

Assignment Project Exam Help

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Lecture 6: Design Principles &  
System Architecture

# Course Outline

- W1: Intro ✓ **Assignment Project Exam Help**
- W2: Modell ✓ **<https://eduassistpro.github.io/>**
- W3-4: Design patterns ✓ **Add WeChat edu\_assist\_pro**
- **W5-6: Design principles & system architecture**
- W7-8: Testing
- W9: Continuous integration
- W10: Review

# Today's Plan

- 10:05-11:55:
  - Quiz 4 (assessed correctness)
  - Design pri
  - System ar <https://eduassistpro.github.io/>
  - Design in practice - revisit Lab
- Long break
- 13:00-14:00 OR 14:00-15:00 in BO1028: **Lab 6 - work on AE1 (tutors will be present) !**

# Quiz 6

- Join YACRS Assignment Project Exam Help
- Session <https://eduassistpro.github.io/>  
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## Q6.1 UML and system architecture

In UML this symbol is used to denote a:

- A: package call
- B: component c
- C: class called "DataHandlers"
- D: interface called "DataHandlers"



A UML Package Diagram showing a package named "DataHandlers". The package is represented by a rectangle with a small tab at the top left containing the name "DataHandlers". The main body of the rectangle is empty, indicating no internal elements or relationships are shown.

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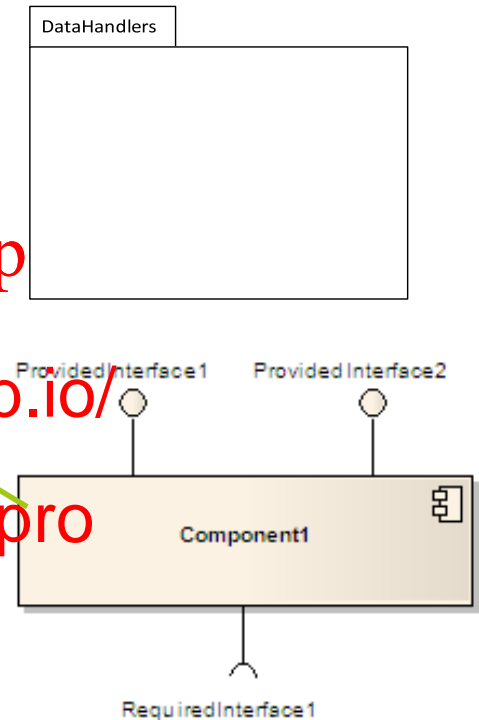
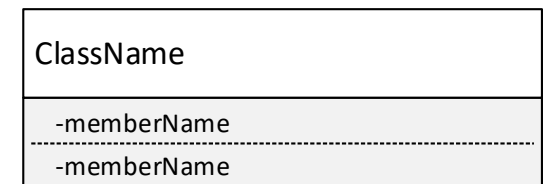
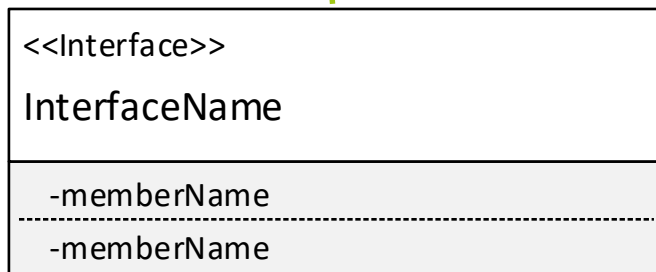
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## Q6.2 Multi-Layer

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The multi-layer architectural pattern can (in a strict design/implementation) be used in which direction(s)? <https://eduassistpro.github.io/>

- A: Any connection between layers is allowed
- B: Higher layers depend on lower layers
- C: Both ways
- D: Lower layers depend on higher layers

## Q6.2 Multi-Layer (solution)

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The multi-layer architectural pattern can (in a strict design/implementation) specify the direction(s) in which

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- A: Any connection/dependency between layers is allowed
- B: **Higher layers depend on lower layers**
- C: Both ways
- D: Lower layers depend on higher layers



## Q6.3 Architectures

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Consider the following scenario. The system includes a user interface, which interacts with a database. The user interface is accessed by a client application.

