CMPSC 441
Distributed Systems
Spring 2016

Syllabus

Course Instructor

Dr. Gregory M. Kapfhammer
Office Location: Alden Hall 108
Office Phone: +1 814-332-2880
Email: `gkapfham@allegheny.edu`
Twitter: `@GregKapfhammer`
Web Site: `http://www.cs.allegheny.edu/sites/gkapfham/`

Instructor's Office Hours

- Tuesday: 11:00 am – 12:00 noon (15 minute time slots) *and*
  2:30 pm - 3:30 pm (15 minute time slots)
- Wednesday: 4:30 pm – 5:30 pm (10 minute time slots)
- Thursday: 11:00 am – 12:00 noon (15 minute time slots) *and*
  1:00 pm - 3:00 pm (15 minute time slots)
- Friday: 3:00 pm – 5:00 pm (15 minute time slots)

To schedule a meeting with me during my office hours, please visit my Web site and click the "Schedule" link in the top right-hand corner. Now, you can browse my office hours or schedule an appointment by clicking the correct link and then reserving an open time slot. Students are also encouraged to post appropriate questions to a channel in Slack, which is available at `https://CMPSC441Spring2016.slack.com`, and monitored by the course instructor.

Course Meeting Schedule

Lecture, Discussion, and Group Work: Tuesday, Thursday, 9:30 am – 10:45 am
Laboratory Session: Monday, 2:30 pm – 4:20 pm
Final Examination: Thursday, May 5, 2016 at 7:00 pm

Course Description

> An examination of the principles and paradigms associated with the design, implementation, and analysis of distributed systems. Topics include the characterization of distributed system models, remote communication, distributed scheduling, synchronization and mutual exclusion, naming and time, consistency and replication, and fault tolerance. Selected distributed system development environments are discussed in the context of the above topics. One laboratory per week. Prerequisites: CMPSC 280 or CMPSC 440 or permission of the instructor.

Course Objectives

The design, implementation, and use of distributed systems involves the application of many interesting theories, techniques, methodologies, and tools. This course has the objective to:

1. Provide an overview of the nature and functions of distributed systems.
2. Study the relationship between computer hardware and distributed systems.
3. Understand the connections between operating systems and distributed systems.
4. Enhance the understanding of the services that distributed systems provide to users.
5. Explore key distributed system concepts (e.g., processes and remote communication).
6. Study the algorithms used in distributed systems (e.g., load balancing and scheduling).
7. Examine, in detail, the design of several important components of a distributed system.
8. Develop a "big picture" understanding of the overall design of a distributed system.
9. Develop a basic understanding of security and reliability issues in distributed systems.
10. Enhance knowledge of the software tools used to design and implement distributed systems.

Throughout the semester students also will enhance their ability to write and present ideas about distributed systems in a clear and compelling fashion. Students will gain practical experience in the design, implementation, and analysis of distributed systems during laboratory sessions and a final project. Finally, students will develop a richer understanding of the fascinating connections between distributed systems and other disciplines in the social and natural sciences and the humanities.

Required Textbook

Distributed Systems: Principles and Paradigms. Andrew S. Tanenbaum and Maarten van Steen. Second Edition, ISBN: 0-13-239227-5, 686 pages, 2007.
(References to the textbook are abbreviated as "DSPP" on the course Web site).

Students who want to improve their technical writing skills may consult the following books.

BUGS in Writing: A Guide to Debugging Your Prose. Lyn Dupré. Second Edition, ISBN-10: 020137921X, ISBN-13: 978-0201379211, 704 pages, 1998.

Writing for Computer Science. Justin Zobel. Second Edition, ISBN-10: 1852338024, ISBN-13: 978-1852338022, 270 pages, 2004.

Along with reading the required textbook, you will be asked to study additional articles from a wide variety of conference proceedings, journals, and the popular press.

Class Policies

Grading

The grade that a student receives in this class will be based on the following categories. All percentages are approximate and, if the need to do so presents itself, it is possible for the assigned percentages to change during the academic semester.

Class Participation and Instructor Meetings	10%
First Examination	15%
Second Examination	15%
Final Examination	20%
Laboratory Assignments	30%
Final Project	10%

These grading categories have the following definitions:

- *Class Participation and Instructor Meetings*: All students are required to actively participate during all of the class sessions. Your participation will take forms such as answering questions about the required reading assignments, asking constructive questions of your group members, giving presentations, and leading a discussion session. Furthermore, all students are required to meet with the course instructor during office hours for a total of thirty minutes throughout the Spring 2016 semester. These meetings must be scheduled through the course instructor's reservation system and documented on a meeting record that you submit on the day of the final examination. A student will receive an interim and final grade for this category.

- *First and Second Examinations*: The first and second interim examinations will cover all of the material in their associated modules, as outlined on the review sheet. While the second examination is not cumulative, it will assume that a student has a basic understanding of the material that was the focus of the first examination. The date for the first and second examinations will be announced at least one week in advance of the scheduled date. Unless prior arrangements are made with the course instructor, all students will be expected to take these examinations on the scheduled date and to complete them in the stated period of time.

- *Final Examination*: The final examination is a three-hour cumulative test. By enrolling in this course, students agree that, unless there are extenuating circumstances, they will take the final examination at the date and time stated on the first page of the syllabus.

