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Daffodil International University

Department of Software Engineering

Faculty of Science & Information Technology

Final Examination , Summer 2025

Course Code: SE323; Course Title: Software Architecture & Design

Sections & Teachers: AE(A,B), FRR(C-E), ZZM(F,G),MMN(H),DDK(I)

Time: 2 Hour **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.]

ExamPro – National Online Exam Platform (Monolithic Today)

ExamPro is a single Spring Boot monolith with a shared PostgreSQL database. Modules: Authentication, Exam Scheduling, Live Proctoring (WebRTC + AI cheat detection), Exam Delivery, Payments, Notifications, and Reporting.

Pain points:

- **Exam windows cause 10× traffic spikes for Live Proctoring, but scaling affects the whole app.**
- **A crash in the AI module last month delayed payments and reminders.**
- **Six squads want different tech stacks, but all must release together.**
- **One big schema mixes PII, exam content, and payment data, causing security concerns.**
- **Universities request custom grading rules and branding without risking other clients' exams.**

1.	a) From the scenario, investigate **two reasons** to keep ExamPro monolithic and **three reasons** to move to microservices. For each, state the **main quality attribute** affected, with proper justification.	**[Marks-5]**	**CLO-2 Level-3**
	b) **Sketch** an improved Microservice approach to solve the issues faced in monolithic.	**[Marks-5]**	**CLO-2 Level-3**
2.	a) **Illustrate** a **Utility Tree** for ExamPro. • *Identify* at least 4 qualities. • For each quality attribute, provide one or more leaf scenario • Add Importance (H/M/L) and Difficulty (H/M/L) per leaf.	**[Marks-10]**	**CLO-3 Level-4**
	b) **Identify** the Sensitivity points and Tradeoffs for the given system considering their impact on quality attributes.	**[Marks-5]**	**CLO-3 Level-4**

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	c) Based on your answer in 1(b) and 2(a,b), Now **Classify step by step** process for applying Architectural Tradeoff Analysis Method (ATAM) for **Exampro**, while shifting from Monolithic to Microservice.	**[Marks-8]**	**CLO-3 Level-4**
3.	In the current monolith, the ExamSessionManager class handles session control, AI cheat detection, payments, and notifications. The class directly calls external APIs for payments and notifications, mixes conditional rules for different universities, and has no clear interfaces for AI cheat detection.	**[Marks-3]**	**CLO-4 Level-5**
	a) **Summarize** three concrete SOLID violations present (name the principle each violates) and explain how each violation harms a quality attribute.		
	b) For each violation in **3(a)**, recommend strategies and state the quality attribute improved and how it eases future microservice extraction.	**[Marks-4]**	**CLO-4 Level-5**