



## 17-695: Design Patterns

T, Th 10:10-11:30am, location  
A1, D1, Fall 2022, 6 Units

### Instructor

Prof. Swarnalatha Ashok

### Email

[swarnala@andrew.cmu.edu](mailto:swarnala@andrew.cmu.edu)

### Office Location & Hours

by appointment

### Teaching Assistants

[3SC 271, M 3:00-4:00 pm] [Zoom,  
W 10:00-11:00 am]

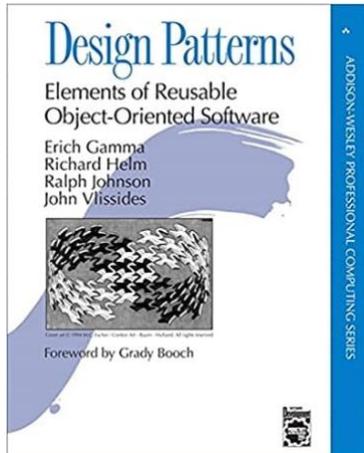
**Course Description.** Attributes of a good quality software, among others are ease of maintenance, modifiability, extensibility, and reusability. Design Patterns, that are mined from existing well-designed software, improve quality through documented and proven solutions to common problems. Reusing good designs appropriately not only improves the quality, but also reduces the development cost. Many existing code without much documentation also can benefit by refactoring to patterns. In this course students will learn techniques to identify design problems and apply design patterns effectively to improve the quality of software. Learning will be facilitated via lectures, flip-classrooms, and a group project. Learning will also be reinforced with many in-class and homework exercises.

**Prior Knowledge.** Experience in developing software using any programming language such as Python, C#, Java or C++. Knowledge of basic software design using UML diagrams.

**Learning Objectives.** After completing this course, you will be able to:

- Understanding good software design principles
- Identifying design problems
- Evaluating and selecting appropriate reusable design patterns
- Solving design problems using design patterns
- Refactoring existing code using design patterns

## Learning Resources.



Capturing a wealth of experience about the design of object-oriented software, four top-notch designers present a catalog of simple and succinct solutions to commonly occurring design problems. Previously undocumented, these 23 patterns allow designers to create more flexible, elegant, and ultimately reusable designs without having to rediscover the design solutions themselves.

The authors begin by describing what patterns are and how they can help you design object-oriented software. They then go on to systematically name, explain, evaluate, and catalog recurring designs in object-oriented systems. With Design Patterns as your guide, you will learn how these important patterns fit into the software development process, and how you can leverage them to solve your own design problems most efficiently.

Each pattern describes the circumstances in which it is applicable, when it can be applied in view of other design constraints, and the consequences and trade-offs of using the pattern within a larger design. All patterns are compiled from real systems and are based on real-world examples. Each pattern also includes code that demonstrates how it may be implemented in object-oriented programming languages like C++ or Smalltalk.

Addison Wesley, 1995. [Order it from Amazon.](#)

**Assessments.** Students learn more by applying and explaining ideas to others, thus, the course requires the following activities:

- **Assessment 1:** Students will be given requirements and design snippet of a portion of an application. A design problem will be described, and a creational design pattern will be suggested. The students will be required to incorporate the design pattern to improve the design and discuss the benefits of the design pattern in the context of this problem.
- **Assessment 2:** Students will be given requirements and design snippet of a portion

of an application. A design problem will be described, and a structural design pattern will be suggested. The students will be required to incorporate the design pattern to improve the design and discuss the benefits of the design pattern in the context of this problem.

- **Assessment 3:** Students will be given requirements and design snippet of a portion of an application. A design problem will be described, and a behavioral design pattern will be suggested. The students will be required to incorporate the design pattern to improve the design and discuss the benefits of the design pattern in the context of this problem.
- **Assessment 4:** Students will be given requirements and code snippets of a portion of an application.

A design problem will be described. The students will be required to identify and **refactor to design pattern** to improve the design and discuss the benefits of the design pattern in the context of this problem.

**Class participation:** to enrich the discussion with your insight, relevant experience, critical questions, and analysis of the material. The quality of contribution is more important than the quantity.

Assessment	Final Grade %
Assessment 1 - A1	10%
Assessment 2 - A2 or A3	15%
Assessment 3 (group) - A4	25%
Examination	40%
Class participation	10%

### Course and Grading Policies

- **Late-work policy:** All work is expected to be handed in at the indicated due date and time. For fairness to the whole class, no late submissions will be accepted for the group work. In the first week of classes, you should receive a course schedule for each course; please use them to plan ahead.

Each student is allowed one late submission for the individual homework assignments. You should immediately notify the course TA(s) before the submission deadline that you will submit late. Late work must be submitted as soon as circumstances allow, ordinarily within 24 hours of the due date. If you have any questions you should raise them immediately rather than waiting for conflicts to arise.