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Which architecture is most suitable for this scenario?

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- ☐ A: Broker pattern
- ☐ B: Model View Controller pattern
- ☐ C: Pipe and filter pattern
- ☐ D: Transaction processing pattern

## Q6.3 Architectures (solution)

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Consider the following scenario. The system includes a user interface, which is connected to a database. The user interface is accessed by a client.

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Which architecture is most suitable for this scenario?

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- ☐ A: Broker architectural pattern
- ☒ B: **Model View Controller**
- ☐ C: Pipe and filter
- ☐ D: Transaction processing

# Design

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- Increasing revenue
- Ensuring the requirements
- Accelerating development
- Increasing qualities such as
  - Usability
  - Efficiency
  - Reliability
  - Maintainability
  - Reusability
  - ...

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# DESIGN Principles

- Divide and Conquer
- Cohesion
- Coupling
- Keep the level of abstraction as high as possible (already covered)
- Increase re
- Reuse existi
- Anticipate obsolescence
- Design for portability
- Design for testability
- Design defensively

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# Divide and conquer (combine)

- Trying to deal with something big all at once is normally much harder than dividing it into a series of smaller things.  
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- Separate concerns.
- An individual software engineer can specialize.
- Each individual component has a specific function and therefore easier to understand.
- Parts can be replaced or changed without having to replace or extensively change other parts.

# Cohesion: High cohesion is good

- Functional
- Layer
- Communicational
- Sequential
- Procedural
- Temporal
- Utility

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# Coupling: High Coupling is Bad

- ▣ Content
  - ▣ Common
  - ▣ Control
  - ▣ Data
  - ▣ Routine
  - ▣ Type Use
  - ▣ Import
  - ▣ External
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# Abstraction level should be as high AS possible

- ▣ Keeping the level of abstraction high means being able to understand or use the system without knowing and understanding sp

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# Increase Reusability Where Possible

- Design the various aspects of your system so that they can be reused
  - Generalize (abstraction)
  - Ensure cohesion and low coupling
  - Design your system to contain reusable components
- Hooks: Which design patterns provide hooks, and how does this help promote reusability?

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# Increase Reusability through Hooks

- The Factory Pattern allows programmers to add their own classes into a custom framework and dynamically setting a custom framework hook to extend the Factory Framework.

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# Reuse existing Designs and Code Where Possible

- (Good) designs and code should be reused.

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- Why is cloning not considered a way of reusing code? What side effects does it have?

# Cloning is Not Reuse

- Copy and Paste is abolished in software engineering.
- If a library changes, it has to be updated.
- Local code can be changed, but it makes maintainability more difficult.
- Unless you have an infrastructure to update your clone (for example using networked version control) a clone is not a good way to reuse code.
- **Unless there is some other need to keep a local copy for reliability reasons. See Tolerating Clones? Page 331.**

# Design for Flexibility

- Actively anticipate changes that a design may have to undergo in or them
- Reduce <https://eduassistpro.github.io/>
- Create abstractions
- Do not hard code anything
- Leave all options open
  - Do not restrict the options of people who have to modify the system later
- Use reusable code and make code reusable
- Identify an alternative to hard coded constraints and how you would implement this alternative in Java?

# Anticipate Obsolescence

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- Anticipating obsolescence is an important design principle, but it is often overlooked in design principles.

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- Which other design principle is in anticipating obsolescence, and how would you balance these concerns?

# Anticipate Obsolescence

- Reusing code can be in direct competition with anticipating obsolescence.
- A library or library producer, then you are maintained by the library producer, then you are a legacy dependency.
- If different parts of a library are not well maintained or implemented, your dependence on them becomes more volatile.
- **For example**, OpenCV is a library with a wide variety of quality in its modules. Dependence on a more experimental module is more risky.

# Design for portability

- Designing for portability means designing so that your software can run on as many platforms as possible.

