CS 319 Object-Oriented Software Engineering

0 – Introduction

Eray Tüzün, Phd

e-mail: eraytuzun@cs.bilkent.edu.tr
About Me

Education

- **Bilkent University**
  - Computer Science, B.S.
- **Case Western Reserve University**
  - Computer Science, M.S.
- **Middle East Technical University**
  - Information Systems, PhD

Research interests

- Software Productivity / Software Analytics
- Application Lifecycle Management
- Agile Methodologies (Scrum)
- Software Product Line Engineering

Work

- **HHMI**
- **Microsoft**
- **Havelsan**

@tuzuneray
@eraytuzun
Son 8 Yıl - Taban Sıralama – Bilkent Bilgisayar Mühendisliği

<table>
<thead>
<tr>
<th>Year</th>
<th>Bilgisayar Mühendisliği (Tam Burslu)</th>
<th>Bilgisayar Mühendisliği (%50 Burslu)</th>
<th>Bilgisayar Mühendisliği (Ücretli)</th>
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<td>2020</td>
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<tr>
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<th>Ücretli</th>
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<tr>
<td>2022</td>
<td>350</td>
<td>1879</td>
<td>6177</td>
</tr>
</tbody>
</table>
About You

- https://pollev.com/erayt350
My assumptions and expectations

Proficient in any programming language, but you have limited experience in analysis or design of a system

CS 201

Wants to be a Software Engineer /wants to learn

Internship experience? (poll)

For Team project

Being a committed team member
Feedback / Class Participation

Share your thoughts
Ask questions – wave your hand forcefully (just unmute your mic and talk) to get my attention
If there is something you do not understand -- ASK!
    There are no stupid questions!!!!
If you have a relevant comment, experience, anecdote -- SPEAK!
    Participation will make the class better!!!!
During Lecture...

- Please open up your webcams
- Try to concentrate
- Participate (Ask questions / Interact)
- No recording
Logistics

- Github (Code)
- Google docs (Documentation)
- Visual Paradigm (UML models)
- Zoom (for classes and term project group meetings)
- Polleverywhere (for polls)
- Slack for peer learning and group formation
  - Make sure you are already logged in ...
Your Expectations

What are your expectations of the course?
What do you want to learn?

...

Please go to https://pollev.com/erayt350
And express your opinion...
Granularity of Software

**Trivial**: <1 month, 1 programmer, 500 LOC
   Ex: Intro programming assignments

**Very small**: <3 months, 1 programmer, 2000 LOC,
   Ex: Course project

**Small**: <1 year, 3 programmers, 50K LOC,
   Ex: Mobile App

**Medium**: 3 years, 10s of programmers, 100K LOC
   Ex: Optimizing compiler

**Large**: 5 years, 100s of programmers, 1M LOC,
   Ex: MS Word, Excel, Linux, Windows

**Very large**: 10 years, 1000s of programmers, 10M LOC
   Ex: Tesla, Air traffic control, Telecommunications, space shuttle
Granularity of Software

Parnas 1987: “Multi-person construction of multi-version software”

– Your projects so far were (probably) neither multipeople nor multiversion

**Trivial:** 1 month, 1 programmer, 500 LOC

**Very small:** 3 months, 1 programmer, 2000 LOC,

**Small:** 1 year, 3 programmers, 50K LOC,

**Medium:** 3 years, 10s of programmers, 100K LOC

**Large:** 5 years, 100s of programmers, 1M LOC,

**Very large:** 10 years, 1000s of programmers, 10M LOC
WEEKS OF PROGRAMMING CAN SAVE YOU HOURS OF PLANNING
Programming != Software Engineering
Analogy with Bridge building

- Over a stream – easy, one person job
- Over river nile ... ? (The techniques do not scale)
Large-Scale Software-Engineering

Project involves a team of people – need to manage process, people and artefacts

System takes a long-time to build – need to plan

Systems are complex – need powerful tools, methods and technologies

Need to reuse code/designs/process


- > 300 Engineers
- > 10.000.000 LOC
- > 10 years!

- > $100.000.000
- > 10.000.000 LOC
Effort, Software Size, & Complexity
Course Objectives

- Learn basics of the software engineering (SE) process life cycle.
- Learn what the object-oriented (OO) approach to software development is, through OO principles and design patterns.
- Learn UML (Unified Modeling Language) that is part of most CASE (Computer Aided Software Engineering) tools and the benefits of visual modelling / diagramming.
- Practice the application of principles of object-oriented software development through the course group project.
- Develop teamwork and communication skills through the course group project.
What will you really gain from this course?

