in San Jose.
6. Dana says he is smarter than the English major.

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5. Class Reports

Five students in the Hebrew literature course (Dror, Hava, Eitan, Maya, and Zvike) have been assigned reports on five modern Hebrew writers (Oz, Agnon, Rahel, Yehoshua, and Bialik). Each student has a different writer, and each report will be made on a different day of the week (Sunday, Monday, Tuesday, Wednesday, or Thursday). From the following information, determine which student will be reporting on which day about which author:

1. The report on Agnon will be given on Monday, and the report on Oz will be given on Wednesday, but the report on Rahel will not be given on Thursday, and the report on Bialik will not be given on either Sunday or Thursday.
2. Neither Zvike nor Dror nor Maya is doing the report on Yehoshua, but Eitan is doing the report on Rahel.
3. Zvike is not giving his report on Monday, and Dror is not giving his report on either Monday or Wednesday.

THE DECLARATION OF INDEPENDENCE

IN CONGRESS, JULY 4, 1776

THE UNANIMOUS DECLARATION OF THE THIRTEEN UNITED STATES OF AMERICA

When, in the course of human events, it becomes necessary for one people to dissolve the political bonds which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed. That whenever any Form of Government becomes destructive to these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that governments long established should not be changed for light and transient causes; and accordingly all experience hath shown that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same object evinces a design to reduce them under absolute despotism, it is their right, it is their duty, to throw off such government, and to provide new guards for their future security. Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former systems of government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. To prove this, let facts be submitted to a candid world.

> He has refused his assent to laws, the most wholesome and necessary for the public good.
>
> He has forbidden his governors to pass laws of immediate and pressing importance, unless suspended in their operation till his assent should be obtained; and when so suspended, he has utterly neglected to attend to them.
>
> He has refused to pass other laws for the accommodation of large districts of people, unless those people would relinquish the right of representation in the Legislature, a right inestimable to them and formidable to tyrants only.

He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their public records, for the sole purpose of fatiguing them into compliance with his measures.

He has dissolved Representative Houses repeatedly, for opposing with manly firmness his invasions on the rights of the people.

He has refused for a long time, after such dissolutions, to cause others to be elected; whereby the legislative powers, incapable of annihilation, have returned to the people at large for their exercise; the State remaining in the meantime exposed to all the dangers of invasion from without, and convulsions within.

He has endeavored to prevent the population of these States; for that purpose obstructing the laws for naturalization of foreigners; refusing to pass others to encourage their migration hither, and raising the conditions of new appropriations of lands.

He has obstructed the administration of justice, by refusing his assent to laws for establishing judiciary powers.

He has made judges dependent on his will alone, for the tenure of their offices, and the amount and payment of their salaries.

He has erected a multitude of new offices, and sent hither swarms of officers to harass our people, and eat out their substance.

He has kept among us, in times of peace, standing armies without the consent of our legislature.

He has affected to render the military independent of and superior to civil power.

He has combined with others to subject us to a jurisdiction foreign to our constitution, and unacknowledged by our laws; giving his assent to their acts of pretended legislation:

> for quartering large bodies of armed troops among us:
>
> for protecting them, by mock trial, from punishment for any murders which they should commit on the inhabitants of these States:

for cutting off our trade with all parts of the world:

for imposing taxes on us without our consent:

for depriving us in many cases, of the benefits of trial by jury:

for transporting us beyond seas to be tried for pretended offenses:

for abolishing the free system of English laws in a neighboring province, establishing therein an arbitrary government, and enlarging its boundaries so as to render it at once an example and fit instrument for introducing the same absolute rule in these colonies:

for taking away our charters, abolishing our most valuable laws, and altering fundamentally the forms of our governments:

for suspending our own legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever.

He has abdicated government here, by declaring us out of his protection and waging war against us.

He has plundered our seas, ravaged our coasts, burned our towns, and destroyed the lives of our people.

He is at this time transporting large armies of foreign mercenaries to complete the works of death, desolation and tyranny, already begun with circumstances of cruelty and perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the Head of a civilized nation.

He has constrained our fellow citizens taken captive on the high seas to bear arms against their country, to become the executioners of their friends and brethren, or to fall themselves by their hands.

He has excited domestic insurrections amongst us, and has endeavored to bring on the inhabitants of our frontiers, the merciless Indian savages, whose known rule of warfare, is undistinguished destruction of all ages, sexes and conditions.

In every stage of these oppressions we have petitioned for redress in the most humble terms: our repeated petitions have been answered only by repeated injury. A prince, whose character is thus marked by every act which may define a Tyrant, is unfit to be the ruler of a free people.

Nor have we been wanting in attention to our British brethren. We have warned them from time to time of attempts by their legislature to extend an unwarrantable jurisdiction over us. We have reminded them of the circumstances of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to disavow these usurpations, which, would inevitably interrupt our connections and correspondence. We must, therefore, acquiesce in the necessity, which denounces our separation, and hold them, as we hold the rest of mankind, enemies in war, in peace friends.

We, therefore, the Representatives of the United States of America, in General Congress, assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the name, and by the authority of the good People of these Colonies, solemnly publish and declare, that these United Colonies are, and of right ought to be Free and Independent States; that they are absolved from all allegiance to the British Crown, and that all political connection between them and the state of Great Britain, is and ought to be totally dissolved; and that as Free and Independent States, they have full power to levy war, conclude peace, contract alliances, establish commerce, and to do all other acts and things which independent states may of right do. And for the support of this Declaration, with a firm reliance on the protection of Divine Providence, we mutually pledge to each other our lives, our fortunes and our sacred honor.

New Hampshire: Josiah Bartlett, William Whipple, Matthew Thornton
Massachusetts: John Hancock, Samuel Adams, John Adams, Robert Treat Paine, Elbridge Gerry
Rhode Island: Stephen Hopkins, William Ellery
Connecticut: Roger Sherman, Samuel Huntington, William Williams, Oliver Wolcott
New York: William Floyd, Philip Livingston, Francis Lewis, Lewis Morris
New Jersey: Richard Stockton, John Witherspoon, Francis Hopkinson, John Hart, Abraham Clark
Pennsylvania: Robert Morris, Benjamin Rush, Benjamin Franklin, John Morton, George Clymer, James Smith, George Taylor, James Wilson, George Ross
Delaware: Caesar Rodney, George Read, Thomas McKean
Maryland: Samuel Chase, William Paca, Thomas Stone, Charles Carroll of Carrollton
Virginia: George Wythe, Richard Henry Lee, Thomas Jefferson, Benjamin Harrison, Thomas Nelson, Jr., Francis Lightfoot Lee, Carter Braxton
North Carolina: William Hooper, Joseph Hewes, John Penn
South Carolina: Edward Rutledge, Thomas Heyward, Jr., Thomas Lynch, Jr., Arthur Middleton
Georgia: Button Gwinnett, Lyman Hall, George Walton