

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION
DURATION: 1 HOUR 30 MINUTES

WINTER SEMESTER, 2021-2022
FULL MARKS: 75

SWE 4301: Object Oriented Concepts-II

Answer all 3 (three) questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

1. Consider, you are a software developer, who is working on a project. A code snippet of the project is given in Figure 1.

```

1 enum DegreeType {
2     RegularThesis, RegularNonThesis
3 }
4 public class MastersProgram {
5     private DegreeType dt;
6     private String major;
7     public MastersProgram(DegreeType type, String major) {
8         this.dt = type;
9         this.major = major;
10    }
11    public boolean isEligible(float cgpa, String major) {
12        if(dt == DegreeType.RegularThesis){
13            return this.major.equals(major) && cgpa >= 3.8;
14        } else {
15            return this.major.equals(major);
16        }
17    }
18    public int getMarks(int theoryM, int thesisM, int pm) {
19        if(dt == DegreeType.RegularNonThesis){
20            return theoryM + pm/2;
21        } else {
22            return theoryM + thesisM;
23        }
24    }
25 }

```

Figure 1: Code Snippet for Question 1 and Question 2.a

- a) What is code smell? Detect at least 5 unique code smells and find at least 10 lines of code with smells. Mention the line number where a particular code smell is found. 12
(CO2)
(PO2)
- b) What is Refactoring? Why refactoring is useful in this context? Draw a class diagram or write a code that represents the expected code after refactoring. 3+10
(CO4)
(PO1)
2. a) A new type of degree named "Executive" is requested from the client for the project discussed in Question 1. To incorporate the change request, you analyzed the code base and identified that the existing code is not open for this extension. 3+4
(CO2)
(PO2)

i. Find the locations of the code that require modification to implement the extension.

ii. What are the benefits of the design you suggested in your answer to Question 1.b) has over the original design? Note that there is a lot more code in the project, the *MastersProgram* class is only a part of it.

- b) Consider the *Car* class as shown in Figure 2, which uses an object of *Engine* class to operate. Both classes have other code that are not relevant for this question.

4+4
(CO1)
(PO1)

```
1 class Car {  
2     Engine engine; // Engine class is declared somewhere  
3     Car() {  
4         engine = new Engine();  
5     }  
6 }
```

Figure 2: Code Snippet for Question 2.b

i. From the design perspective, do you find any problem between the classes *Car* and *Engine*? Identify dependent class and dependee class?

ii. Rewrite the code to demonstrate *Dependency Injection* for *Car* class.

- c) State *Liskov Substitution Principle (LSP)*, and give a simple code example where *LSP* is violated and mention possible solution (without code).

10
(CO2)
(PO2)

3. a) A common phrase among the developer community is, "prefer composition over inheritance". How do you choose one over the other? Defend your preference with an example.

7
(CO2)
(PO2)

- b) The *count* method of the class *Algorithm* as shown in Figure 3, only supports list elements of Integer type and checks whether an element of the list has a specific property or not (in this case, property is divisible by 3).

```
1 public class Algorithm {  
2     public static int count(List<Integer> list) {  
3         int count = 0;  
4         for (Integer elem : list)  
5             if (elem%3 == 0)  
6                 ++count;  
7         return count;  
8     }  
9 }
```

Figure 3: Code Snippet for Question 3.b

i. Rewrite a generic version of this method so that any type of list can be supported. Elements of the list may have a different property like even number, or palindrome string.

8
(CO2)
(PO2)

ii. Write 2 unit test cases to check the correctness of the program in Figure 3

4
(CO3)
(PO1)

- c) What is Test Driven Development (TDD)? Write 3 differences between TDD and Unit Testing.

6
(CO3)
(PO1)