

**San José State University**  
**Department of Computer Science**  
**Spring Semester 2018**  
**CS 249 – Distributed Systems, Section 1**

**Course and Contact Information**

**Instructor:** Ahmed Ezzat  
**Office Location:** MH-218  
**Email:** [Ahmed.Ezzat@sjsu.edu](mailto:Ahmed.Ezzat@sjsu.edu)  
**Office Hours:** Mon+Wed 10:00AM – 12:00Noon (by advance reservation only)  
**Class Hours:** Mon+Wed: 7:30PM – 8:45PM  
**Classroom:** MH-222  
**Prerequisites:** CS 149 (Operating Systems) with a grade of C or better, or instructor's consent. The Department of Computer Science strictly enforces prerequisites. The instructor may drop any student who does not show up for the first two class meetings without providing a valid excuse ahead of time.  
**Grader:** Ahmed Ezzat      **Email:** [Ahmed.Ezzat@sjsu.edu](mailto:Ahmed.Ezzat@sjsu.edu)

**Course Description**

**Distributed System:** is an advanced course that focuses on Distributed System architecture and issues and covers distributed algorithms. The class will focus on the fundamental concepts associated with distributed systems and conclude with couple of case studies. The course include individual homework assignments and group project. Prerequisite: (1) CS149 (with a grade “C” or better. (2) Java and C programming knowledge. (3) Computer Science, Applied and Computational Math, or Software Engineering Majors only; or with instructor consent.

**Course Learning Outcomes (CLO)**

Upon successful course completion, students would achieve the following:

- Understand what distributed systems are.
- Understand various distributed systems challenges and relevant algorithms.
- Strong grasp of distributed algorithms
- Explain the software challenges associated with distributed systems.
- Become a better programmer.
- Improved presentation skills

## Required TextBooks

- George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, “Distributed Systems Concepts and Design,” Addison Wesley/Pearson, 5<sup>th</sup> Edition, 2012, ISBN-13: 978-0-13-214301-1 [Mandatory]

## Recommended TextBooks for self-study

- Andrew S. Tanenbaum, Maarten Van Steen, “Distributed Systems: Principals and Paradigms,” 2<sup>nd</sup> Edition, 2016, ISBN-13: 978-0132392273 [Optional].

## Course Requirements and Assignments

All the assignments and related documents (hard copy) must be handed in the classroom on due date. Students will lose 10% of the homework or project grade for each day delay, and after 5 days, homework or projects will not be accepted.

### Homework and Project descriptions are available on Canvas:

#### Homework:

- Homework-1: [Assignment is on Jan. 29, 2018, and is due back on Feb. 7, 2018.](#)
- Homework-2: [Assignment is on Feb. 7, 2018, and is due back on Feb. 19, 2018.](#)
- Homework-3: [Assignment is on Feb. 28, 2018, and is due back on March 21, 2018.](#)
- Homework-4: [Assignment is on April 9, 2018, and is due back on April 18, 2018.](#)
- Homework-5: [Assignment is on April 23, 2018, and is due back on May 7, 2018.](#)

### Projects: Project and Research paper Groups are formed by Jan. 31, 2018:

- Project-1 (Group): [Assignment is on Feb. 5, 2018, Outline finalized on Feb. 12, 2018 and project is due back on March 7, 2018.](#)
- Project-2 (Group): [Assignment is on Feb. 7, 2018, Outline finalized on Feb. 19, 2018, and Final is due on May 9, 2018.](#)

### Research Paper: Project and Research paper Groups are formed by Jan. 31, 2018:

- Research Paper (Group): [Assignment is on Feb. 5, 2018, Outline finalized on Feb. 21, 2018, and project is due back on April 30, 2018.](#)

## Exams or Evaluation

The midterm and final examinations will be closed book and no notes. There will be no laptops, or any personal digital devices allowed. There will be no make-up exams. If a student misses an exam without a legitimate excuse, a grade of zero will be recorded. If a student missed an exam with a legitimate excuse then the grade for that exam will be prorated. More details can be found on final examination in [University Policy S06-4](http://www.sjsu.edu/senate/docs/S06-4.pdf) (<http://www.sjsu.edu/senate/docs/S06-4.pdf>) which states that “There shall be an appropriate final examination or evaluation at the scheduled time in every course, unless

*specifically exempted by the college dean who has curricular responsibility for the course.”*

## **Grading Information**

Your individual class grade will be weighted as follows:

- |                        |     |           |                                   |
|------------------------|-----|-----------|-----------------------------------|
| • Homework (5)         | 20% | 20 points | individual scores                 |
| • Projects (1)         | 10% | 10 points | (Group project)                   |
| • Research Paper (1)   | 15% | 15 points | (Group Research Paper)            |
| • Random Class Quizzes | 10% | 10 points | individual scores                 |
| • Midterm              | 20% | 20 points | individual scores                 |
| • Project Demo         | 25% | 25 points | individual (10)/Group scores (15) |

Each assignment, project, and exam will be scored (given points) but not assigned a letter grade. The mean score for the class will be announced with returning the graded exams.

## **Important NOTE:**

In some occasions, the instructor may decide to administer evaluations where students are allowed to use their “paper notes”- (NO BOOK OR ELECTRONIC COPIES), so it is in your best interest to attend to class and take good notes; they may be handy in such situations. These individual in-class quizzes are not scheduled in-advance and they account to 10% of the overall class grade.

