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Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science & Engineering
Final Examination, Spring 2026
Course Code: CSE315, Course Title: Software Engineering
Level: 3 Term: 1 Batch: 65

Time: 02:00 Hrs **Marks: 40**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

The Roads and Highways Department of Bangladesh manages multiple infrastructure development projects across the country. Each project progresses through phases such as planning, execution, and completion, and is implemented across different districts and regions.
Each project is divided into several work packages (e.g., road construction, bridge construction, maintenance), which are assigned to contractors for execution. Contractors are registered organizations that may handle multiple work packages, while each work package is assigned to one contractor. Engineers supervise project activities. Some engineers act as project managers, and each project has exactly one project manager. The system also manages resources (such as equipment and materials) allocated to work packages. Project progress is monitored through progress reports, capturing completion updates over time. Payments are issued to contractors based on completed work and approval processes.

1.	Construct a UML Class Diagram based on the above scenario. • Identify appropriate classes, relationships, and multiplicities • Define suitable attributes for each class • Include relevant methods where necessary	[10]	CO2
2.	Develop a BPMN diagram for the project execution and monitoring process described above. Your BPMN model should include interactions among key participants such as Project Manager, Contractor, Engineer, and Accounts (Finance/Administration). The process should cover activities such as project initiation, work package assignment, resource allocation, work execution, progress reporting, verification, and payment approval.	[10]	CO2

A Geometric Shape Classification System (GSCS) determines the type of shape based on the number of sides entered by the user. The system only accepts an integer input. Inputs less than a minimum threshold or greater than a maximum threshold are considered invalid. Valid inputs are classified into different shape categories depending on the number of sides such as Triangle, Quadrilateral, Pentagon and Polygon. Based on this scenario, answer the following questions:

3.	*a)*	Provide Boundary Value Analysis (BVA) test cases for the number of sides.	[2]	CO3
	b)	Identify and provide valid and invalid input classes using Equivalence Partitioning (EP).	[3]	

A University Fee Management System calculates the semester fee of a student based on credit hours, scholarship status, and lab course enrollment. The system first validates the credit hour range. If valid, it computes tuition fee, applies scholarship-based discount, and calculates lab fees. An additional charge is added for higher lab course loads. The implemented code is given as follows:

```
#include <stdio.h>

float calculateFee(int c, int l, int s) {
```

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```
    if (c < 3 || c > 21)
        return -1;
    else {
        float fee = c * 500;
        float discount = 0;

        if (s == 1)
            discount = (c >= 12) ? fee * 0.15 : fee * 0.10;
        else
            discount = 0;

        float lab = 0;
        if (l > 0)
            lab = l * 300;
        else
            lab = 0;

        if (l > 3)
            lab += 200;

        return fee - discount + lab;
    }
}
```

4.	***a)***	Analyze the code and determine the minimum number of independent paths required for basis path testing.	**[3]**	**CO3**
	b)	Examine the code and design a test case to verify the scholarship discount logic.	**[2]**	

A university's Digital Library System has been operational for several years. Recently, several issues have been identified. Borrowed book records are sometimes not properly updated after returns, leading to data inconsistency. The system also requires integration with a new external national digital library API, which demands structural modifications.

In addition, users have reported slow search performance and difficulties in navigating the system interface. A recent security review has also revealed weaknesses in the authentication mechanism, increasing the risk of unauthorized access. The development team plans to improve the system gradually while ensuring it remains operational. The estimated size of the system after enhancement is 28 KLOC. The system is built as a real-time integrated application that continuously synchronizes user activities (such as search, borrowing, and returning books) with a centralized database and external library services. It also performs automated validation of user access requests and ensures immediate update of transaction records across multiple connected modules. Based on this scenario, answer the following questions:

5.	***a)***	Discuss the nature of system changes and recommend an appropriate software maintenance model. Justify your answer in terms of handling bug fixes, system enhancement, integration, performance improvement and security updates.	**[2]**	**CO3**
	b)	Identify and explain the key elements of Software Quality Assurance (SQA) that should be considered to ensure system quality.	**[3]**	
	c)	Explain two security or ethical risks associated with weak authentication and improper handling of library data. Also discuss their possible impact on the system and users.	**[3]**	
	d)	Estimate the Effort (Person-Months) required for enhancing the system using the Basic COCOMO model. Clearly state any necessary assumptions and show the calculation steps.	**[2]**	