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- One field where this is particularly true is mobile platforms where standardization is limited. Mobile platforms specifically compete for business by providing different features.

- For example, let's say you want to design a mobile application that requires an NFC sensor to function properly. What trade-offs must you consider when deciding to use NFC features or not?



# Example: NFC and Portability

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- How likely is it that many platforms will support NFC hardware?

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- What market forces will influence continued support for NFC?
- What will happen if a user downloads this app but doesn't have the correct hardware?

# Design for Testability

- Take steps to make testing easier
  - Design a test strategy that allows you to test the software
  - Discuss <https://eduassistpro.github.io/>
  - Ensure that all the functions can be tested by code that can be driven by an external program or graphical user interface
- In Java, you can create a main() method in each class in order to exercise the other methods
- E.g. the Model View Controller is one way of dividing and organizing a system architecture. How does the architecture help or hinder designing for testability?

# Design for Testability

- Model View Controller separates functionality from a GUI, but design step further and provides main functions either through additional main menu or through a command line interface.
- If functionality is coupled to GUI actions, it can be costly and time consuming to run testing. Large scale testing would not be practical if testers had to run tests through the application GUI.

# Design Defensively

- Not only must you be able to produce code without errors, you should attempt enough that other users of your code are satisfied.

How might you refactor this code more defensively?

```
// This is snippet from a Course class.  
// A student can be enrolled in a Course, but the ID  
// number must be valid  
  
public void enrollStudent(int studentID) {  
    this.addStudent(studentID);  
}
```

# Design Defensively

```
// This is snippet from a Course class.  
// A student can be enrolled in a Course, but the ID number  
// must be valid
```

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```
public boolean enroll(int studentID) {
```

