

Name: KEY

GRADE POINTS MISSED

$$n_1 = 84$$

$$n_2 = 4 \text{ (DRC)}$$

40 PT MAX

REPORT % SCORE

Instructions: Write neatly; be precise; use proper spelling, grammar, and notation. Each response is worth 1 point, unless otherwise noted. This is a closed-book text.

Allowed: Calculator; one self-generated 4-by-6 index card

Note: Z- and t-tables appear as the last two pages on this exam.

Time limit: 1-hour.

- 1) What *symbol* is used to represent the *point estimator* of the population mean?

$$\bar{x}$$

- 2) What *symbol* is used to represent the *true value* of the population mean?

$$\mu$$

- 3) Populations typically have a mean fasting glucose level of 83 mg/dL. The mean from a sample of $n = 40$ from your community is 88 mg/dL.

- (a) State the *null hypothesis* for testing whether your community has significantly higher than expected fasting blood glucose levels. Use proper statistical notation.

$$H_0: \mu = 83$$

- (b) Suppose the standard deviation σ for fasting blood glucose is typically 10 mg/dL. What is the value of the *standard error of the mean*?

$$SE_{\bar{x}} = \frac{10}{\sqrt{40}} = 1.5811$$

- (c) Calculate the *test statistic* for this problem.

$$z = \frac{88 - 83}{1.5811} = 3.16$$

- (d) Determine the *one-tailed P-value* for the problem.

$$P = .0008$$

- 4) In one of our labs, we compared serum creatinine levels in sample of patients to an expected mean of 0.9 mg/dL. The mean serum creatinine in the sample was 0.992. The two-sided P -value was .0214. Concisely, what does this say about the data?

SAMPLE MEAN SIGNIFICANTLY GREATER THAN / DIFFERENT
FROM 0.9; OR GOOD EVIDENCE AGAINST H_0

- 5) A 95% CI for a mean is 10.3 to 13.7.

(a) Does this CI provide significant evidence against $H_0: \mu = 10$ at $\alpha = .05$?

(circle) Yes / No

(b) Does this CI provide significant evidence against $H_0: \mu = 11$ at $\alpha = .05$?

(circle) Yes (No)

- 6) How large a sample is needed to calculate a 95% confidence interval for μ so that the margin of error is no more than 5? Assume standard deviation σ is 10 units. Show work. [2 pts]

$$n = \left(\frac{z_{1-\alpha/2} \sigma}{m} \right)^2 = \frac{1.96 \cdot 10}{5}$$

$$= 15.3 \rightarrow \underline{16}$$

SAMPLE SIZE UP TO
NEXT INTEGER TO
ENSURE PRECISION

- 7) A trial examines a treatment for glaucoma in 6 patients with bilateral disease. (Glaucoma is a disease of increased intra-ocular pressure). After a week of treatment, these intraocular pressures are recorded:

Control eye	Treated eye	
24.1	21.0	3.1
26.8	25.6	1.2
23.8	25.0	-1.2
16.8	21.0	-4.2
27.8	20.4	7.4
28.0	21.9	6.1

- (a) What type of sample is this?

(circle) Single sample / Paired samples / Independent samples

- (b) List the within-pair difference ("delta") values.

SEE ABOVE

OK TO REVERSE SIGN IF CONSISTENT

- (c) Calculate the mean difference in eye pressure.

$$\bar{x}_d = 2.067$$

- (d) Calculate the standard deviation of the difference*

$$s_d = 4.393$$

* Use of a hand calculator is recommended.

- 8) A sample of 16 paired measurements shows a mean difference \bar{x}_d of 10.013 with standard deviation s_d of 2.404 based. Calculate a 99% CI for μ_d . Show all work. [4 pts]

$$t_{15, .995} = 2.947$$

$$SE_{\bar{x}_d} = \frac{2.404}{\sqrt{16}} = 0.601$$

$$\begin{aligned} 99\% \text{ CI for } \mu_d &= 10.013 \pm (2.947) \cdot (.601) \\ &= 10.013 \pm 1.771 \\ &= 8.242 - 11.784 \end{aligned}$$

- 9) What is the value of the margin of error of the confidence interval you just calculated in question 8?† (Additional calculations *not* required.)

1.771

- 10) Homework exercise 9.19 assigned this semester compared a jury weighing evidence against a person being tried, to a statistician weighing evidence against a null hypothesis. In this analogy, the null hypothesis is “innocent until proven guilty.”

- (a) If the null hypothesis is actually “innocent,” but is declared “guilty,” what type of error has occurred?

TYPE I (α OK)

- (b) If the null hypothesis is actually “guilty,” but is declared “not guilty,” what type of error has occurred?

TYPE II (β OK)

† Note for *after* the exam: LM5.3a.

8

11) We are concerned about delay in discharges for older patients from hospitals to long term care facilities. A dozen recent discharges from two different hospitals are compared. The lengths in delays from Hospital A are {12, 9, 13, 16, 7, 19, 20, 16, 15, 14, 12, 16}. The delays fro Hospital B are {7, 10, 13, 15, 9, 15, 12, 16, 8, 9, 6, 12}. SPSS provides these descriptive statistics:

Group Statistics

	Hosp ital	N	Mean	Std. Deviation	Std. Error Mean
DELAY	A	12	14.08	3.777	1.090
	B	12	11.00	3.330	.961

✓

(a) What type of sample is this?
 (circle) Single sample / Paired samples Independent samples

(b) Test whether there a significant difference in the means from these two groups. Show all hypothesis testing steps. Use a two-sided alternative. Remember to interpret the results of the test. [7 pts]

✓

$$H_0: \mu_1 - \mu_2 = 0$$

✓

$$SE_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{3.777^2}{12} + \frac{3.330^2}{12}} = 1.454$$

✓

$$t_{stat} = \frac{3.777 - 3.330}{1.454} = 2.121$$

✓

$$df_{con} = 11$$

✓

ONE-SIDED P BETWEEN .05 & .025

✓

TWO-SIDED P BETWEEN .10 & .05

The Tuesday and Wednesday labs do *not* meet this week, but the Thursday lab *does* meet at its regularly scheduled time.

✓ THE DIFFERENCE IS MARGINALLY SIGNIFICANT

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