

## CS 452: Operating Systems

### Instructor

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### Meetings

Lectures: TuTh 4:30–5:45 CCP-260  
Office hours: TuTh 2:45–3:45 CCP-359  
by appointment CCP-359

Lectures will be audio/video recorded, and made available, afterwards.

Our Teaching Assistant is:

TBA

TA office hours are at (this “pub” directory is explained, below):

[pub/TutorOfficeHours](#)

I am happy to answer questions by email. Please please click [here](#), or see:

[pub/doc/EmailQuestions.pdf](#)

### Catalog Description

Operating systems structure and design. Process management, concurrency and synchronization, interprocess communication, scheduling, device management, memory management, file systems and security. Case studies of multiple operating systems.

PREREQ: CS 230, CS 253, CS 321, ECE 330, and CS 155.

## Goals

Students are introduced to basic concepts of operating systems, including:

- using processes and threads
- operating system organization
- computer organization
- device management
- implementing processes and threads
- scheduling
- synchronization
- interprocess communication
- deadlock
- memory management
- virtual memory
- file management
- security
- networks

## Textbook

*Operating Systems: Three Easy Pieces*, by A. Arpaci-Dusseau and R. Arpaci-Dusseau, 2018, [online](#).

## Other Course Material

This syllabus, lecture slides, assignments, and other material is available in what we'll call our “pub” directory, on our Computer Science Lab (CCP-240, CCP-241, and CCP-242) computers, served by `onyx.boisestate.edu`. The directory is at:

`~jbuffenb/classes/452/pub`

This directory is read-only. So, you might want to copy it, perhaps to your local computer. Since **onyx** services Secure Shell (SSH) requests, you can use SSH clients (e.g., **scp** and **sftp**) to do so. However, beware: It contains symbolic links to parent directories, and **scp -r** will unconditionally follow them, thereby looping forever. To avoid this, use **sftp** or **tar/ssh**, as needed.

A copy of this directory can be accessed from our [Canvas](#) website, via the “Files” tab on the left sidebar. This copy is updated less frequently, since bulk upload is slow. Furthermore, although lecture slides can be viewed, the Canvas PDF viewer will not follow links to other files.

A copy of this directory can also be accessed at [GitHub](#), as shown in:

[pub/GitHub](#)

You may also find the following local guide useful:

[pub/etc/cs-linux.pdf](#)

In particular, it explains how to use SSH.

## Grades

At the end of the semester, the Registrar requires a letter grade for each student. Accordingly, during the semester, homework and exams are evaluated, and numeric scores are assigned. Each such artifact is worth a certain number of points, and has a weight. From these scores, a student’s overall numeric/raw percentage is computed.

Collectively, a class’s raw percentages form a distribution, with a mean and standard deviation, sometimes called a Bell Curve. An algorithm normalizes these values into a “grading” distribution, with a desired mean and standard deviation of 85 and 10 (i.e., the values are “curved”). A normalized value is then mapped to a letter grade, in the conventional way. If you are interested in the gory details, click [here](#).

During the semester all of this evolving data can be found in our **pub** directory, on **onyx**, its nodes, Canvas, and GitHub.

Homework is due at 11:59PM, Mountain Time, on the day it is due. Late work is not accepted. To submit your solution to an assignment, login to a lab computer, change to the directory containing the files you want to submit, and execute:

```
submit jbuffenb class assignment
```

For example:

```
submit jbuffenb cs452 hw1
```

The `submit` program has a nice `man` page.

When you submit a program, include: the source code, sample input data, and its corresponding results.

Scores are posted in our `pub/scores` directory, as they become available. You will receive a code, by email, indicating your row in the score sheet. You are encouraged to check your scores to ensure they are recorded properly. If you feel that a grading mistake has been made, contact me as soon as possible.

The weights of homework and exams is shown in the table below:

| <i>Activity</i> | <i>Weight</i> |
|-----------------|---------------|
| Homework        | 80%           |
| Exam            | 10%           |
| Final           | 10%           |

## Homework

Several homework problems are assigned during the semester. Each asks you to develop software in the C programming language. Students work on these individually.

The rubric that will be used to grade each assignment is distributed with the assignment. Try to focus on the assignments, rather than the rubrics.

## Exams

An exam and a final are administered. These are in-class, open-note, open-textbook, and open-laptop tests. Students work on these individually.

## Attendance

In-person lecture attendance is an important part of course participation. Attendance is taken at each lecture: starting five minutes before the scheduled

start time, and ending fifteen minutes after the scheduled start time. Attendance is not taken during the first week of classes, holidays, or finals week.