```
    if (checkID(studentID)) {
```

```
        this.addStudent(studentID);
```

```
        return true;
```

```
    }
```

```
    else {
```

```
        return false;
```

```
    }
```

```
}
```

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Software Architecture

# Software Architecture

- Software architecture is process of designing the global organization including:
  - Dividing s
  - Deciding how these will int
  - Determining their interface
- The architecture is the core of the design, so all software engineers need to understand it.
- The architecture will often constrain the overall efficiency, reusability and maintainability of the system.

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# Architectural Models Support Good Design

- Enable everyone to better understand the system
- To allow p <https://eduassistpro.github.io/> pieces of the system in isolation
- To prepare for extension of
- To facilitate reuse and reusability

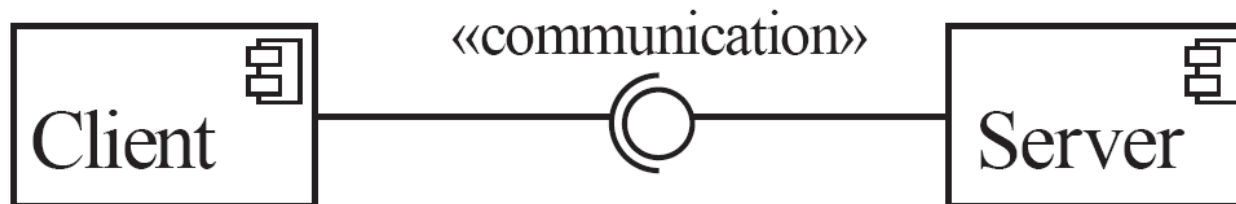


# UML for System level modelling

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# Deployment diagrams

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# MultiLayer Architecture

High Level Layer (UI Layer)

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Low Level Layer (Low Level Services)

An abstract example multilayer architecture.  
Actual implementations vary....

# Multilayer Implementation I

A simple implementation

with procedure

■ Demo: myloveredup.com

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Presentation

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# Relaxed multi layer architecture

- What happens if the database changes w layer know

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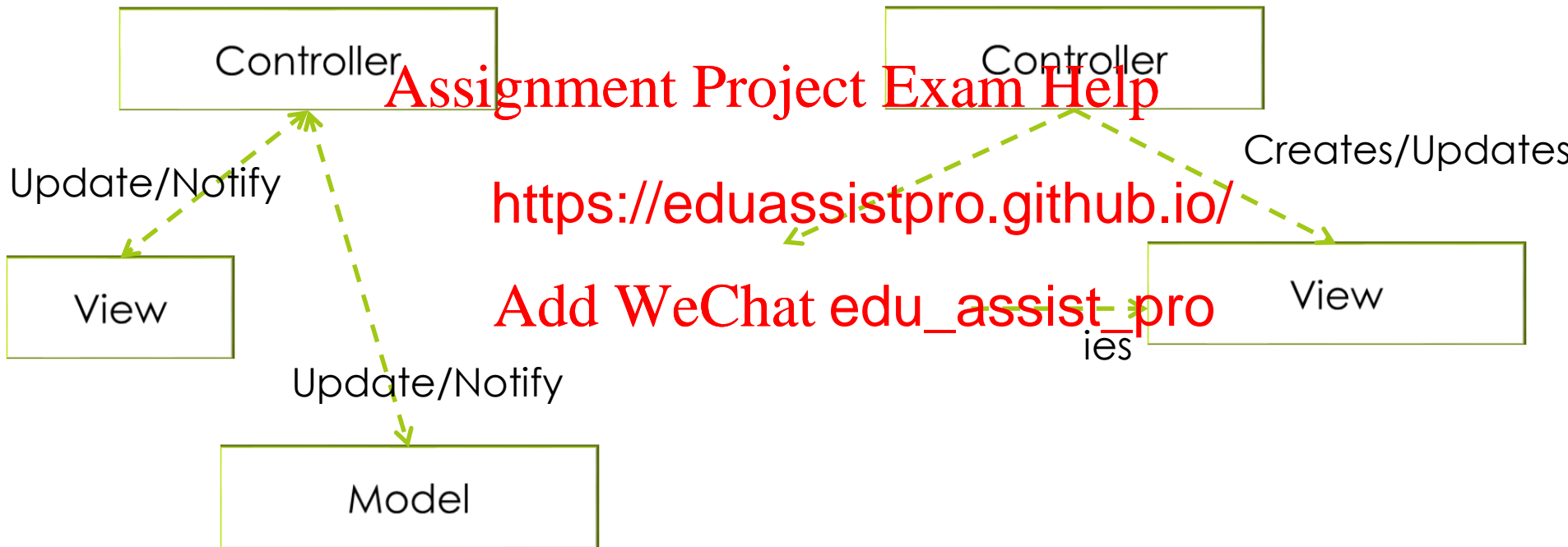
<https://eduassistpro.github.io/>

- Can we come up with an implementation with minim coupling that allow a lower layer to indicate a change ?

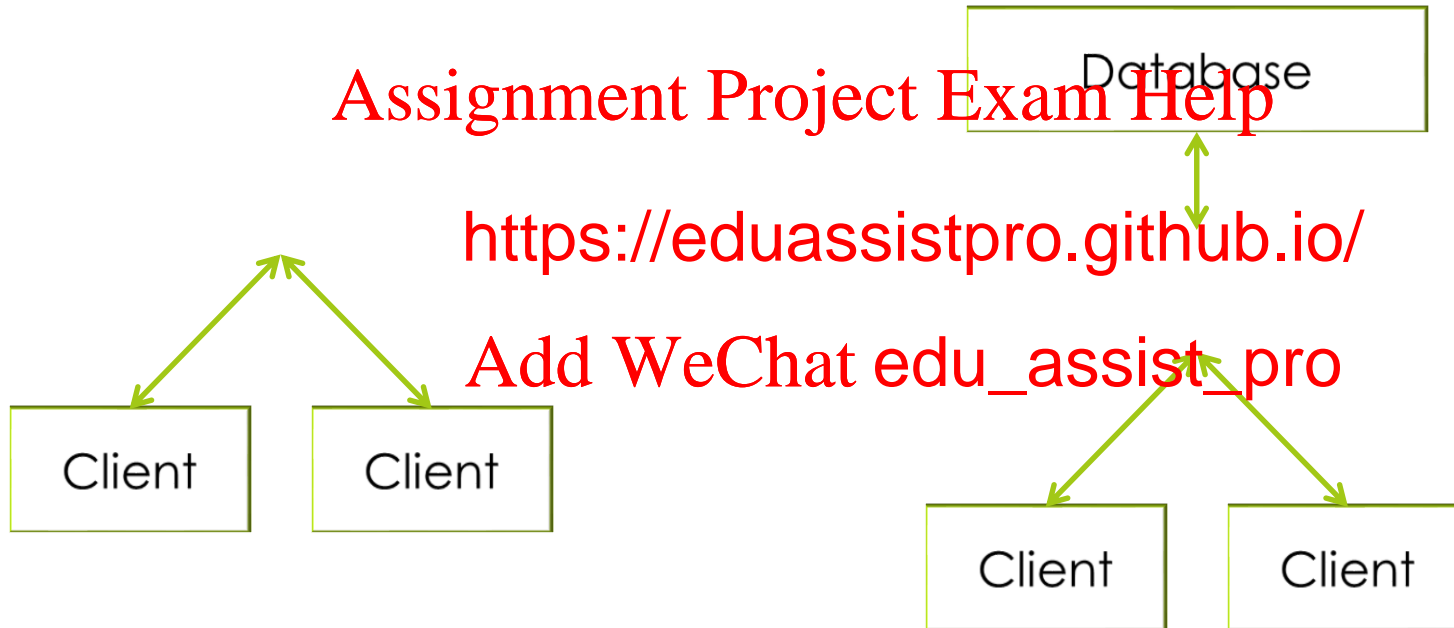
- Which design pattern would you use ?



# Model View Controller

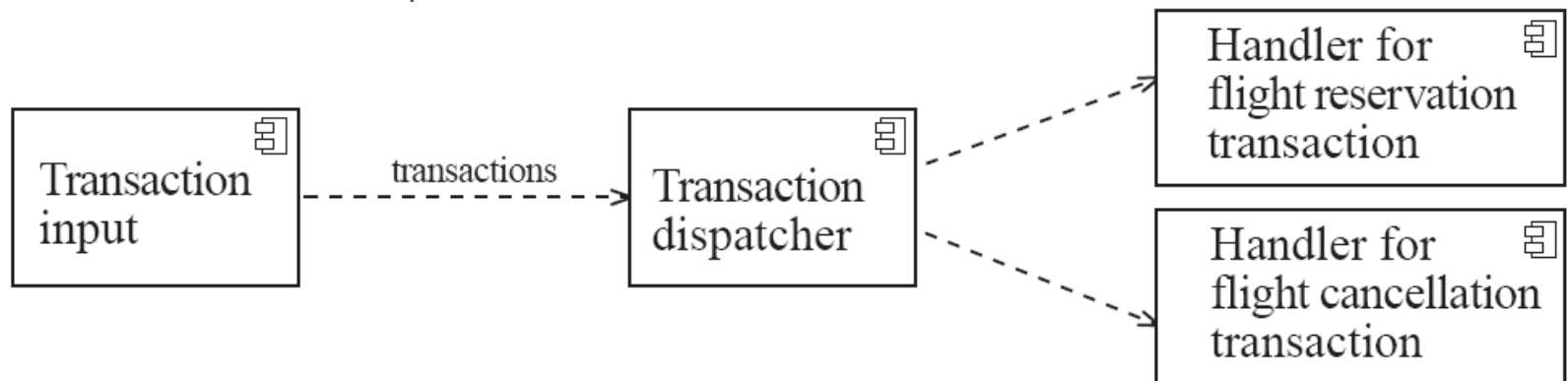


# Client Server



# Transaction-Processing

- A process reads a series of inputs one by one.
- Each input describes a *transaction*—a command that typically so *processed* by the system
- There is a *transaction dispatcher* that decides what to do with each transac
- This dispatches a procedure c to one of a series of component that will *handle* the transaction





# Pipe-and-Filter

- A stream of data, in a relatively simple format, is passed through a series of filters.
  - Each of the filters performs a specific task.
