Course Description

This course provides a basic understanding of the software that manages a computer’s hardware resources to provide a powerful abstract interface on which user programs execute. The course focuses on the control and utilization of processor, memory, storage, and network resources. The concepts in this course include operating system structure, process management and scheduling, interprocess communication, synchronization of concurrent processes, deadlock, main and secondary storage management, virtual memory, file systems, protection and security, and some introduction to networking.

The course content is structured into two parts, a principles part and a projects part. The lectures and projects have been sequenced so that by the time you are working on a project, we have covered the concepts involved in that project in the lectures. Your implementation work in the projects will help make those concepts “real” and anchor these ideas in your understanding.

There are two versions of this course: COMP 421/ELEC 421, intended for undergraduate students, and COMP 521/ELEC 552, intended for graduate students. The lectures for both versions meet together, and the projects and exams for both are the same. However, for students taking the graduate version of the course, COMP 521/ELEC 552, there will also be a written report required as a part of each project.

Class Meetings

Due to COVID-19, all course lectures will be delivered as recorded videos that you can watch online, asynchronously, on Canvas.

Instructor

Dave Johnson, dbj@rice.edu, DCH 3007, 713-348-3063. Note that, due to COVID-19, I do not anticipate being available in my office this semester.

Office hours: The schedule for my office hours will be announced on the course website shortly.

Teaching Assistants

TAs for the class and their office hours will be announced on the course website shortly.

Prerequisites

Students taking this course should have already taken the Rice courses COMP 215 and COMP 321, or equivalent. In particular, you must be familiar with data structures and basic computer architecture concepts. You must also be proficient in programming in the C programming language on UNIX/Linux systems.

Most importantly, all programming projects in this course must be done in C, and the projects will require a significant amount of programming. If you need to review your programming skills, pay
special attention to studying data structures with pointers. Operating systems, in general, use more pointers (and sometimes in more confusing ways) than “normal” types of programs commonly do.

Be sure you understand exactly what a pointer actually is and how to make it point to something; there is a very important difference between declaring a pointer variable and making that pointer point to something (including allocating what you make it point to). Also be sure you understand the difference between a “static” or “global” variable, an “automatic” variable, and a variable allocated with “malloc” (or “calloc” and related calls).

Text


Note that we will cover topics in more depth than in the book, and will also cover some in a slightly different order. There may also be a few additional reading assignments, to be assigned in class during the semester. There will be a lot of material in the lectures that is not in the book.

Assignments

The assignments in this course will include three programming projects, plus a midterm exam and a final exam.

The exams may cover any material covered in the course. This includes the material from the lectures, from the assigned sections of the textbook, from any additional reading assignments handed out, or from the programming projects.

The first programming project must be done individually, and the last two projects will be done in groups of two students. The projects must be done on the Rice CLEAR system running Linux. For the programming projects done in groups, both partners in a project group must fully understand and participate in designing and programming the solution to the project. For example, there might be a question on an exam that can only be answered well if you have done the projects and really understand them.

Note that for the last two projects, done in groups of two students, both students in a group are jointly responsible for what the group submits for their project. Only one of the two students in a group actually does the project submission, but both partners should agree on what is to be submitted. Also, after a project submission, both partners should receive email (also sent automatically to the instructor) detailing the submission and the files that were included in it. Please carefully check this email when you receive it to make sure that the right files were submitted. In any case, if you have a concern about what your partner has submitted for your group, try to work it out with your partner (and if needed, you can redo the submission with a different version of the project files, up to the deadline for that project); if you still have a concern about a submission by your group, contact the instructor.

In addition, as noted above, for each of the three projects, students taking the graduate version of the course will also be required to submit a written report on the project. This report must be done individually, even for the second and third projects, where the other aspects of the project are done
in groups of two students; within a project group, each student taking COMP 521 or ELEC 552 must write their own report individually, not jointly with your group partner on that project.

Course Communication

This semester, we will be using Rice’s Canvas Learning Management System as well as a separate course website. This website is located at

http://www.clear.rice.edu/comp421/

You are responsible for keeping up with announcements and other content posted on Canvas or on the course website. Please check both regularly.

In addition, we will also be using Piazza for class discussion. Piazza is a web-based platform that will allow you to post questions about the course material, including the course projects, and to quickly receive answers from me, from the TAs, and from your fellow classmates. Please register now for the course on Piazza by going to

https://piazza.com/rice/spring2021/comp421

Throughout the semester, in addition to regularly checking Canvas and the course website, you should also check Piazza regularly for new information. In addition to finding answers to your own questions, reading other questions and answers on Piazza can help you find additional valuable information, including project assistance and clarifications and schedule updates. And if you encounter a new problem or question, you may well find an answer to it by searching on Piazza.

