Daffodil International University
Faculty of Science & Information Technology
Department of Software Engineering
Midterm Examination, Spring 2025
Course Code: SE 311; Course Title: Design Pattern
Sections: All & Teachers: AD(A, B, C, D, I), SD(E, F, G, H)

Time: 1:30 Hrs **Marks: 25**

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.]

1.	a)	The Examination Controller Office of Daffodil International University has introduced a new online portal for faculty members to submit their midterm questions. Each department is required to submit the questions within a given deadline. To ensure smooth coordination, the university has strict rules: • Each department can only submit its set of questions through a centralized system that verifies and stores the submission. • Once a faculty member submits the questions, no one else from the same department can re-submit or make changes. • If someone tries to bypass this process and attempt another submission in an incorrect manner, the system will throw them out immediately. So, be cautious and follow the correct approach. **Apply** your knowledge of design patterns to identify the appropriate pattern for this scenario, explain its intent and implement the code that correctly follows the pattern.	6	CLO-1 *Level-3*

	b)	**Start From Here:**
		`public class CoffeeMachine {`
		`  public static void main(String[] args) {`
		`  System.out.println("Starting coffee machine...");`
		`  try {`
		`  brew();`
		`  } catch (Exception e) {`
		`  System.out.println("ERROR! " + e.getMessage());`
		`  }`
		`  System.out.println("Machine shutting down...");`
		`  }`
		[[NEXT BOX]] —>
		
		`public static void brew() {`
		`  try {`
		`  if (Math.random() > 0.5) throw new ArithmeticException("Overheated!");`
		`  System.out.println("Done");`
		`  } catch (ArithmeticException e) {`
		`  System.out.println("WARNING! " + e.getMessage());`
		`  throw new RuntimeException("System Failure!");`
		`  } finally {`
		`  System.out.println("Cleaning up");`
		`  }`
		`  }`
		`}`
		
		Predict two possible outputs of the program.
			2	

	c)	**N.B:** Here, "S.O.Pln" means System.out.println
		
		Start From Here:
		class StRec {
		public String nm;
		public int s1, s2, s3, s4, s5;
		public int ttl, avrg;
		
		public StRec(String n, int sub1, int sub2, int sub3, int sub4, int sub5) {
		nm = n;
		s1 = sub1;
		s2 = sub2;
		s3 = sub3;
		s4 = sub4;
		s5 = sub5;
		}
		public void clc(int total, int avg) {
		// This method calculates the total and average of student marks.
		total = s1 + s2 + s3 + s4 + s5; // Summing up all marks
		
		[[NEXT BOX]] —>
		
		avg = total / 5; // Finding the average
		if (avg >= 50) {
		S.O.Pln(nm + " Passed");
		} else {
		S.O.Pln(nm + " Failed");
		}
		}
		
		public void display() {
		S.O.Pln("Student Name: " + nm);
		S.O.Pln("Subject1: " + s1);
		S.O.Pln("Subject2: " + s2);
		S.O.Pln("Subject3: " + s3);
		S.O.Pln("Subject4: " + s4);
		S.O.Pln("Subject5: " + s5);
		S.O.Pln("Total Marks: " + ttl);
		S.O.Pln("Average: " + avrg);
		}
		public void unusedMethod() {
		S.O.Pln("This method does nothing but still exists!");
		}
		}
		
		Identify code smells from the above scenario and **Apply** refactoring techniques to refactor the system and write the refactored code.
			7	

2.	a)	At **Daffodil International University**, the classrooms have different types of **projectors** from various brands. Each projector comes with its own **remote control**, which means teachers need to carry multiple remotes to control different projectors.
		
		To solve this issue, the university decided to introduce a **single universal remote** that can operate all projectors, regardless of their brand. However, there's a challenge:
		
		• **Brand A projectors** follow a standard interface with methods:
		  ○ turnOn(), turnOff(), and changeSource().
		• **Brand B projectors** use different method names:
		  ○ powerUp(), powerDown(), and switchInput().
		• **Brand C projectors** use an entirely different command system:
		  ○ startProjector(), stopProjector(), and setMode().
		
		The university wants to **standardize all projectors** under **Brand A's interface** so that the universal remote can control them easily.
		
		Figure out the Interface, Adapter, and Adaptee in this scenario.
			1	CLO-2
				Level-4

	b)	**Document** the code for the Adapter class that allows Brand B projectors to follow the Brand A interface.	6	
	c)	**Illustrate** a class diagram for the above scenario of a Universal Remote controlling different brands of projectors.	3	

Daffodil International University

Faculty of Science & Information Technology

Department of Software Engineering

Midterm Examination, Spring 2025

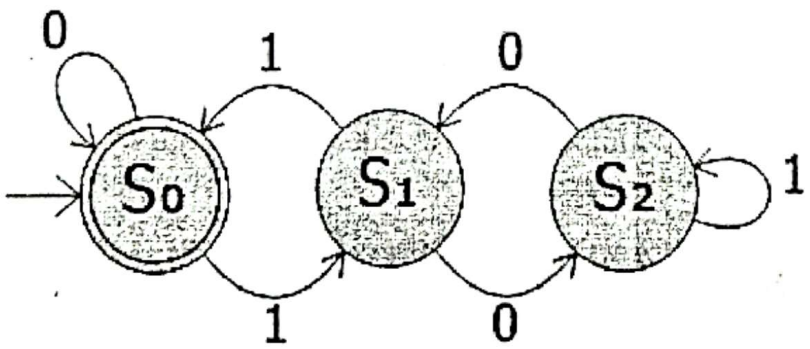
Course Code: SE234 ; Course Title: Theory of Computing

