# CSCI 4448 and 5448 Syllabus
# Object-Oriented Analysis & Design
# Spring 2022


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| **Instructor** | Bruce R. Montgomery, PhD, PMP | **IM** | https://piazza.com/colorado/spring2022/csci44485448/home |
| **Office** | ECOT 734 and by Zoom | **E-mail** | bruce.r.montgomery@colorado.edu |
| **Office Hours** | As posted on Canvas/Piazza | **Canvas** | https://canvas.colorado.edu/courses/79638 |


## I. Overview

Lectures: Monday/Wednesday/Friday, 10:20 AM – 11:10 AM, Classroom ECCS 1B12 (when on-campus attendance is available). Lectures will be recorded for later review. Class can also be attended at the posted class date/time via Zoom conference at: https://cuboulder.zoom.us/j/96130960944

### Teaching and Student Assistants:

- TA: Dwight Browne - Dwight.Browne@colorado.edu
- Class manager: Roshan Nellore Prasad - rone7552@colorado.edu
- Class manager: William (Max) Donovan - wido1885@colorado.edu
- Grader: Gayathri Padmanabhan - gayathri.padmanabhan@colorado.edu

## II. Description and Content

Object-Oriented Analysis and Design is a course that presents an introduction to the design and construction of software systems using techniques that view a system as a set of objects that work together to realize the system's functionality. This perspective stands in contrast to more traditional "procedural" or "structured" design techniques that viewed systems as a set of procedures that manipulate shared data structures. Proponents of object-oriented techniques point to the flexibility and extensibility of object-oriented systems along with other benefits such as increased modularity, abstraction, and encapsulation.

In this class, we will examine fundamental objected-oriented analysis and design techniques and show how decisions made during analysis and design impact the implementation of software systems. This class does not focus on object-oriented programming; however, we will examine many examples of object-oriented systems written in Java, Python, and other languages. A primary focus will be the understanding and application of key object-oriented principles and design patterns.

By the end of the class, students will have been exposed to the major steps of object-oriented software development life cycles and will understand the tools and techniques that are used in these steps. They will also have applied these skills to the development of a project and the analysis of real-world object-oriented systems.

## III. Requirements and Format

### Prerequisites:

This course involves extensive work in programming for projects and assessments and therefore requires knowledge of programming (this course will primarily use Java, along with some Python) and basic computer architecture. Corresponding CU Boulder courses includes CSCI 1300 and 2270. Both Java and Python are straightforward languages to install, read, and apply, especially for those with existing background in other languages (like C, C++, or C#). They are also particularly suited to object-oriented design projects such as those in this class.

Note: neither Java nor Python programming will be taught in depth as an in-class topic, although examples and code snippets will be reviewed. Links for Java and Python tutorials and support materials will be provided for students to use as needed.

The class may also provide experience with other tools and languages, including but not limited to Git, HTML, UML, Amazon Web Services, various databases, and others. Prior experience in these tools is not required for the class.

### Attendance and Participation:

Class lectures will start promptly at the scheduled class start time. Students may attend class in-person on campus, by Zoom synchronously, or by reviewing recorded video at a time of their choosing. While we will be doing some in-class exercises, you will have other options for any bonus awards from such exercises if you cannot attend synchronously. You may take the class entirely asynchronously, as long as deadlines for submissions are met.

Most class materials will be made available on Canvas, however, it is the student's responsibility to obtain materials handed out in a lecture which the student missed. Students are expected to keep up with the course material. If you fall behind or need other help, schedule an appointment with the professor or a TA/SA as soon as possible.

Students are expected to complete assignments on time, extensions to class assignment dates will be very rare. In some cases, project assignments will be accepted late, but the grade earned on the assignment will be reduced – this allowance and reduction will be made clear for each assignment. Details of late policies will be reviewed in class.

### Canvas Web-based Instruction and Piazza Messaging:

Students must have access to and accounts for Canvas to find materials, get class notices, submit homework, and take quizzes and/or exams. I will use the announcements feature of Canvas for posting information on assignments and class changes. Please ensure you can reach the class Canvas site (https://canvas.colorado.edu/courses/79638). It is suggested that you sign up in Canvas account settings for instant notifications of news, class schedule or assignment changes, content postings, assignment and quiz due dates, and grade updates.

For our internal messaging we will use Piazza, which is available for the web as well as iOS and Android apps. The class Piazza site is at: https://piazza.com/colorado/spring2022/csci44485448. Please sign up to participate. The class staff will try to answer questions posted on Piazza as quickly as possible. We will also use Piazza for posting articles and links related to class subjects.

### Remote Participation:

Students enrolled in the class through distance sections of the class are required to use the Zoom conferencing tool. To join the class synchronously, use the following Zoom meeting ID & connection information:

**https://cuboulder.zoom.us/j/96130960944**

**Meeting ID: 961 3096 0944**

One tap mobile

+12532158782,,96130960944# US (Tacoma)

+13462487799,,96130960944# US (Houston)

Meeting ID: 961 3096 0944

Find your local number: https://cuboulder.zoom.us/u/adRFVIheZJ

Join by SIP 96130960944@zoomcrc.com

For more information, visit the OIT Zoom website:

https://oit.colorado.edu/services/conferencing-services/web-conferencing-zoom/help/getting-started

For questions or comments regarding accessibility issues in Zoom, please contact the CU Digital Accessibility Office at digitalaccessibility@colorado.edu.