In particular, when using Piazza, please observe the following guidelines:

• Before posting any question, always search the existing Piazza posts first to see if your question has already been asked. If it has, and you don’t think the answer(s) are clear, please follow up in that post, rather than creating a new one. As the semester progresses, you should also keep up with reading all of the postings on Piazza and all of the answers there, since this may enable you to discover the answer to some new concern you have even before you realize you need help with that!

• Note that although you can post anonymously, the staff will always be able to see who you are. Be polite, considerate, and do not ask frivolous questions or post frivolous content. Always be aware of how your statements might be perceived by others.

• When posting questions or answers on Piazza, please be careful about what you post, to avoid inadvertently violating the course’s Honor Code policy. Specifically, do not include portions of your code (even if it doesn’t work) in public questions or answers on Piazza. Please use public Piazza for questions about the material for the course, not about how to fix your particular specific solution.

• If you are asking a question about the material in the class, your post should always be public. You should use private Piazza posts only when you need to talk privately with the staff. If your post is of a personal nature, you likely should bring it up with the instructor directly, rather than through Piazza. If your post absolutely requires you to include information about your solution, then your post should certainly be made private. To make your question private, select "Instructor(s)” (rather than "Entire Class”) for "Post to” at the top of the posting page, so that only the course instructors and TAs can see your posting.
• Piazza is not always the best avenue to receive help in the course. It may be better to discuss some issues during office hours, for example.

**Grading**

Your final grade for the course will be computed based on the following tentative weights for the individual assignments:

- 15% First programming project
- 20% Second programming project
- 15% Third programming project
- 25% Midterm exam
- 25% Final exam

In addition, your weighted project average and weighted exam average must each be a passing grade in order to pass the course.

If you believe that your grade on an assignment is incorrect and you would like to request it to be regraded, you must submit your regrade request within one week (7 days) from when grades for that assignment are released (for a project, when the grade report is emailed to you, or for an exam, when the graded exams are released).

Specifically, for a *programming project*, to submit a regrade request for that project, you must send a clear description by email to

`comp421-requests@mailman.rice.edu`

giving details on specifically what you believe was misgraded and why. The “Subject:” of this email must be

`COMP 421 Regrade Request`

Requests for regrades on any project made in any other way or made after the one-week cutoff for requesting regrades will *not* be accepted. Your regrade request email must clearly state what aspect of the project grade you want to be regraded; also clearly state who you worked with as a partner on that project (for projects done with a partner) and state which TA graded your project. You should also then contact that TA to address your grading concerns. After working with that TA, if you are still not satisfied with your grade on the project, contact the instructor.

The *exams* will be conducted online on a system called Gradescope, and to submit a regrade request for any question on an exam, you must use the Gradescope online regrade request mechanism. Requests for regrades on any exam question made in any other way or made after the one-week cutoff for requesting regrades will *not* be accepted. In your regrade request for any exam question, you must clearly state specifically in detail why you believe the original grade is incorrect.

**Policy on Late Work**

Please take project deadlines seriously. If you try to start on each project when it is first released and try to make steady progress throughout the period for each project, the projects can be quite manageable and rewarding. If you wait until the last few days (for example) to start on a project, you
will not be able to complete it and will not get much out of the experience. The time allotted for each project is a combination of the actual difficulty of each and the time you will probably need to spend just “thinking” about the project at different points while you are working on it, trying to figure out and make sure you understand the some of the concepts clearly.

Each student will be given 3 “slip days” to use throughout the semester. When you use a slip day for some project, you will receive up to 24 additional hours to complete that project. You may use these slip days in any way you see fit (e.g., 3 days on one project, or 1 day on each of the 3 projects, etc.). On projects done as a group of two students, both students in the group must each use a slip day in order to extend the deadline for the project (e.g., the group does not get 12 additional hours when only one of the two in the group uses a slip day). Fractional uses of slip days are not allowed. Each programming project assignment will describe procedurally how to make use of slip days.

Other than as described above for use of slip days, late assignments will not be accepted, except under exceptional circumstances (such as medical emergencies). Having deadlines in other classes and participating in extracurricular activities are all part of the university experience and are not exceptional circumstances.

If you are aware of some exceptional circumstance that you believe precludes a timely submission, submit the assignment early or contact the instructor in advance to arrange for delayed submission if warranted. After-the-fact explanations will not be treated favorably. Sometimes, of course, circumstances may arise unexpectedly, but even in those cases, you should try to alert the instructor (e.g., by email) as early as possible, before the submission deadline.

