

CS352: Software Engineering II

Midterm Sample Questions



Question 1 - (Software Design)

1. An accounting application in a computer store uses the following method calculate the total price of a customer's order of different computer parts.

```
public double totalPrice(Part[] parts) {  
    double total = 0.0;  
    for (int i = 0; i < parts.length; i++) {  
        if (parts[i] instanceof Motherboard)  
            total += (1.45 * parts[i].getPrice());  
        else if (parts[i] instanceof Memory)  
            total += (1.27 * parts[i].getPrice());  
        else  
            total += parts[i].getPrice();  
    }  
    return total;  
}
```

Q1: (1) Does this code satisfy / or violate the open-close principle (OPC)? (2) And why?

Q2: If it does not satisfy this principle, modify it to follow the OCP principle.

Question 2 - (Software Architecture)

1. (1) Explain the pipe-and-filter architecture style (2) Explain an example application that suites this style.
2. (1) Explain the peer-to-peer architecture style, (2) What are its advantages? (3) Explain one sample application that is suitable for this architecture and why this architecture is best for this application.
3. To let banking customers use their accounts to pay mobile bills, a startup company is building for the banking sector a middle layer between banks (such as HBSC and NSGB) and billers (such as Modafone and Vobinil). This component needs to interface with:

The system for querying for bills from each telecommunication company (view / pay). Each biller provides one interface to get / pay bills given customer mobile number

The SOF (Source of fund) interface for each bank where authenticated components (such as the middle layer) could ask for debiting (taking) an amount of money from a customer bank account and crediting (putting it in) a biller's bank account in the same or a different bank (e.g. when a bill is confirmed as paid).

- (1) Draw a simple architecture for this component. Use clean and clear notation for drawing.
- (2) Update the architecture and redraw it considering two appropriate design patterns, one for each of the following requirements (draw the class diagram part related to each pattern in details):
 - (a) **Data Format:** To provide information about customer bills, Modafone uses XML format and Vobinil uses a simple text file. However both formats have the same information.
 - (b) **Communication:** Both Modafone and HSPC communicate using Sockets. Vobinil Communicate through Remote Procedure Call (RPC). NSGB Communicate through Java Message Service (JMS)

The start-up company will totally depend on Java technologies for communication

CS352: Software Engineering II

Midterm Sample Questions



Question 3 - (Process, CMMI & Scrum)

- 1- Explain the Rational Unified Process for software development and how it distributes and organizes development activities.
- 2- You are the manager of Shams Software Company. To compete in the market and get contracts, you have to distinguish the quality of your work from other companies. To do so, your company decided to apply for CMMI certification level two. This requires that the company has a repeatable software production process with the following practices well established:
 - Software configuration management
 - Software project tracking and oversight
 - Requirements management
 - Software quality assurance
 - Software project planning

Your company is considering applying Scrum software development process. **Explain how Scrum practices support the required CMMI practices. Explain which CMMI practices are not explicitly stated in Scrum and what you will do to apply them. Good luck with your CMMI certification process.**

Hint: This link may help you answer this question:

[http://www.scrumalliance.org/community/articles/2011/february/implementing-scrum-\(agile\)-and-cmmi%C2%AE-together](http://www.scrumalliance.org/community/articles/2011/february/implementing-scrum-(agile)-and-cmmi%C2%AE-together)

- 3- (1) Explain what CMMI is and (2) Why companies try to obtain it and (3) The main KPA required for achieving level 3.

Question 4 - (Design Patterns)

- 1- Consider the following design goals. **(1) Indicate the candidate** pattern(s) you would consider to satisfy each goal and **(2) Why** (Justify your choice.)? **(2) Draw a UML** class diagram for this Design Pattern.
 - a. Given a legacy banking application, encapsulate the existing business logic component to be able to use it within a new application.
 - b. Given a chess program, enable a monitoring component to switch planning algorithms at runtime, based on the opposing player's style and response time
 - c. Given two low level APIs for maps and weather apps that are usually used in predefined scenarios, like giving a city name and showing its weather and also the close cities on the map, it is required to develop a high level API that supports directly these predefined usages without having to deal with the low level APIs.
- 2- **Which design pattern would you use** to design a solution for this problem? It is required to design a program to print a report. Report printing has various steps regardless of the report format such as printing title page, table of content, executive summary, introduction, content and conclusion. It is required to be able to print reports in pdf and in html formats.

(1) Adapter Pattern (2) Strategy Pattern (3) Template Method Pattern (4) Visitor Pattern
- 3- Describe in words and using a class diagram how to use the **decorator** design pattern to model the different types of toppings that apply to different kinds of pizza.

CS352: Software Engineering II

Midterm Sample Questions



- 4- Given the following incomplete implementation of a program that implements the Template Method design pattern, **complete this code** by writing the missing parts.

Assume that methods `printTicketDetails` and `printHotelDetails` print only simple messages.

```
public abstract class HolidayPackage {
    private int price;
    public void printPackageDetails () {
        printTicketDetails();
        printHotelDetails();
    }
    public abstract void printTicketDetails ();
    public abstract void printHotelDetails ();
}
```

```
public class HolidayPackageTurkey extends HolidayPackage {

    ..... // (1) Add code here
}
```

```
public class HolidayPackageUK extends HolidayPackage {

    ..... // (2) Add code here
}
```

- 5- For the following questions, Consider the following design goals, Indicate the candidate pattern you would consider to satisfy each goal, Why and draw UML for this design pattern
- Given a Robot class, anywhere in the application should only have one single instance of the Robot object.
 - Printing of a book involves various steps such as printing table of content, preface, introduction, chapters and conclusion. Also each book can be printed in document format(docx format) or web format (html)
 - Given the logic of the general guideline of building a plane (you have to make body first then wing), also consider that each plan type has its own building process
 - Suppose we have an application which manages routers in different environments (Dlink, TPLink, LinkSys). Routers should be capable of sending and receiving char data from other nodes and application should be capable of configuring routers in different environment (Mac, Linux). You should consider that if we need to add new configuration in new environment, We don't need to recompile all the system again
 - When you have to read from two data source i.e CSV and database then you have to process that data and generate output as CSV files. Here are the three steps are involved.
 - Read data from corresponding data source
 - Process data
 - Write output to CSV files (only one and well-known implementation for this function)
 - A mobile application needs to deal with a variety of network access protocols (phone, wireless, LAN), depending on the context of the user (location, communication costs, etc)
 - we would implement a simple topic and users can register to this topic. Whenever any new message will be posted to the topic, all the registered users will be notified and they can consume the message.