### Readings:

Course materials include lecture slides, project guides, and other online materials, with frequent references to various texts and other resources. The textbook for the class is a required resource, but is available from the CU Library.

Textbook:

- Head First Design Patterns
- By Freeman, Robson, Bates, & Sierra
- O'Reilly Media, December 2020 (2nd Edition)
- Available as a paper book ($42) or e-book ($21 rent, $40 buy) via Amazon.
- The e-book is also available via O'Reilly Safari (free access at CU Library online e-books here: https://libguides.colorado.edu/strategies/ebooks under the sciences tab).

Course lecture slides, course labs and project material, and links to other readings or web sites to support class topics and projects will be embedded in lecture slides and provided via Canvas.

### Homework and Projects:

Homework and related project assignments will be provided covering material from class lectures. Students may collaborate on homework as presented in homework details; a group of students collaborating on a homework may turn in one group submission. All homework and reports must be legibly written or typed and must include the students name(s) in the submission. All homework assignments should be turned in at the due date/time presented for the assignment on Canvas. Late homework may be accepted but will be penalized as detailed in class or assignment descriptions.

Code and reports are expected to be thorough work, including proper references to any supporting materials. Whether working as a team or leveraging software designs from books, magazines, the Internet, or other sources, students are expected and required to cite and credit the source of the information clearly and completely. **Plagiarism will not be tolerated** and will be reported to the CU Honor Code Office.

### Other Assessments:

There will be scheduled quizzes most weeks over material presented; these will be provided via Canvas and will be performed outside of class. All quizzes must be completed prior to the Canvas due date/time. There will also be a mid-term and final examination. The quiz and exam assessments are to be done using individual effort alone. Mid-term and final exam logistics, times, and locations will be scheduled and announced.

### Extra Credit:

From time to time, there may be opportunities for extra credit. Generally, extra credit opportunities come from two sources – classroom participation and project work. In most cases, classroom extra credit will supplement overall quiz grades; distance students not in class will be given equivalent opportunities for extra credit. Project extra credit will be described in project grading rubrics and will be awarded for individual projects when projects are graded.

## IV. Evaluation and Grading Procedures

Grading will be based on total points accumulated from each type of assessment and assignment used in the class. All points from class activities have the same weight. A student earning less than 60% of the points possible will be given a failing grade. In all cases, grades may be assigned based on a curve determined by the instructor.

The following table shows percentage assignments for final posted class letter grades:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 94 – 100 | 90 – 93 | 87 - 89 | 83 – 86 | 80 – 82 | 77 – 79 | 73 – 76 | 70 – 72 | 67 – 69 | 63 – 66 | 60 – 62 | 0 – 59 |
| A | A- | B+ | B | B- | C+ | C | C- | D+ | D | D- | F |

Make-up Exam Policy: No make-up exams are given except for medical or other similar hardships where advanced arrangements are made with the instructor; or in case of non-selective medical emergencies with physician's note or documentation. Otherwise, failure to take the exam at the scheduled time will result in a zero grade in the exam.

The overall course grade will be based on participation and attendance, homework/projects, quizzes, and exams. The grade proportions are as follows (note they differ for graduate and undergraduate students):

Undergraduate students:

- Homework/projects 50% (500 points)
- Quizzes 20% (200 points)
- Mid-term and Final Exams 20% (200 points)
- Participation 10% (100 Points)

Graduate students:

- Homework/projects 40% (500 points)
- Graduate research project 20% (250 points)
- Quizzes 16% (200 points)
- Mid-term and Final Exams 16% (200 points)
- Participation 8% (100 points)

## V. Campus-Wide Policies

### Classroom Behavior:

Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the policies on classroom behavior and the Student Conduct & Conflict Resolution policies.

### Requirements for COVID-19:

As a matter of public health and safety, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements and all public health orders in place to reduce the risk of spreading infectious disease. Students who fail to adhere to these requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policy on classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please follow the steps in the "Accommodation for Disabilities" statement on this syllabus.

CU Boulder currently requires masks in classrooms and laboratories regardless of vaccination status. This requirement is a precaution to supplement CU Boulder's COVID-19 vaccine requirement. Exemptions include individuals who cannot medically tolerate a face covering, as well as those who are hearing-impaired or otherwise disabled or who are communicating with

someone who is hearing-impaired or otherwise disabled and where the ability to see the mouth is essential to communication. If you qualify for a mask-related accommodation, please follow the steps in the "Accommodation for Disabilities" statement on this syllabus. In addition, vaccinated instructional faculty who are engaged in an indoor instructional activity and are separated by at least 6 feet from the nearest person are exempt from wearing masks if they so choose.