To officially request an extension on any deadline, although you may speak to the instructor about it first, you must submit your request by email to

    comp421-requests@mailman.rice.edu

prior to the deadline for which you are requesting an extension or as soon as you are aware of any circumstance for which you believe an extension is warranted. The “Subject:” of this email must be

    COMP 421 Extension Request

In your request, you must clearly describe why you believe an extension is warranted and the length of the extension you are requesting. The instructor will make a decision to grant or deny the extension, and if granted, how long the extension will be. You will receive the result of this decision by return email.

**Course Schedule**

A tentative schedule for major events in the course is available on the course website at:

    https://www.clear.rice.edu/comp421/schedule.html

**Work Load**

This course requires a substantial amount of work, particularly in the projects. My best advice to you is to start each assignment early; don’t wait until the last few days to try to do all the work. You will need to start on the programming projects early in order to make good use of your time during the assignment; for example, it may take some time while working on the project to pause and understand
why something may not be working correctly before proceeding with the next part of the project. I also recommend you work on each project incrementally, implementing and testing each part of the project as you go, before proceeding with implementing and testing the next part of the project. The projects can be enriching if you stay on top of them; they can be impossible if you don’t.

**Honor Code Policy**

*The Honor Code is a special privilege and responsibility at Rice University.* As stated in a recent student editorial published in the January 20, 2016 edition of *The Rice Thresher*: “As incoming students enter Rice, many are surprised by the degree to which the university’s Honor Code extends trust to the student body. . . . The privileges of the Honor Code stem from the idea that Rice’s aim is not just to instill knowledge in its students, but [to] also help them develop moral character. This idea is fundamental to Rice’s identity: Students can and should be held to a high moral character standard.”

Specifically, all assignments in this course are conducted under the Rice Honor Code, a code that you pledged to honor when you matriculated at Rice. You are expected to behave in all aspects of your work in this course according to the Rice Honor Code. When in doubt as to whether a specific behavior is acceptable, ask the instructor for a written clarification. For more information on the Rice Honor System, see [http://honor.rice.edu/](http://honor.rice.edu/) and [http://gradhonor.rice.edu/](http://gradhonor.rice.edu/). In particular, you should consult the Honor System Handbook at [http://honor.rice.edu/honor-system-handbook/](http://honor.rice.edu/honor-system-handbook/)

This handbook outlines the University’s expectations for the integrity of your academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. *Suspected Honor Code violations in this course will be researched, documented, and reported in explicit detail to the Rice Honor Council or Rice Graduate Honor Council.* I take the Honor Code seriously, and you should too.

In this class, for the midterm exam and final exam, your solutions, of course, must be your own work. During each exam, you may refer to the course textbook, (*Operating System Concepts*, by Silberschatz, Galvin, and Gagne, Tenth Edition, 2018), to any of the handouts from class, and to your own notes you made yourself from any source before beginning the exam. You may not refer to any other sources, such as past exams or things from the web or elsewhere, during the exam.

For the programming assignments in this course, students are encouraged to talk to each other, to the TAs, to the instructor, or to anyone else about the assignment. This assistance, however, must be limited to general discussion of the problem; *each student or project group must produce their own solution to each programming project*. Consulting or copying, for any reason, in any manner, any part of another solution (even from a previous class or otherwise) is prohibited. Submitted solutions or parts thereof may not be copied from any source.

Also, for students taking COMP 521 or ELEC 552, for all projects, each student must write their own report on the project; for the last two projects, for which the project itself will be done in groups of two students, *each student in the group must still write their own report, not working together on your report with your group partner*. Submitted reports must not be copied, in whole or in part, from any source, and you must fully cite any references you use in preparing your report.

In addition, for all programming assignments, you may not place source code for your project on any publicly accessible repository (such as GitHub), including even after the end of the semester; to do so
would be a violation of the Honor Code, as it would give aid to other students on the project (whether this semester or in future semesters). Also, if any such public repositories do exist, you may not refer them (or other such sources) in working on or producing your solution for such project.

*I want to treat you all in this class as responsible adults.* But please be aware that *cheating* on any of the programming projects or exams in this class constitutes a *Rice Honor Code violation*. Submitting a case to the Honor Council requires a lot of work on my part, but it will have a much larger impact on you, your status as a student at Rice University, and beyond. Please do not make me have to submit any Honor Council cases in this class. This will help both you and me. As I said, I want to treat you all in this class as responsible adults.

**Students with Disabilities**

If you have a documented disability that may affect your academic performance in this class, you should: (1) make sure this documentation is on file with Rice’s Disability Resource Center (located in Allen Center room 111, adarice@rice.edu, 713-348-5841) to determine the accommodations you need; and (2) meet with me to discuss your accommodation needs.

**Syllabus Change Policy**

This syllabus is only a guide for the course and is subject to change with advanced notice.