B.Sc. Engg. CSE 5th Semester | 15 December 2023 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT) 22

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION | WINTER SEMESTER, 2022-2023

DURATION: 3 HOURS | FULL MARKS: 150

CSE 4513: Software Engineering and Object-Oriented Design

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer **all 6 (six)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

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1. a) Suppose a software version 2.4.7.133 has been released to QA for quality control, and they come back with an issue that requires a change. What should be the version number of the software when it will be sent back to the QA after fixing the issue? How do different segments of a version number help developers communicate the magnitude of changes made to the software? — 2 + 5 (CO3) (PO1)

   b) With proper justification, mention the type of maintenance required for the scenarios mentioned below: — 3 + 3 (CO3) (PO2)

      i. Consider a popular mobile banking application that has been in use for a few years. With the ever-evolving landscape of cyber-security threats, the app's development team receives reports of potential vulnerabilities in its authentication system. After thorough analysis, they realized that the current encryption methods used to secure user data are becoming outdated and susceptible to newer hacking techniques.

      ii. Imagine a cloud-based project management platform that is widely used by various organizations. The development team notices a gradual decrease in the performance of the platform as the user base grows. Analysis reveals that the database indexing and query optimization methods, which were sufficient in the initial stage, are now struggling to handle the increased volume of data and user requests efficiently.

   c) Under what circumstances does corrective maintenance typically occur? — 5 (CO3) (PO1)

   d) One way of reusing software components is to modify the reusable software component keeping the user requirement same. Another way is to modify the user requirements keeping the reusable software component same. Which way is more beneficial for the developer company? How can that help companies to generate more profit? — 2 + 5 (CO3) (PO1)

2. a) A company is hiring software developers based on the following criteria: — 12 (CO3) (PO2)

   - Experience in Python $\geq$ 2 years
   - Experience in Java $\geq$ 1 year
   - Experience in SQL $\geq$ 1 year
   - Total experience in all three languages $\geq$ 4 years OR Total experience in Python and Java $\geq$ 2.5 years

   If the total experience of an eligible candidate is more than 5 years, they will be eligible for a senior developer role, otherwise, they will be eligible for a junior developer role. Design test cases using decision table testing for the program that checks the eligibility of candidates based on their programming language experience.

   b) How does continuous delivery differ from continuous deployment? — 3 (CO3) (PO2)

c) For the Control flow graph of Figure 1 — 10

i. Calculate the cyclomatic complexity of the program. (CO3)

ii. List all the independent paths. (PO2)

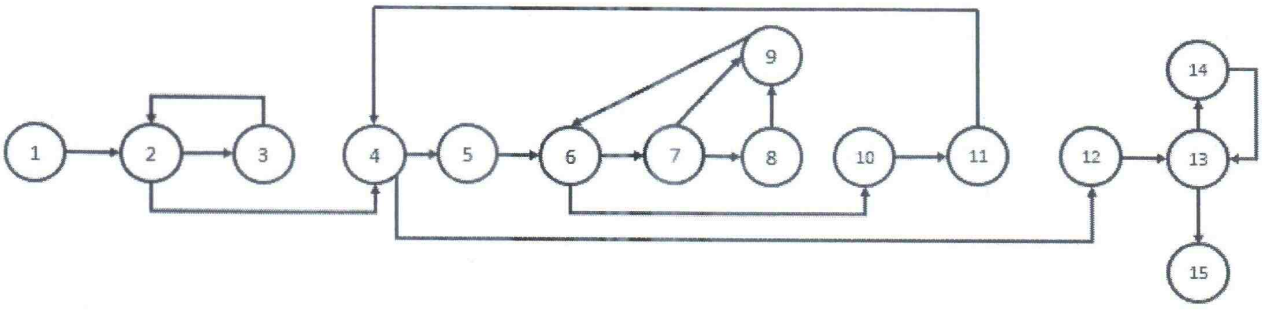

Figure 1: Control Flow Grapth for Question 2.c)

