Desiggn patterns- mam Faiza Hameed

FA24 Mid term and Final Exam

14/11/2

COMSATS University Islamabad, Abbottabad Campus

Department of Computer Science

MID-TERM EXAMINATION

Class: BSE-7A
Subject: Design Patterns
Total Time Allowed: 80 minutes
Name: _____

Date: 14 Nov 2024
Instructor:
Max Marks: 30 marks
Registration # FA21 BSE 019

CLO-1: [10 marks]

Question 1: Write the intent of the following design patterns: [CLO-1] (2*3= 6)

a. Builder Design Pattern
b. Factory Method Design Pattern
c. Adaptor Design Pattern

Question 2: When would you apply each of the following pattern? [CLO-1] (2*2= 4)

a. Null object pattern
b. Application controller pattern

Question 3: CLO-2 [10 marks]

Imagine a **car rental service** that allows customers to rent cars. The service offers a range of **car models** (SUVs, Sedans, Trucks, etc.) and allows customers to customize their rentals with various **add-ons** (GPS, child seats, additional insurance, etc.). Following are the basic requirements of the system:

- **Car Model Selection**: Customers select from a variety of car models (e.g., Sedan, SUV, Truck).
- **Add-ons Selection**: Once a car model is selected, the customer can choose from a list of **optional add-ons** (e.g., GPS, Child Seat, Insurance) that come with additional costs.
- **Dynamic Customization**: Each car model can be **dynamically customized** by adding multiple add-ons. The total cost of the rental will depend on both the base car model and the selected add-ons.
- **Extensibility**: The system should be designed in such a way that **new car models** and **new add-ons** can be easily integrated in the future with minimal changes to the existing codebase.

Decorator

Abstract

(a) write the names of the pattern that can be applied in the above scenario. [2 marks]
(b) Also create the structure Diagram. [3 marks]
(c) What principles/ OOP Concepts are applied in the given scenario? [5 marks]

SOLID

Question 4: CLO-3 [10 marks]

Imagine you are designing an e-commerce platform that sells customizable gifts, such as personalized mugs, t-shirts, and frames. The platform allows customers to choose a product, customize it by adding personal messages or designs, and then have it shipped with various options like premium packaging or expedited shipping. This platform must integrate with **third-party services** (for payment, shipping, and product customization), and it needs to offer **dynamic customization** features to personalize products.

(a) To achieve this, which design patters will be used? [2 marks]
(b) Write the code to implement the patterns. [8 marks]

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Department of Computer Science

Examination – Final Term Exam (Fall 2024)

Class: BSSE 7th A/B
Subject: Design Patterns
Total Time Allowed: 3 hrs
Name: _____

Date: 18th Jan, 2025
Instructor: Ms. Faiza Hameed
Max Marks: 50
Registration #: FA21-BSE-019.

13/1/12

SECTION-A (Marks: 30)

Q1: [CLO 1]: Discuss how the SOLID principles relate to the use of design patterns. Provide examples of specific patterns that adhere to each principle. **[5 Marks]**

Q2: [CLO 1]: Describe how do design patterns improve maintainability in software projects? Provide few examples. **[5 Marks]**

Q3: [CLO 1]: Explain how the "Low Coupling" GRASP principle aligns with the Observer design pattern. And list the components involved in the Observer design pattern. **[5 Marks]**

Q4: [CLO 2]: Interpret whether the statement is true or false, and justify your answer with a proper reason. **[5 Marks]**

- "The **Factory Method pattern** violates the Open/Closed Principle (OCP) because it requires modifying the factory class to add new product types." F
- "The **Decorator pattern** is used to add new functionality to objects, but only through inheritance, not composition." F
- "The **Strategy pattern** requires the client to use a single algorithm for the entire system, making it rigid and unchangeable." F
- "The **Mediator pattern** is used to promote loose coupling by centralizing communication between objects " T
- "The **Proxy pattern** is used to control access to an object by providing a surrogate or placeholder for it." T

Q5: [CLO 2]: What are the concepts of 'intrinsic' and 'extrinsic' states in the Flyweight pattern, and how are they managed to optimize memory usage? Provide an example scenario where the Flyweight pattern is applied, and identify the intrinsic and extrinsic states involved. **[5 Marks]**

Q6: [CLO 2]: Describe the primary purpose of the Template Method design pattern and how it might result in a violation of the Liskov Substitution Principle (LSP). Support your answer by demonstrating a code example. **[5 Marks]**

SECTION-B (Marks: 20)

Q7: [CLO 3]: For the given design problem answer the following three questions:

- ***Which?*** Select the most appropriate design pattern to use and you must provide the pattern's intent. **(2 marks)**
- ***Why?*** Clearly motivate how this pattern addresses the problem. **(2 marks)**
- ***How?*** Explain how this pattern should be implemented by drawing an appropriate class diagram to illustrate the implementation of your pattern. **(4 marks)**

Scenario 1: In a photo editing application, users can apply various filters, adjust brightness, crop images, and add annotations to photos. These actions can be undone or redone, but users may want to keep a history of the changes they've made to a photo. The photo editing application can capture the photo's state after each change. Every time the user makes a modification (e.g., adjusting the brightness or applying a filter), an object is created that stores the current image state. When the user presses the undo button, the application restores the photo to the state stored in the most recent object. This allows users to go back to a previous version of the image, undoing multiple changes, without complicating the image manipulation process by keeping track of each individual modification. **[8 Marks]**

Q8: [CLO 4]: For the given design problem answer the following four questions:

- ***Which?*** Select the most appropriate design pattern to use and you must provide the pattern's intent. **(2 marks)**
- ***Why?*** Clearly motivate how this pattern addresses the problem. **(2 marks)**
- ***How?*** Explain how this pattern should be implemented by drawing an appropriate class diagram to illustrate the implementation of your pattern. **(4 marks)**
- ***Implement the solution:*** Implement the solution by writing the code in accordance with the class diagram. **(4 marks)**

Scenario 1: You are developing a compiler for a programming language that supports various language constructs such as variables, functions, loops, conditionals, and class declarations. These constructs are modeled as different classes, and you need to perform a series of operations like; code optimization, code generation, syntax checking and validation, and memory allocation analysis. Each operation needs to be applied across the different language constructs without modifying the language construct classes. As new operations, like type inference and dead code elimination, are added frequently, the design should allow for easy extensibility. **[12 Marks]**

Good Luck!