If you feel ill and think you might have COVID-19, if you have tested positive for COVID-19, or if you are unvaccinated or partially vaccinated and have been in close contact with someone who has COVID-19, you should stay home and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). If you are fully vaccinated and have been in close contact with someone who has COVID-19, you do not need to stay home; rather, you should self-monitor for symptoms and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). Please notify the instructor of absences caused by illness or quarantine. Note that you do not have to provide details of your illness or doctor's documentation.

### Accommodation for Disabilities:

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.

### Preferred Student Names and Pronouns:

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

### Honor Code:

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code academic integrity policy. Violations of the Honor Code may include, but are not limited to: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu; 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found on the Honor Code website.

### Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation:

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. The university will not tolerate acts of sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, or protected-class discrimination or harassment by or against members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and the support resources can be found on the OIEC website.

Please know that faculty and graduate instructors have a responsibility to inform OIEC when they are made aware of incidents of sexual misconduct, dating and domestic violence, stalking, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about their rights, support resources, and reporting options. To learn more about reporting and support options for a variety of concerns, visit Don't Ignore It.

### Religious Holidays:

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please contact the instructor two weeks prior to the conflicting date to make alternative arrangements.

See the campus policy regarding religious observances for full details.

### Course Concerns:

If you have any questions or concerns about the course, please discuss them with the class staff as soon as possible. If we cannot address your concern, the issue can be brought to the attention of the program advisors, faculty directors, or department chairs.

## VI. Tentative Course Schedule

**Please note this can and likely will change.** As the instructor for this course, I reserve the right to adjust this schedule or related assignments in any way that serves the educational needs of the students enrolled in this course.

| OOAD | | | | | | |
|---|---|---|---|---|---|---|
| Spring 2022 | | | | | | |
| Week | Mon | Topics | Wed | Topics | Fri | Topics |
| 1 | 1/10/22 | Introductions | 1/12/22 | OO Paradigm | 1/14/22 | OO Fundamentals |
| 2 | 1/17/22 | MLK Holiday | 1/19/22 | Git | 1/21/22 | Java/Python |
| 3 | 1/24/22 | UML | 1/26/22 | UML | 1/28/22 | TDD |
| 4 | 1/31/22 | Patterns/Strategy | 2/2/22 | Observer | 2/4/22 | Problem-Solution |
| 5 | 2/7/22 | Decorator | 2/9/22 | Factory | 2/11/22 | Conceptual Modeling |
| 6 | 2/14/22 | Singleton | 2/16/22 | Command | 2/18/22 | Façade/Adapter |
| 7 | 2/21/22 | Expanding Horizons | 2/23/22 | Template | 2/25/22 | Iterator/Composite |
| 8 | 2/28/22 | MVC | 3/2/22 | Principles | 3/4/22 | State |
| 9 | 3/7/22 | Proxy | 3/9/22 | Bridge/Builder | 3/11/22 | Guest Lecture: Privacy |
| 10 | 3/14/22 | Flyweight/Interp/CoR | 3/16/22 | Mediator/Memento | 3/18/22 | Prototype/Visitor |
| 11 | 3/21/22 | Spring Break | 3/23/22 | Spring Break | 3/25/22 | Spring Break |
| 12 | 3/28/22 | Expert Design | 3/30/22 | Design Techniques | 4/1/22 | ORMs |
| 13 | 4/4/22 | Refactoring | 4/6/22 | Dependency Injection | 4/8/22 | Reflection |
| 14 | 4/11/22 | Architecture | 4/13/22 | APIs | 4/15/22 | Design Philosophy |
| 15 | 4/18/22 | Anti-/Other Patterns | 4/20/22 | Graduate Presentations | 4/22/22 | Graduate Presentations |
| 16 | 4/25/22 | Other than OOAD | 4/27/22 | Final Review/Wrap-up | 4/29/22 | Reading Day |
| | Finals Sat 4/30/22 - Wed 5/4/22 | | | | | |

| | Projects | | Exam/Quiz | Graduate Research Presentation | |
|---|---|---|---|---|---|
| | Assigned | Due | Posted Sat | Assigned | Due |
| Week | Wed | Wed | Due Thur | Fri | Fri |
| 1 | 1 | - | - | | |
| 2 | - | 1.1 | Q1 | Proposal | |
| 3 | 2 | 1.2 | Q2 | | |
| 4 | - | 2.1 | Q3 | Outline | Proposal |
| 5 | 3 | 2.2 | Q4 | | |
| 6 | - | 3.1 | Q5 | Draft | Outline |
| 7 | 4 | 3.2 | Q6 | | |
| 8 | - | 4.1 | Midterm | | |
| 9 | 5 | 4.2 | Q7 | Peer Review | Draft |
| 10 | - | - | Q8 | | |
| 11 | - | - | | | |
| 12 | 6 | 5 | Q9 | Final & Pecha Kucha | Peer Review |
| 13 | - | - | Q10 | | |
| 14 | 7 | 6 | Q11 | | Pecha Kucha |
| 15 | - | - | - | | |
| 16 | - | 7 | - | | Final Presentation |
| | | | Final | | |