Attendance can affect your grade. Each absence results in a one-percent reduction of your overall normalized percentage. Since a few absences are expected, completion of BSU's on-line end-of-semester course evaluation will erase up to five absences.

Attendance is administered wirelessly, via the iClicker app, available for free, from your smartphone's app store. For more information, click [here](#).

## Source-Code Documentation

Good documentation and programming style is very important. Your programs must demonstrate these qualities for full credit. Good documentation and programming style includes:

- heading comments giving: author, date, class, and description
- function/procedure comments giving description of: purpose, parameters, and return value
- other comments where clarification of source code is needed
- proper and consistent indentation
- proper structure and modularity

For more information, and examples, click [here](#).

## Academic Integrity

The University's goal is to foster an intellectual atmosphere that produces educated, literate people. Because cheating and plagiarism are at odds with that goal, those actions shall not be tolerated in any form. Academic dishonesty includes assisting a student to cheat, plagiarize, or commit any act of academic dishonesty. Plagiarism occurs when a person tries to represent another person's work as his or her own or borrows directly from another person's work without proper documentation.

If a student engages in academic dishonesty, the student may be dismissed from the class and may receive a failing grade. Other penalties may include suspension or expulsion from the University.

For much more information about academic integrity, including examples of academic dishonesty, please click [here](#). If you are unsure about a particular behavior, ask your instructor.

## Labs and Safety

Each student receives an account on the cluster of computers in the Computer Science Labs: CCP-240, CCP-241, and CCP-242. The cluster comprises a server named `onyx.boisestate.edu` and a set of nodes with shared home directories. It is remotely accessible, via SSH. The cluster runs the Linux operating system.

Physical access requires building and room access. After-hours building access, and all-hours room access, require an authenticated proximity-type student-identification card.

You are responsible for understanding and obeying lab [rules](#).

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## Schedule

| <i>Week</i> | <i>Date</i> | <i>Topic</i>             | <i>Assigned</i> | <i>Due</i> | <i>Reading</i> |
|-------------|-------------|--------------------------|-----------------|------------|----------------|
| 1           | Aug 22 Tue  | Introduction             |                 |            | 1-2            |
|             | Aug 24 Thu  | Processes and Processors | HW1             |            | 3-11           |
| 2           | Aug 29 Tue  |                          |                 |            |                |
|             | Aug 31 Thu  |                          |                 | HW1        |                |
| 3           | Sep 05 Tue  |                          | HW2             |            |                |
|             | Sep 07 Thu  |                          |                 |            |                |
| 4           | Sep 12 Tue  |                          |                 |            |                |
|             | Sep 14 Thu  |                          |                 |            |                |
| 5           | Sep 19 Tue  | Memory                   | HW3             | HW2        | 12-24          |
|             | Sep 21 Thu  |                          |                 |            |                |
| 6           | Sep 26 Tue  |                          |                 |            |                |
|             | Sep 28 Thu  |                          |                 |            |                |
| 7           | Oct 03 Tue  | Concurrency              |                 | HW3        | 25-34          |
|             | Oct 05 Thu  |                          |                 |            |                |
| 8           | Oct 10 Tue  |                          | HW4             |            |                |
|             | Oct 12 Thu  |                          |                 |            |                |
| 9           | Oct 17 Tue  | Exam                     |                 |            |                |
|             | Oct 19 Thu  |                          |                 |            |                |
| 10          | Oct 24 Tue  |                          |                 |            |                |
|             | Oct 26 Thu  |                          |                 | HW4        |                |
| 11          | Oct 31 Tue  |                          |                 |            |                |
|             | Nov 02 Thu  |                          |                 |            |                |
| 12          | Nov 07 Tue  | Input/Output Devices     | HW5             |            | 35-42          |
|             | Nov 09 Thu  |                          |                 |            |                |
| 13          | Nov 14 Tue  |                          |                 |            |                |
|             | Nov 16 Thu  |                          |                 |            |                |
| 14          | Nov 21 Tue  | Thanksgiving             |                 |            |                |
|             | Nov 23 Thu  | Thanksgiving             |                 |            |                |
| 15          | Nov 28 Tue  |                          |                 |            |                |
|             | Nov 30 Thu  |                          |                 | HW5        |                |
| 16          | Dec 05 Tue  |                          |                 |            |                |
|             | Dec 07 Thu  |                          |                 |            |                |
| 17          | Dec 14 Thu  | Final: 12:00-2:00        |                 |            |                |