## **Determination of Grades**

Final individual class letter grades will be assigned based on the class curve (i.e. relative grading). Your final class grade can be impacted up or down depending on the quizzes and on your level and quality of participation in your project team.

## **Classroom Protocol**

It is expected that student attend classes, be active and participate in the class by asking/answering questions, arrive in time and leave only after the class is ended. No eating is allowed in the classroom, and it is expected to turn your cell off before entering the classroom. Also, students are expected to track due dates for homework and projects as outlined in the syllabus on their own.

## **University Policies**

### **General Expectations, Rights and Responsibilities of the Student**

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and undergrad Programs’ [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>”

## CS 249, Distributed Systems, Section 1, Course Schedule

Any changes in the schedule will be sent to registered students through SJSU email 1 week earlier.

### Tentative course calendar

Week	Date	Item
1	Jan. 24 <sup>th</sup>	Lecture: Introduction to Distributed Systems – Characteristics, Motivation, Architecture Models, Networking, etc.
2	Jan. 29 <sup>th</sup>	Lecture: Introduction to Distributed Systems (Contd.) + <b>HW-1 Preview</b>
2	Jan. 31 <sup>st</sup>	Lecture: Inter-Process Communication - IPC: Architecture, IPC primitives, Remote Invocation, Space and time coupling, OS support, and RPC + <b>Project + Research Paper Group Formation</b>
3	Feb. 5 <sup>th</sup>	Lecture: Inter-Process Communication – IPC (Contd.) + <b>Project-1 Preview + Research Paper Preview</b>
3	Feb. 7 <sup>th</sup>	Lecture: Inter-Process Communication – IPC (Contd.) + <b>HW-1 due + HW-2 Preview + Final Project-2 Preview</b>
4	Feb. 12 <sup>th</sup>	Lecture: Distributed Objects and Components: IDL, Application Servers, Web Services, Peer-2-Peer systems + <b>Project-1 Proposal/Outline Finalized</b>
4	Feb. 14 <sup>th</sup>	Lecture: Distributed Objects and Components (Contd.)
5	Feb. 19 <sup>th</sup>	Lecture: Distributed Objects and Components (Contd.) + <b>HW-2 due + Final Project-2 Proposal/Outline Finalized</b>
5	Feb. 21 <sup>th</sup>	Lecture: Security Components, examples of authentication, authorization and privacy + <b>Research Paper Proposal/Outline Finalized</b>
6	Feb. 26 <sup>th</sup>	Lecture: Security Components (Contd.)
6	Feb. 28 <sup>th</sup>	Lecture: Distributed Shared Memory + <b>HW-3 Preview</b>
7	March 5 <sup>th</sup>	Lecture: Distributed Shared Memory (Contd.)
7	March 7 <sup>th</sup>	Lecture: Distributed File System: Storage and its properties, File system modules, Unix file system operation, examples (NFS, Andrew, Cedar, TAO, Facebook Distributed Graph store) + <b>Project-1 due</b>
8	March 12 <sup>th</sup>	Lecture: Distributed File System (Contd.) + <b>Midterm Preview</b>
8	March 14 <sup>th</sup>	Lecture: Distributed File System (Contd.)
9	<b>March 19<sup>th</sup></b>	<b>Midterm (Closed book)</b>
9	<b>March 21<sup>st</sup></b>	Lecture: Name Services + <b>HW-3 due</b>
10	<b>March 26<sup>th</sup></b>	<b>Spring Recess</b>
10	<b>March 28<sup>th</sup></b>	<b>Spring Recess</b>
11	April 2 <sup>nd</sup>	Lecture: Clock synchronization

<b>11</b>	April 4 <sup>th</sup>	Lecture: Clock synchronization (Contd.)
<b>12</b>	April 9 <sup>th</sup>	Lecture: Clock synchronization + <b>HW-4 Preview</b>
<b>12</b>	April 11 <sup>th</sup>	Lecture: Coordination and Agreement/Consensus: Paxos, Raft, Byzantine, etc...
<b>13</b>	April 16 <sup>th</sup>	Lecture: Coordination and Agreement/Consensus: (Contd.)
<b>13</b>	April 18 <sup>th</sup>	Lecture: Coordination and Agreement/Consensus: (Contd.) + <b>HW-4 due</b>
<b>14</b>	April 23 <sup>rd</sup>	Lecture: Transaction and Concurrency Control: Optimistic CC, distributed and Nested transactions, 2PC, distributed Deadlock + <b>HW-5 Preview</b>
<b>14</b>	April 25 <sup>th</sup>	Lecture: Transaction and Concurrency Control (Contd.)
<b>15</b>	April 30 <sup>th</sup>	Lecture: Transaction and Concurrency Control (Contd.) + <b>Research Paper is due</b>
<b>15</b>	May 2 <sup>nd</sup>	Lecture: Replication: Synchronous, Asynchronous, Quorum
<b>16</b>	May 7 <sup>th</sup>	Lecture: Replication (Contd.) + <b>HW-5 due</b>
<b>16</b>	May 9 <sup>th</sup>	Lecture: Case Study 1: Google – Search engine, message exchange in Paxos, Big Table + <b>Final Project Report-word/presentation-PPT is due</b>
<b>17</b>	May 14 <sup>th</sup>	Lecture: Case Study 2: MapReduce, Zookeeper
<b>17</b>	May 16 <sup>th</sup>	<b>Final (Project demo) – MH-222, Time is – 7:45pm – 10:00pm</b>