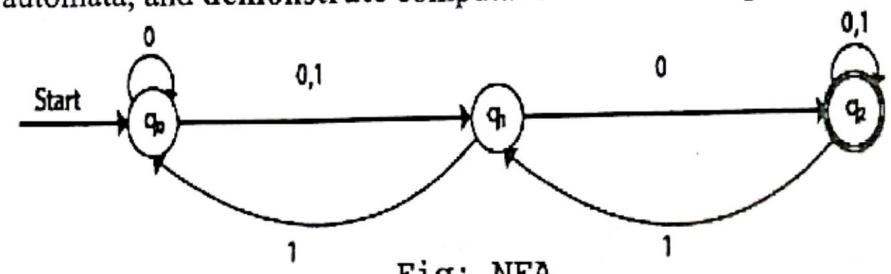
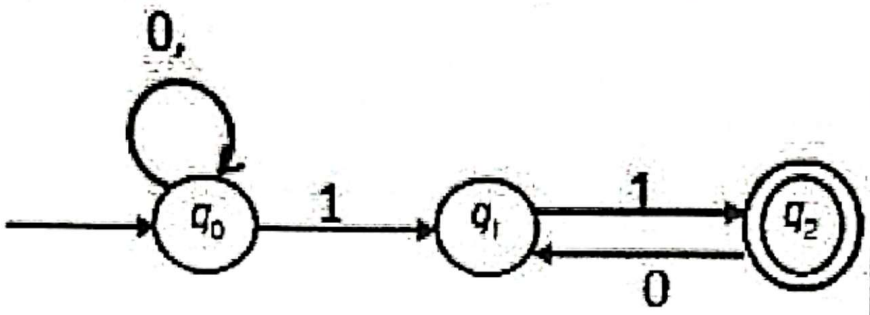
Sections & Teachers: FBR (A,B,C,D), FJT (E, F, G, H) , RJM (I)

Time: 1 Hour 30 Mins **Marks: 25**

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.]

1.	*a)*	Identify the difference between ε and ϕ with a finite automata diagram. Compare and contrast the advantages and disadvantages of Deterministic Finite Automata (DFA) and Non-Deterministic Finite Automata (NFA) in terms of implementation and design.	[Marks-3]	CLO-1 *Level-3*
	b)	**Construct** Deterministic finite Automata for following language: i) {w | every odd position of w is a 1 for binary alphabet} ii) Let Σ = {a, b} and let L = {ababa}. Design a DFA for L	[Marks-4]	
	c)	**Demonstrate** the following finite automata and identify it. Also show epsilon/ empty string acceptance for provided finite automata.  	[Marks-3]	

2.	*a)*	Use formal definition to precisely **identify** the following automata, and **demonstrate** computation for the string "0000.".  Fig: NFA $Q = \{ q0 ; q1 , q2 \}$	[Marks-5]	CLO-2 *Level-3*
	b)	**Apply** "Subset construction" method to convert the following Non-Deterministic Finite Automata (NFA) to Deterministic Finite Automata (DFA)- 	[Marks-4]	
	c)	Sketch a non-deterministic finite automata which accept a string containing "the" anywhere in a string of {a-z}, e.g., "there" but not "those"	[Marks-3]	
3.	*a)*	Mention real life applications of Regular expression	[Marks-2]	CLO-3 *Level-3*
	b)	**Construct** Regular Expression for the following Language: L= {w| w does contain 3 consecutive b's where alphabet in {b, d}}	[Marks-3]	

Daffodil International University

Department of Software Engineering

Faculty of Science & Information Technology

Midterm Examination, Spring 2025

Course Code: SE 225; Course Title: Data Communication and Computer Networking

Sections & Teachers: ALL(Batch-40); NIR, RT, SR

Time: 1 Hour 30 Mins **Marks: 25**

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.]

1	*a*	A network with bandwidth of 10 Mbps can pass only an average of 12,000 frames per minute with each frame carrying an average of 10,000 bits. **Calculate** the throughput of this network and Express its relation with bandwidth.	[Marks-3]	CLO-1 *Level-3*
	b	**Show** the effectiveness of DIU Student Registration System based on four fundamental characteristics.	[Marks-4]	
	c	For *n* devices in a network, **Demonstrate** the number of cable links required for a mesh, bus, and star topology with related figure.	[Marks-3]	
2	*a*	Suppose a computer sends a message at application layer to another computer somewhere in the internet. **Explain** how does information get passed from one layer to the next and finally reach the destination in the OSI model with appropriate figure.	[Marks-3]	CLO-2 *Level-2*
	b	"A high SNR means the signal is less corrupted by noise"- Discuss the statement with required equation.	[Marks-3]	
	c	**Determine** the total latency for a frame of size 6 MB that is being sent of having a queuing time of 3 μs. The processing time is 1 μs and length of the link is 2000 Km. The speed of light inside the link is 3×10^8 m/s. The link has a bandwidth of 100 Kbps.	[Marks-4]	
3	*a*	**Demonstrate** the concept of redundancy in error detection and correction.	[Marks-2]	CLO-3 *Level-3*
	b	Assume that Data to be sent is: 1011000 1011011 1011001. **Apply** Checksum procedure for both Sender & Receiver Side where received data is: 1011010 1011001 1011001.	[Marks-3]	