YourCV ++
- UML
- Git
- Design Patterns
- Analytical Thinking
- Requirements Analysis and Design
- Visual Paradigm
- Slack

Programming vs Software Engineering (Programmer - > Software Engineer)

Building software from scratch

CV writing tips

Working with a group
Outline

Intro to SE (Chapter 1)
Modeling w/ UML (Chapter 2)
Project Organization and Communication (Chapter 3 Sections 3.1 - 3.3)
Requirements Elicitation (Chapter 4)
Requirements Analysis (Chapter 5)
System Design (Chapters 6 & 7)
Object Design (Chapters 8 & 9)
Mapping Models to Code (Chapter 10)
Testing (Chapter 11)
Activities

- CV Development workshop
- Git Tutorial and Lab
- Design Patterns Tutorial and take-home exam
- Slack channel to ease up team-formation and peer learning

Please provide feedback throughout the semester related to teaching style
Contact Information

Eray Tüzün

- email: eraytuzun@cs.bilkent.edu.tr
- Office hours: by arrangement (Zoom)
- Use Slack channels first!
- Talk to your TA first!
- Ask me any questions in the class
- / after every class, you can find me outside

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<table>
<thead>
<tr>
<th>Name</th>
<th>Areas of Assistance</th>
<th>Contact Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metehan Saçakçı</td>
<td>Design Patterns</td>
<td>DM on Slack or <a href="mailto:metehan.sacakci@ug.bilkent.edu.tr">metehan.sacakci@ug.bilkent.edu.tr</a></td>
</tr>
<tr>
<td>Muhammad Umair Ahmed</td>
<td>Overall Questions, Forming Teams, Requirement Reports</td>
<td>DM on Slack or <a href="mailto:umair.ahmed@bilkent.edu.tr">umair.ahmed@bilkent.edu.tr</a>, GitHub</td>
</tr>
<tr>
<td>Emre Sülün</td>
<td>Git Related Questions, Final Reports</td>
<td>DM on Slack or <a href="mailto:idilhanhan@gmail.com">idilhanhan@gmail.com</a></td>
</tr>
<tr>
<td>Idil Hanhan</td>
<td>Requirement Reports</td>
<td>DM on Slack or <a href="mailto:mert.kara@bilkent.edu.tr">mert.kara@bilkent.edu.tr</a></td>
</tr>
<tr>
<td>Mert Kara</td>
<td>Design Reports and Implementation</td>
<td>DM on Slack (peerpanda channel)</td>
</tr>
<tr>
<td>Peer Panda Teams</td>
<td>All questions related to PeerPanda</td>
<td>DM on Slack or <a href="mailto:idilhanhan@gmail.com">idilhanhan@gmail.com</a></td>
</tr>
</tbody>
</table>
## Weekly Schedule

| Hours       | Monday                                      | Tuesday                                      | Wednesday                                    | Thursday                                      | Friday                                       | Saturday                                      | Sunday                                     |
|-------------|---------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|
| 08:30 - 09:20 | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 003**                             | **CS 319 - 001**                             | **CS 319 - 003**                             | **CS 319 - 003**                             |                                            |
|             | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               |                                            |
| 09:30 - 10:20 | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 003**                             | **CS 319 - 001**                             | **CS 319 - 003**                             | **CS 319 - 003**                             |                                            |
|             | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               |                                            |
| 10:30 - 11:20 | **CS 319 - 002**                             | **CS 319 - 002**                             | **CS 319 - 001**                             | **CS 319 - 002**                             | **CS 319 - 001**                             | **CS 319 - 001**                             |                                            |
|             | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               |                                            |
| 11:30 - 12:20 | **CS 319 - 002**                             |                                              | **CS 319 - 002**                             | **CS 319 - 002**                             | **CS 319 - 002**                             | **CS 319 - 002**                             |                                            |
|             | **B-204** Face-to-face Lecture               |                                              | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               |                                            |
| 12:30 - 13:20 |                                              |                                              |                                              |                                              |                                              |                                              |                                            |
| 13:30 - 14:20 | **CS 319 - 003**                             | **CS 319 - 003**                             | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 001**                             |                                            |
|             | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               |                                            |
| 14:30 - 15:20 | **CS 319 - 003**                             | **CS 319 - 003**                             | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 001**                             |                                            |
|             | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               |                                            |
| 15:30 - 16:20 | **CS 319 - 002**                             | **CS 319 - 002**                             | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 001**                             |                                            |
|             | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               |                                            |
| 16:30 - 17:20 | **CS 319 - 002**                             | **CS 319 - 002**                             | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 001**                             | **CS 319 - 001**                             |                                            |
|             | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               | **B-204** Face-to-face Lecture               |                                            |
| 17:30 - 18:20 |                                              |                                              |                                              |                                              |                                              |                                              |                                            |
| 18:30 - 19:20 |                                              |                                              |                                              |                                              |                                              |                                              |                                            |
| 19:30 - 20:20 |                                              |                                              |                                              |                                              |                                              |                                              |                                            |
| 20:30 - 21:20 |                                              |                                              |                                              |                                              |                                              |                                              |                                            |
| 21:30 - 22:20 |                                              |                                              |                                              |                                              |                                              |                                              |                                            |