  - Data is constantly fed into the filters.
  - The processes work concurrently.
  - The architecture is very flexible.
    - Almost all the components could be removed.
    - Components could be replaced.
    - New components could be inserted.
    - Certain components could be reordered.

# Example: Pipe-and-Filter

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# Others...

■ Service oriented **Assignment Project Exam Help**

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■ Message oriented

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In practise..

# Making design decisions

- Using priorities and objectives to decide among alternative
  - Step 1: <https://eduassistpro.github.io/> alternatives for the design decision.
  - Step 2: List the advantages of each alternative with respect to [Add WeChat edu\\_assist\\_pro](#) es and priorities.
  - Step 3: Determine whether any of the alternatives prevents you from meeting one or more of the objectives.
  - Step 4: Choose the alternative that helps you to best meet your objectives.
  - Step 5: Adjust priorities for subsequent decision making.

# Cost-benefit analysis

- To estimate the costs, add up:
  - The incremental costs of software engineering work, including <https://eduassistpro.github.io/>
  - The incremental costs of a new technology required **Add WeChat edu\_assist\_pro**
  - The incremental costs that personnel will experience of product support
- To estimate the *benefits*, add up:
  - The incremental software engineering time saved
  - The incremental benefits measured in terms of either **increased sales or other financial benefits** to users

# Design documentation

- Design documents as an aid to making better designs
  - They force designers to consider the important issues before they start the design.
  - They allow a group of people to discuss the design and therefore to improve it.
  - Design documents as a means of communication.
    - To those who will be *implementing* the design.
    - To those who will need, in the future, to *modify* the design.
    - To those who need to create systems or subsystems that *interface* with the system being designed.

# Documentation

## **A. Purpose:** Assignment Project Exam Help

- What system or part of the system this design document describes.
- Make r re being implemented by this design (

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## **B. General prior**

- Describe the priorities used to process.

## **C. Outline of the design:** Add WeChat edu\_assist\_pro

- Give a high-level description that allows the reader to quickly get a general feeling for it.

