UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 5 Examination in Engineering: November 2024

Module Number: EE5262 **Module Name: Object Oriented Design Patterns and Principles**

[Three Hours]

[Answer **all questions**, each question carries 10 marks]

Q1. a) Answer using the knowledge on object-oriented design patterns.

i) What is a design pattern?

[2.0 mark]

ii) Briefly explain three different types of design patterns.

[3.0 mark]

b) Sometimes it's important to have exactly one instance of a class.

i) What is a singleton, and why is it used in software design?

[2.0 mark]

ii) Why is a basic singleton implementation not thread-safe in a multithreaded environment?

[3.0 mark]

Q2. a) MVC is a commonly used design pattern in software development, briefly explain MVC design pattern using a diagram. [2.0 marks]

b) Imagine you are tasked with designing a smart home automation system that supports various devices such as Smart Lights, Smart Thermostat and Smart Security Camera.

i) What are the SOLID Principles?

[5.0 mark]

ii) Describe how you would apply Interface Segregation Principle (ISP) to the design of the smart home automation system.

[3.0 mark]

Q3. a) Consider the following design patterns list.

```
1: Abstract Factory design pattern
2: Factory Method design pattern
```

i) Explain any one of the design pattern from the above list.

[4.0 marks]

ii) Draw a rough class diagram for the design pattern used in the above section (Q3.a.i).

[3.0 marks]

b) Provide a practical example where the Factory Method design pattern can be applied.

[3.0 marks]

Q4. a) Consider the following design patterns list.

```
1: Adapter design pattern
2: Decorator design pattern
3: Proxy design pattern
```

i) Explain any one of the design pattern from the above list.

[4.0 marks]

ii) Draw a rough class diagram for the design pattern used in the above section (Q4.a.i).

[3.0 marks]

b) Provide a practical example where the Adapter design pattern can be applied.

[3.0 marks]

Q5. a) Consider the following design patterns list.

```
1: Strategy design pattern
2: Observer design pattern
3: Template Method design pattern
4: Command design pattern
```

i) Explain any one of the design pattern from the above list.

[4.0 marks]

ii) Draw a rough class diagram for the design pattern used in the above section (Q5.a.i).

[3.0 marks]

b) Provide a practical example where the Template Method design pattern can be applied.

[3.0 marks]