- **Participation policy.** Class participation will be graded by in-class engagement, including asking relevant questions based on a critical review of required readings, lectures, and comments made by your peers. The lack of attendance, and the use of mobile devices — including phones, tablets, and laptops — for purposes other than participating in class, will count against your participation grade.

This semester involves regular use of technology. Research has shown that divided attention is detrimental to learning; I encourage you to close any windows not directly related to what we are doing while you are in class. Please turn off your phone notifications and limit other likely sources of technology disruption, so that you can fully engage with the material, each other, and me. This will create a better learning environment for everyone. **A laptop will be required for our in-person classes. If you do not have access to one, please email me [swarnala@andrew.cmu.edu] as soon as possible so we can find a solution.**

**Attendance.** In order to attend class in person, I expect that you will abide by all behaviors indicated in [A Tartan's Responsibility](#), including any timely updates based on the current conditions.

**Facial Coverings.** If you do not wear a facial covering to class, I will ask you to put one on (and if you don't have one with you, I will direct you to a distribution location on campus). If you do not comply, please remember that you will be subject to student conduct proceedings, up to and including removal from CMU. Accordingly, I will be obliged to take other measures for the safety of the whole class.

**Recording of Class Sessions.** All synchronous classes will be recorded via Zoom so that students in this course (and only students in the course) can watch or re-watch past class sessions. Please note that breakout rooms will not be recorded. I will make recordings available on Canvas as soon as possible after each class session (usually within 3 hours of the class meeting). Please note that you are not allowed to share these recordings. This is to protect your FERPA rights and those of your fellow students.

**Transferring to Fully Remote During the Semester.** If the class needs to go fully remote, you will receive an email from me and an announcement will be published on our course website on Canvas.

**Course Schedule.** The following schedule provides a general overview of topics and assignments. Please refer to the syllabus online in Canvas for specific lecture topics, reading assignments and due dates.

Class	Topic and Readings	Assignments
1	Introduction to Design Patterns and Gang of Four Design Patterns	Class discussions
2	Design Principles	Practice exercises
3	Creational Patterns	<p>A1: Students will be given requirements and design snippet of a portion of an application. A design problem will be described, and a creational design pattern will be suggested. The students will be required to incorporate the design pattern to improve the design and discuss the benefits of the design pattern in the context of this problem.</p>
4	Structural Patterns	<p>A2: Students will be given requirements and design snippet of a portion of an application. A design problem will be described, and a structural design pattern will be suggested. The students will be required to incorporate the design pattern to improve the design and discuss the benefits of the design pattern in the context of this problem.</p>

5	Behavioural Patterns	A3: Students will be given requirements and design snippet of a portion of an application. A design problem will be described, and a behavioral design pattern will be suggested. The students will be required to incorporate the design pattern to improve the design and discuss the benefits of the design pattern in the context of this problem.
6	Identifying design problems and Selecting Design Patterns	Practice exercises
7	Refactoring to Patterns	A4: Students will be given requirements and code snippets of a portion of an application. A design problem will be described. The students will be required to identify, select, and refactor the design pattern to improve the design and discuss the benefits of the design pattern in the context of this problem.
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**Accommodations for Students Disabilities.** If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at [access@andrew.cmu.edu](mailto:access@andrew.cmu.edu).

**Academic Integrity.** Honesty and transparency are important to good scholarship. Plagiarism and cheating, however, are serious academic offenses with serious consequences.

If you are discovered engaging in either behavior in this course, you will earn a failing grade on the assignment in question, and further disciplinary action may be taken.

For a clear description of what counts as plagiarism, cheating, and/or the use of unauthorized sources, please see the [University's Policy on Academic Integrity](#). If you have any questions regarding plagiarism or cheating, please ask me as soon as possible to avoid any misunderstandings. For more information about Carnegie Mellon's standards with respect to academic integrity, you can also check out the [Office of Community Standards & Integrity](#) website.

**Student Well-Being.** We are all under a lot of stress and uncertainty at this time. Attending Zoom classes all day can take its toll on our mental health. Make sure to move regularly, eat well, and reach out to your support system or me [email: [swarnala@andrew.cmu.edu](mailto:swarnala@andrew.cmu.edu)] if you need to. We can all benefit from support in times of stress, and this semester is no exception.

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. CMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at the [Counseling and Psychological Services](#) website. Support is always available (24/7) from Counseling and Psychological Services: 412-268-2922.

If you are worried about affording food or feeling insecure about food, there are resources on campus who can help. Email ([cmu-pantry@andrew.cmu.edu](mailto:cmu-pantry@andrew.cmu.edu)) or call (412-268-8704) the CMU Food Pantry Coordinator to schedule an appointment.

**We must treat every individual with respect.** We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community.

Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity, and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.

Each of us is responsible for creating a safer, more inclusive environment.

Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- **Center for Student Diversity and Inclusion:** [csdi@andrew.cmu.edu](mailto:csdi@andrew.cmu.edu), (412) 268-2150
- **Report-It online anonymous reporting platform:** [reportit.net](https://reportit.net) username: *tartans* password: *plaid*

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.