## **D. Major design issues:**

- Discuss the important issues that had to be resolved.
- Give the possible alternatives that were considered, the final decision and the rationale for the decision.

## **E. Other details of the design:**

- Give any other details the reader may want to know that have not yet been mentioned.



# Documentation: Javadoc

- The audience for Javadoc is Java developers

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# Keywords

- @author (classes and interfaces only required)
- @version (class [ootnote 1](https://eduassistpro.github.io/oootnote 1))
- @param (method)
- @return (method only)
- @exception (@throws is a synonym added in Javadoc 1.2)
- @see
- @since
- @serial (or @serialField or @serialData)
- @deprecated (see [How and When To Deprecate APIs](https://eduassistpro.github.io/oootnote 1))

# Full JavaDoc Overview

- **Assignment Project Exam Help**  
<http://www.oracle.com/technetwork/articles/java/index-137868.htm>

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Design in practise - revisit Lab 2

# User Requirements to Design

- A software for a travel agency provide reservations facilities for the people who wish to travel on tours by accessing a built-in network at the agency bureau.
- The application software keeps information on all the tours.
- Users can access the system to make a reservation on a tour and to view information on the reservation available online.
- Users can access the reservation the he/she has made.
- Any complaints or suggestions that they have could be sent by email to the agency or stored in the database.
- The employees of the corresponding agency could use the application to administrate the systems operations. Employees can add, delete, and update the information on the customers and the tours.
- For security purposes, the employee should be provided a login ID and password by the manager to be able to access the database of the travel agency.

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# Model solution (high level)

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# Consensus

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# Summary

- Design process
  - Analysis
  - Design process
  - Design principles
  - Architectural patterns
  - Documentation

**Assumptions and trade-offs among priorities are required and ubiquitous – make sure to provide explanation and rationale for MAJOR decisions.**

- Lab 6 at 13:00 or 14:00 in BO1028

# Next Week

- Testing Assignment Project Exam Help
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