- *Laboratory Assignments*: These assignments invite students to explore different techniques for designing, implementing, evaluating, and documenting software solutions to challenging problems in the field of distributed systems. Many of the assignments will require students to write programs, conduct experiments, and collect, analyze, and write about data sets. To best ensure that students are ready to develop software in both other classes at Allegheny College and after graduation, students will complete assignments either on an individual basis or in teams. When teamwork is required, the instructor will often assign individuals to teams.

- *Final Project*: This project will present you with the description of an distributed systems problem and ask you to design and implement a correct and carefully evaluated solution. Completion of the final project will require you to apply all of the knowledge and skills that you have accumulated during the course of the semester to solve a problem and, whenever possible, make your solution and results publicly available in a free and open fashion.

Assignment Submission

All assignments will have a stated due date. Electronic versions of the laboratory and the final project assignments must be submitted to the version control repository that the student creates

at the start of the semester. Additionally, the printed version of the assignment is to be turned in at the beginning of the class on that due date; the printed materials must be dated and signed with the Honor Code pledge of the student(s) completing the work. Late assignments will be accepted for up to one week past the assigned due date with a 15% penalty. All of the late assignments must be turned in at the beginning of the session that is scheduled one week after the due date. Unless special arrangements are made with the instructor, no work will be accepted after the late deadline. For any assignment completed in a group, students must also turn in a one-page document that describes, in detail, each group member's contribution to the submitted deliverables.

Course Attendance

It is mandatory for all students to attend all of the class and laboratory sessions. If, due to extenuating circumstances, you will not be able to attend a session, then, whenever possible, please see the course instructor at least one week in advance to describe your situation. Students who miss more than five unexcused sessions will have their final grade in the course reduced by one letter grade. Students who miss more than ten of the aforementioned events will fail the course.

Use of Laboratory Facilities

Throughout the semester, we will experiment with many different software tools that computer scientists use during the design, implementation, evaluation, and interaction with operating systems. The course instructor and the department's systems administrator have invested a considerable amount of time to ensure that our laboratories support the completion of both the laboratory assignments and the final project. To this end, students are required to complete all assignments and the final project while using the department's laboratory facilities. The course instructor and the systems administrator normally do not assist students in configuring their personal computers.

Class Preparation

In order to minimize confusion and maximize learning, students must invest time to prepare for the class discussions, lectures, and laboratory sessions. During the class periods, the course instructor will often pose demanding questions that could require group discussion, the creation of a program or data set, a vote on a thought-provoking issue, or a group presentation. Only students who have prepared for class by reading the assigned material and reviewing the current laboratory and practical assignments will be able to effectively participate in these discussions.

More importantly, only prepared students will be able to acquire the knowledge and skills that are needed to be successful in this course, subsequent courses, and the field of computer science. In order to help students remain organized and effectively prepare for classes, the course instructor will maintain a class schedule with reading assignments and presentation slides. During the class sessions students will also be required to download, use, and modify programs and data sets that are made available through means such as the course Web site and a version control repository.

Seeking Assistance

Students who are struggling to understand the knowledge and skills developed in a class or laboratory session session are encouraged to seek assistance from the course instructor. Throughout the semester, students should, within the bounds of the Honor Code, ask and answer questions on the

Slack site for our course; please request assistance from the instructor first through Slack before sending an email. Students who need the instructor's assistance must schedule a meeting through his Web site and come to the meeting with all of the details needed to discuss their question.

Using Email

Although we will primarily use Slack for class communication, I will sometimes use email to send announcements about important matters such as changes in the schedule. It is your responsibility to check your email at least once a day and to ensure that you can reliably send and receive emails. This class policy is based on the statement about the use of email that appears in *The Compass*, the College's student handbook; please see the instructor if you do not have this handbook.

Disability Services

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. Students with disabilities who believe they may need accommodations in this class are encouraged to contact Disability Services at 332-2898. Disability Services is part of the Learning Commons and is located in Pelletier Library. Please do this as soon as possible to ensure that approved accommodations are implemented in a timely fashion.

Honor Code

The Academic Honor Program that governs the entire academic program at Allegheny College is described in the Allegheny Course Catalogue. The Honor Program applies to all work that is submitted for academic credit or to meet non-credit requirements for graduation at Allegheny College. This includes all work assigned for this class (e.g., examinations, laboratory assignments, and the final project). All students who have enrolled in the College will work under the Honor Program. Each student who has matriculated at the College has acknowledged the following pledge:

> I hereby recognize and pledge to fulfill my responsibilities, as defined in the Honor Code, and to maintain the integrity of both myself and the College community as a whole.

It is recognized that an important part of the learning process in any course, and particularly one in computer science, derives from thoughtful discussions with teachers and fellow students. Such dialogue is encouraged. However, it is necessary to distinguish carefully between the student who discusses the principles underlying a problem with others and the student who produces assignments that are identical to, or merely variations on, someone else's work. While it is acceptable for students in this class to discuss their programs, data sets, and reports with their classmates, deliverables that are nearly identical to the work of others will be taken as evidence of violating the Honor Code.

Welcome to an Adventure in Distributed Systems

In reference to software, Frederick P. Brooks, Jr. wrote in chapter one of *The Mythical Man Month*, "The magic of myth and legend has come true in our time." Software is a pervasive aspect of our society and distributed systems are one of the crucial components that enables people to interact with a wide range of hardware and software. At the start of this class, I invite you to participate in this adventure in the design, implementation, and evaluation of distributed systems!