00382

Sri Lanka Institute of Information Technology

B. Sc. Special Honours Degree
in
Information Technology

Final Examination
Year 3, Semester I (2022)

SE3030 – Software Architecture

Duration: 02 Hours

Instructions to Candidates:

- This paper contains **Four** questions. **Answer All** Questions.
- Marks for each question are given in the paper.
- Total Marks: 100.
- This paper contains **5** pages with the Cover Page.

Question 01 (30 marks)

a) This question is based on the **Enterprise Application Integration (EAI)**.

i). Assume you have a distributed system with 10 nodes as following figure 01 and if you are planning to increase number of nodes into 25, explain the relationship in between ***nodes*** and ***physical links*** with a formula and compute total possible links.
(04 marks)

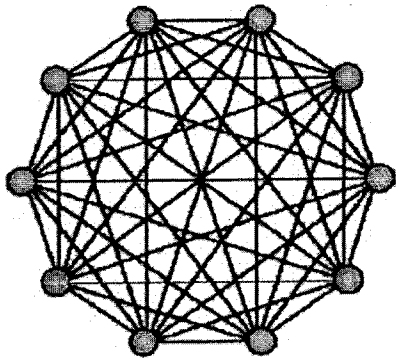

Figure 01

ii). According to the above architecture represented in the *Figure 01*, explain the problem when increasing number of components and suggest a solution to sort out the problem using a ***behavioural pattern***. (Draw a diagram as well for your explanation)
(08 marks)

b) Compare ***Adapter Pattern*** with ***message translator pattern*** in EAI, and draw a diagram to explain the ***message translator*** with an example
(10 marks)

c) Compare Presentation Layer ***Intercepting Filter*** pattern with EAI ***Pipes and Filter*** pattern and give examples
(08 marks)

Question 02 (20 marks)

a) This question is based on the **Front Controller** implementation of the **Presentation Layer Pattern.** You should select two services **PaymentService** and **ReservationService** to make payments and make reservations. This works as per the **Command pattern** and refer the **Test class** and the outputs of the console is given in the below diagram.

Test.java | ServiceSelector.java | PaymentService.java | ReservationController.java | ReservationService.java | PaymentController.java | FrontController.java

```
1  public class Test {
2
3      public static void main(String[] args) {
4
5          ServiceSelector serviceSelector = new ServiceSelector();
6
7          PaymentService paymentService = PaymentService.getInstance();
8          ReservationService reservationService = ReservationService.getInstance();
9
10         FrontController paymentController = new PaymentController(paymentService, 5000);
11         FrontController reservationController = new ReservationController(reservationService, 60);
12
13         serviceSelector.setController(paymentController, reservationController);
14         serviceSelector.selectPaymentService();
15         serviceSelector.selectReservationService();
16     }
17 }
```

Console | Problems | Javadoc | Declaration

```
<terminated> Test (1) [Java Application] C:\Program Files\Java\jre1.8.0_144\bin\javaw.exe (Apr 3, 2022, 11:09:10 AM)
Payment service paid amount of = 5000.0
You reserved the room = 60
```

i). Construct the code for **PaymentService** class according to the **Singleton design pattern** and you can implement make payment method as follows.

(03 marks)

```
public void makePayment(double amount) {
    System.out.println("Payment service paid amount of = " + amount);
}
```

ii). Design **ReservationService** class according to the **Singleton design pattern** and there should be a method to reserve rooms as follows.

(03 marks)

```
public void reserveRoom(int roomNo){
    System.out.println("You reserved the room = " + roomNo);
}
```

iii). You should design the **PaymentController** and **ReservationController** classes and they implement the **FrontController interface** as per the given below. Each controller should override the execute methods.

(06 marks)

```
public interface FrontController {
    void execute();
}
```

iv). Construct the **ServiceSelector** class and there should be a method to set both controllers in **setController** method and implement **selectPaymentService** and **selectReservationService** methods to delegate the responsibility from controller to service.

(08 marks)

Question 03 (25 marks)

a) Explain why **Software Architecture** is important.

(03 marks)

b) Apply 02 widely used **Enterprise Architecture Frameworks** and briefly explain the **benefits** of using them.

(06 marks)

c) Apply 03 examples for different type of **Non-Functional Requirements** and explain each.

(06 marks)

d) Explain what **Architectural Views** are and explain the purpose of a view providing examples.

(04 marks)

e) Analyse the below Architecture Validation methods.

i). ATAM

(02 marks)

ii). SAAM

(02 marks)

iii). ARID

(02 marks)

Question 04 (25 marks)

a) Explain what **Quality Attributes** are affected by **Denial-of-Service** attack. **Propose** a **tactic** that can prevent above attack and explain how it will improve the system's quality.

(05 marks)

b) Write concrete Quality Attribute scenarios for a social media mobile application operating under low network bandwidth for below Quality Attributes.

i). Availability

(03 marks)

ii). Usability

(03 marks)

c) How is **N-Tier Architecture** different to **Layered Architecture**. What are the distinct **advantages** and **disadvantages** of N-Tier Architecture compared to Layered Architecture?

(04 marks)

d) Explain the types of **Client-Server Architecture** and identify where each type is better suited for **practical use** by providing an example for each.

(04 marks)

e) A start-up business selling seasonal gifts wants to have an online presence so its customers can order their goods online. If you are to Architect a **Web based system** for above, what **Architecture style(s)** would you use to design above. Explain how your proposed Architecture style(s) would help the business's technical front to be successful.

(06 marks)