CMPSC 400 – Operating Systems Syllabus

Spring 2020

Course Instructor

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Exam Code: D
Final deliverable due: Friday, 1st May 2020, 9:00 pm

Office Hours

Instructor's Office Hours

- Monday, Wednesday *and* Friday: 10:00 pm – 12:00 pm (10 minute time slots)
- By appointment, if these times do not work for you.

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 view my calendar or by clicking "schedule an appointment" link browse my office hours and schedule an appointment by clicking the correct link to reserve an open time slot.

Technical Leaders

- `https://www.cs.allegheny.edu/teaching/technicalleaders/`

Course Meeting Schedule

- **Lecture, Discussion, Presentations, and Group Work:**

    - 14th January - 29th April 2020
    - **Lecture**; Tuesday *and* Thursday, 11:00AM - 12:15AM, Alden Hall, Room 101
    - **Lab**; Tuesday, 2:30PM - 4:20PM, Alden Hall, Room 101

Academic Bulletin Description

A study of operating systems and their design and implementation. Topics include the evolution of modern computer operating systems, basic components of an operating system, and hardware issues of importance to operating system design and implementation. Consideration is given to processes & threads, resource (processor, memory, device, and software) management, process and device scheduling, deadlocks, input/output, file systems, and system security. A representative operating system is examined in detail. One laboratory per week. Offered in alternate years. Prerequisite: Computer Science 210. Offered in alternate years. Distribution Requirements: QR and SP.

Course Objectives

The design, implementation, and use of operating 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 operating systems.

2. Study the relationship between computer hardware and operating systems.

3. Enhance the understanding of the services that operating systems provide to users.

4. Explore fundamental operating system concepts (e.g., processes, address spaces, and files).

5. Study the algorithms in operating systems (e.g., memory management and scheduling).

6. Examine, in detail, the design of the important modules in an operating system.

7. Develop a "big picture" understanding of the overall design of an operating system.

8. Provide an introduction to multi-processor systems and distributed systems.

9. Develop a basic understanding of security and protection issues in operating systems.

10. Enhance knowledge of the Linux operating system and its associated tools.

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

Textbooks

The material for this course will be taken from two main books which are listed below. We will be following *Tanenbaum's Modern operating systems* but we may supplement some detail with *Galvin's Operating system concepts* for the lectures. It is highly recommended that you obtain a copy of each book for your study in this course.

- Tanenbaum, Andrew S., and Herbert Bos. *Modern operating systems: Forth Edition.* Prentice Hall Press, 2014.

- *Suggested*: Galvin, Peter B., Greg Gagne, and Abraham Silberschatz. *Operating system concepts: Ninth Edition.* John Wiley & Sons, Inc., 2013.

- *Suggested*: McHoes, Ann, and Ida M. Flynn. *Understanding operating systems.* Cengage Learning, 2013.

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

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

- Crapsi, Linda. *Bugs in Writing: A Guide to Debugging Your Prose.* Technical Communication 42.4 (1995): 665-667., ISBN-10: 020137921X, ISBN-13: 978-0201379211, 704 pages, 1998.

- Zobel, Justin. *Writing for computer science.* Vol. 8. New York NY: Springer, 2004., ISBN-10: 1852338024, ISBN-13:978-1852338022, 270 pages, 2004.

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 /Practical	10%
First Quiz	5%
Second Quiz	5%
First Examination	10%
Second Examination	10%
Laboratory Assignments	30%
Final Project	30%

Definitions of Grading Categories

- *Class Participation*: 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, completing in-class exercises, asking constructive questions of the other members of the class, giving presentations, leading a discussion session in class.

- *First and Second Quizzes*: The quizzes are designed to permit the student to know whether she or he is ready for the exam. Although the exams will contain new material, the quizzes will contain some of the concepts which the student may expect to see on the exam. Poor scores on quizzes will alert the student to approach the subject material with more focus.

- *First and Second Examinations*: The first and second examinations will cover all of the material in their associated module(s). 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 complete the tests in the stated period of time.

- *Laboratory Assignments*: These assignments invite students to explore the concepts, tools, and techniques associated with the management of data. All of the laboratory assignments require the use of the provided tools to design, implement, and evaluate systems that solve data management problems. To ensure that students are ready to develop software in both other classes at Allegheny College and after graduation, the instructor will assign individuals to teams for some of the laboratory assignments. Unless specified otherwise, each laboratory assignment will be due at the beginning of the next laboratory session. Some of the laboratory assignments in this course will expect students to give both a short presentation and a demonstration of the software that they created to manage a collection of data.

- *Final Project*: This project will present you with the description of a problem and ask you to implement a full-featured solution using one or more programming languages and a wide variety of data management techniques. The final project in this class 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 publicly available as a free and open-source tool. The project will invite you to draw upon both your problem solving skills and your knowledge of programming languages and data management systems.

Assignment Submission

We will be using GitHub Classroom to collect all assignments. It is expected that you are able to effectively use `git` to submit your work. If you require help, please see your peers, the Technology Leaders, or your instructor.

All assignments will have a stated due date. **Since solutions guides will be handed out at the beginning of class on due dates, the electronic version of the class assignments are to be turned in at the beginning of the class on that due date. Submissions after the beginning of class are counted as being late.** Assignments will be accepted for up to one week past the assigned due date with a 15% penalty. All late assignments must be submitted at the beginning of the session that is scheduled one week after the due date.

Extensions

Unless special arrangements are made with the course instructor, no assignments will be accepted after the late deadline. If you are requesting extensions for a lab assignment, then you are to email me with your request and also provide a *valid reason* for your extension. This request must come before the due date of the lab and not on the due date. Requests will not be granted where the reason appears to be insignificant. Extensions are 24 hours of extra time (after the original due date) and are given out at my discretion. The decision to provide you with an extension (or not) will be weighed in light of fairness to your peers who are still able to complete their labs, regardless of their own busy schedules.

The submission of homework comprises the Honor Code pledge of the student(s) completing the work. For any assignment completed in a group, students must also turn in a one-page reflection that describes each group member's contribution to the submitted deliverables.

Attendance

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

Use of Laboratory Facilities

Throughout the semester, we will experiment with many different tools that data managers use during the phases of the data management process. 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 will only be able to devote a limited amount of time to the configuration of a student's personal computer.

Class Preparation

In order to minimize confusion and maximize learning, students must invest time to prepare for class discussions and lectures. During the class periods, the course instructor will often pose demanding questions that could require group discussion, the creation of a program or test suite, 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 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 both this course and the field of data management. 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, diagrams, and data sets that are made available through the course GitHub repository.

Email

Using your Allegheny College email address, I will sometimes send out class announcements about matters such as assignment clarifications or 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 following statement in *The Compass*, the college's student handbook.

> "The use of email is a primary method of communication on campus. . . . All students are provided with a campus email account and address while enrolled at Allegheny and are expected to check the account on a regular basis."

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 Catalog. 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.*

Additionally, we expect that you will adhere to the following Department Policy:

Department of Computer Science Honor Code Policy

It is recognized that an important part of the learning process in any course, and particularly in computer science, derives from thoughtful discussions with teachers, student assistants, 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. It will therefore be understood that all assignments submitted to faculty of the Department of Computer Science are to be the original work of the student submitting the assignment, and should be signed in accordance with the provisions of the Honor Code. Appropriate action will be taken when assignments give evidence that they were derived from the work of others.