* Throughout the semester, we will be using the two-hours blocks
Textbooks


Recommended - Textbook: Developing Software with UML, Object-Oriented Analysis and D, Bernd Oestereich, 1999, Addison-Wesley

Recommended - Textbook: Object-Oriented Analysis and Design with Applications, 2nd e, G. Booch, 1994, Benjamin/Cummings


Required - Textbook: Object-Oriented Software Engineering, Using UML, Patterns, and Java, Bernd Bruegge and Allen H. Dutoit, 2010/3rd, Pearson
Grading (Tentative)

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Contribution</th>
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<tbody>
<tr>
<td>1 Final: Essay/written</td>
<td>30</td>
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<tr>
<td>2 Project</td>
<td>40</td>
</tr>
<tr>
<td>3 Design Pattern take-home and Attending project presentations</td>
<td>10</td>
</tr>
<tr>
<td>4 Midterm</td>
<td>20</td>
</tr>
</tbody>
</table>

- Those students who fail to get a minimum of 25 out of 70 points will get an FZ
Plagiarism

All individual assignments must represent your own work.

No collaboration is permitted during the quizzes, the final examination, the individual labs, and the assignments. Collaboration among team members is permitted for the term project.

Plagiarism is to take and use as one’s own, or copy without acknowledgement, the works of another person. The provider of such material can be ruled equally culpable.
Term Project – 2020

* 5 teams per each game – First come first serve
Term Project 2021

• Classroom helper
  – Group formation
  – Peer review
    • Term project team member assessment
    • Reviewing the other’s group work
  – You are expected to extend the requirements after the requirement analysis
  – Best group’s software will be used next semester.

• Tools
  – Documentation: Google docs
  – Source control: Github
Term Project Fall 2021

• Pandemty Manager for University
  – Managing HES codes/ Vaccine & PCR status
  – Keeping track of quarantine status of students
  – ....
  – You are expected to extend the requirements after the requirement analysis

• Tools
  – Documentation: Google docs
  – Source control: Github
Term Project Fall 2021

• **Student Club Manager**
  – Managing activities
  – Managing users
  – Announcements, events ...
  – ....
  – You are expected to extend the requirements after the requirement analysis

• **Tools**
  – Documentation: Google docs
  – Source control: Github
Term Project 2022 Spring

• Gym Management System (For Bilkent University)
  – Gym reservation
  – Field reservation
  – Scheduling courses
  – ...

• Health Center Management System (For Bilkent University)
  – Doctor appointments
  – Medical history
  – Handling COVID status, vaccines etc.
  – ...
Team Project 2022 Fall

- Erasmus Application Manager
  - https://w3.bilkent.edu.tr/bilkent/outgoing-students/

Customer: Can Alkan and Ayşegül Dündar
Term Project

Every Group Project

Does 99% of the work

Says he's going to help but he's not

Has no idea what's going on the whole time

Disappears at the very beginning and doesn't show up again until the very end

In school you have ever done
<table>
<thead>
<tr>
<th>Week</th>
<th>Assignment</th>
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<tbody>
<tr>
<td>1</td>
<td>Course Overview</td>
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<tr>
<td>2</td>
<td>Chapter 1, Group Formation (via PeerPanda.net)</td>
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<tr>
<td>3</td>
<td>Chapter 2, CV Workshop</td>
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<tr>
<td>4</td>
<td>Chapter 2, Git (Tutorial), 1 page Project Scope</td>
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<tr>
<td>5</td>
<td>Chapter 3</td>
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<tr>
<td>6</td>
<td>Chapter 4, Iteration 1 Analysis Report</td>
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<td>9</td>
<td>Chapter 6, Midterm</td>
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<td>Chapter 7, Iteration 1 Design Report</td>
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<td>Chapter 8, Design Patterns (Tutorial)</td>
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<td>Chapter 9, Iteration 2 Analysis and Design Reports</td>
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<tr>
<td>14</td>
<td>Chapter 10</td>
</tr>
<tr>
<td>15</td>
<td>Final Report and Presentation</td>
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</tbody>
</table>
Key to Success

Ninety percent of your work's outcome will depend on the team you select to work with.

Find the right people
Be a team player
Be nice!
Key to Success

If you are the smartest person in the room, you are in the wrong room.
Term Project

• In at most 1 page, give a rough description of what you intend to implement. Discussion with the TA about your project is highly recommended.

• Come up with a rough scope for your software. Certain changes throughout the semester are welcome and expected.

• Start to form up your teams (More info after the add-drop period)

• Start researching the requirements