17-723: Designing Large-scale Software Systems

Recitation on Midterm Preparation

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Learning Objectives
Assessed by The Midterm

- Describe, recognize, and apply **principles** for: design for change, design for testability, design for interoperability
- Identify, describe, and prioritize relevant **requirements** for a given design problem
- **Generate** viable design solutions that appropriately satisfy the trade-offs between given requirements
- Apply appropriate abstractions & modeling techniques to **communicate** and document design solutions
- **Evaluate** design solutions based on their satisfaction of common design principles and trade-offs between different quality attributes

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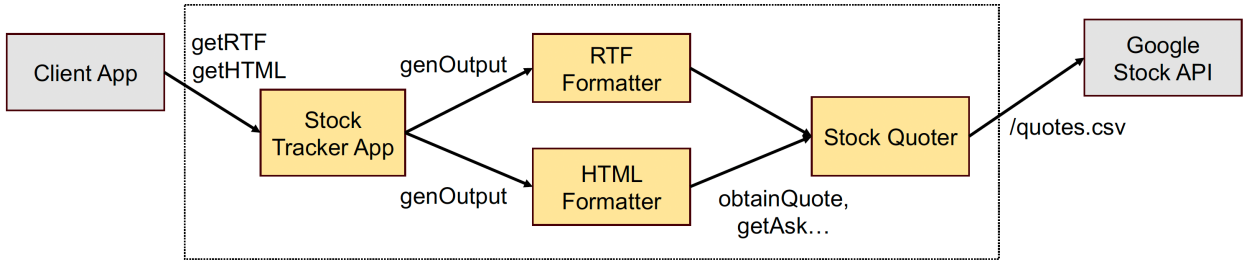
Be prepared to Solve Tasks, such as:

Given an Existing Design Description D & Changed Requirements Req':

- **Evaluate** D for a given QA
- **Specify** Quality Attribute Requirements QAReq for Req'
- **Generate** & **Communicate** an Improved Design for Req' & QAReq
- **Evaluate** Improved Design for QAReq
- Bonus Points for Study Sheet



Evaluate Given Design D for a Given QA

Example questions could be:

- Explain whether D violates <Design Principle>?
  - ➢"It (does / does not) violate the principle, because …"
- Describe Testability challenges that might occur when testing <Feature> for D
  - ➢"Hard to control X because … "
  - ➢"Hard to observe Y because … "

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Specify Quality Attribute Requirements

Questions can be like:

- Describe relevant quality attribute requirements for <QA Type>
  - <Like your M1 submission>
- Describe relevant quality attribute requirements for that system

Remember: The reason for describing QAs is to evaluate your decisions, so pick QAs that impact your decisions

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Generate & Communicate an Improved Design (for a QA spec and/or functionality change) given a baseline design

- Component Diagrams & CRC Cards
- Sequence Diagrams
- Interface Descriptions (see Interoperability Lecture)

Remember: The purpose of modeling a design it to **show HOW it solves a design problem**! In this case, how it improves the QA or how the design change supports the QA spec

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Generate & Communicate an Improved Design – Design Reuse can be helpful!

- Publish-Subscribe
- Model-View-Controller
- Test Spies, Test Stubs, Mock Components
- Adapter
- Designs similar to case studies
- …

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Making GDS More Changeable

Harder to Implement

Extensible Interfaces:

- Offers can contain a dynamically-defined add-ons
- Add-on: **`(price, name, description, id)`**
  - **`price(int)`**: The price in cents (excl. tax) additionally charged when this add-on is selected
  - **`name(str)`**: The name of the add-on as shown to the user (in UTF-8)
  - **`description(str)`**: A short description shown to the user in order to decide if they want to purchase the add-on (in UTF-8)
  - **`id(str)`**: Unique identifier of this add-on starting with the flight number (in ASCII)
- A list of add-ons is added to a flight listing. The booking API needs to add an optional list of add-on **`ids`** to identify requested add-ons.

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Compare two Design Options (for a QA spec)

- How do <D1> and <D2> compare regarding <QA Spec>?
  - D1 is better, because it supports <design principle for QA>
  - D2 is better, because …
  - D1 and D2 satisfy QA Spec about equally, because …

Make sure your arguments are directly derived from the information **communicated in the design models** and are **follow a logical chain of clear arguments**

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Bonus Points for Study Sheet

- Bring a one-page study sheet that summarizes the most important points from the course, so that you don't have to go through all slides if you want to look up something important
- Hand it in to receive bonus points!

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Recommended Study Approach

1. Creating your **study sheet**
2. Solve the **exercises** in the lectures & recitations & homework
    1. Instantiate the question templates from earlier slides for these examples
    2. Think of variations to these exercises that
    3. Improve your study sheet if it needs more information
3. Discuss your solutions with **other students** to give each other **feedback** on your solutions