3. a) Why is throwing exceptions preferred over returning error codes? 5

b) Consider the program of Code Snippet 1: 4+4

```
1  main()
2      {
3           int a,b,c,sum,diff,mul;
4           scanf(   %d %d % d   , &a, &b, &c);
5           sum = calsum(a,b,c);
6           diff = caldiff(a,b,c);
7           mul = calmul(a,b,c);
8           printf(   %d %d % d   , sum, diff, mul);
9      }
10 calsum(int x, int y, int z)
11     {
12         int d;
13         d = x + y + z;
14         return(d);
15     }
```

Code Snippet 1: Function definitions for Question 3.b)

i. Suppose `main()` module is not ready for the testing of `calsum()` module. Design a driver module for `main()`.

ii. Modules `caldiff()` and `calmul()` are not ready when called in `main()`. Design stubs for these two modules.

c) For your upcoming project, you are going to maintain a set of cities as an interconnected graph structure. One module needs to be designed to maintain multiple views of the distances between cities. Assume that the GRAPH class provides operations for obtaining the distance between any two cities. New roads are always constructed between cities and as a result, the distances change. One view provides a table of distances between cities in kilometers, and another view maintains the same information in miles. Besides this, an application needs to collect various kinds of information about the cities such as the least and most crowded cities, the city with the largest mall, etc. Assume each object representing a city is equipped with the necessary operations to obtain the population, and size of the largest mall, etc. 12

For the above scenario, state which design pattern(s) can best solve the problem. Provide the UML diagrams for your chosen design pattern(s).

4. a) Consider the program of Code Snippet 2: 5+7

```
1  public class ComplexCalculator {
2      private int result;
3      public void calculateAndPrintSumAndProduct(int num1, int num2) {
4          int sum = add(num1, num2);
5          int product = multiply(num1, num2);
6          System.out.println("Sum: " + sum + ", Product: " + product);
7      }
8      private int add(int a, int b) {
9          return a + b;
10     }
11     private int multiply(int a, int b) {
12         return a * b;
13     }
14     public int calculateDivision(int dividend, int divisor) {
15         if (divisor != 0) {
16             return dividend / divisor;
17         } else {
18             System.out.println("Cannot divide by zero");
19             return -1;
20         }
21     }
22     public int getResult() {
23         return this.result;
24     }
25     public void setNumberAndCalculate(int a, int b, int c) {
26         this.result = add(a, b);
27         this.result = multiply(this.result, c);
28     }
29     public void printResult() {
30         System.out.println("Result: " + this.result);
31     }
32 }
```

Code Snippet 2: A sample program for Question 4. a)

i. Identify potential violations of clean coding principles present in the code snippet.

ii. Provide suggestions for each of the identified violations to make the code easier to understand and maintain.

b) Suppose, you are working at a commercial bank as a member of the security testing team. During a recent security audit, it was noted that the user's passwords were not strong enough for their mobile banking application. So, a new set of requirements has been issued to ensure password strength. The development team includes all the new requirements and passes the application to the QA team. With proper justification, mention different tests that must be performed by the QA team. 7

c) In a certain SW development company, developers use a Version Control System (VCS) which allows them to make parallel changes on the same file, but it does not allow developers to clone the remote repository locally. 1+5

i. What type of VCS the company is using?

ii. How are merge conflicts handled in such VCS?

5. a) Illustrate the different combined fragments that can be present in a sequence diagram with an example. 10

b) Despite their complexity in large systems, object diagrams prove advantageous in specific scenarios. Mention three scenarios where object diagrams are particularly advantageous. 5

c) Using an example, discuss the potential adverse effects that cyclic dependencies could introduce to software maintainability and extensibility. Mention the strategies that can effectively remove cyclic dependencies in software design. 5+5

6. a) How does the usability of a product directly contribute to a business's profits? 5

b) Prepare five system requirements for the user requirement provided below: 10

User Requirement: *The system must allow users to securely access their account using biometric authentication (fingerprint or facial recognition) in addition to traditional password based login.*

c) Briefly explain the events and artifacts that are present in the scrum Agile development. 5+5