Daffodil International University

**Department of Software Engineering**

**Faculty of Science & Information Technology**

**Midterm Examination, Spring 2024**

**Course Code: SE123; Course Title: Discrete Mathematics**

**Sections:** A, B, C, D, E, F, G, H, I, J, K, L, M, N, O **Teachers:** NF, NAE, NJM, MAH, MI, RM, RHH, AD

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

**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 | **Explain** if the propositional statements are logically equivalent. You must justify your answer.<br>**(a)** *(i)* $(P \wedge Q) \vee (\neg P \wedge \neg Q \wedge R)$<br>*(ii)* $(P \vee \neg Q) \wedge (Q \vee \neg P \vee R)$<br>**(b)** *(i)* $(X \wedge (X \rightarrow Y)) \vee (X \wedge (Y \rightarrow X))$<br>*(ii)* $(X \vee \neg Y) \wedge (Y \vee \neg X)$  | [Mark 10] | CLO-1<br>Level-2 |
| 2 | **Translate** the sentence into predicate logic.<br>"For every person, if they have a smartphone, then they can access the internet." | [Marks-5] | CLO-2<br>Level-3 |
| 3 | Let's say you tossed a coin and a dice at the same time. **Apply** probabilistic theory to find out the probability of both getting a head (from coin) and a six (from dice). | [Marks-5] | CLO-2<br>Level-3 |
| 4 | Let set $A = \{m \in Z \mid m = 2x+1 \text{ for some } x \in Z\}$ and set $B = \{n \in Z \mid 0 < n < 10 \ \& \ n \text{ is an odd number}\}$<br>**Prove** that $B \subseteq A$. | [Marks-5] | CLO-2<br>Level-3 |

$(2 \times 6)^1$

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**Midterm Examination, Fall 2024**
**Course Code: SE123; Course Title: Discrete Mathematics**
**Sections: All Teachers: MAK, RM, MI2, MJ**

**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 | **Explain** if the propositional statements are logically equivalent or not. You must justify your answer.<br>(a) *(1)* Justify it : $(J \wedge K) \equiv (\neg J \wedge K \wedge L)$<br>*(2)* Justify it : $(C \vee (D \wedge E) \equiv (C \vee D) \wedge (C \vee E)$<br>(b) *(1)* Justify it : $(G \wedge (G \rightarrow H)) \equiv (\neg G \wedge (H \rightarrow G))$<br>*(2)* Justify it : $(S \vee \neg T) \equiv (T \vee \neg S)$<br>(C) Justify that $M \leftrightarrow N$ is equivalent to $(M \rightarrow N) \wedge (N \rightarrow M)$<br>(D) What does Inverse & X-NOR? Assume a state for 2 variables and justify it by the Truth table.<br>(E) Justify the De Morgan's Law : $\sim(O \vee P) \equiv \sim O \wedge \sim P$ | [Marks-10] | CLO-1<br>*Level-2* |
| 2 | **Translate** the sentence into predicate logic for question (a).<br>a) "For every student, if they have a smart device, then they can access the internet to find relevant information."<br>b) M (a, b, c): a = b + c + 3. What is the truth value of the proposition M (2, 3, and 4) and M (2, 4, and 7)? | [Marks-5] | CLO-2<br>*Level-2* |
| 3 | X is the set of positive factors of 4.<br>Y is the set of prime factors of 3.<br>Z is the set of positive proper factors of 5.<br>M is the set of positive factors of 6.<br>Apply the Set theory concept and illustrate what type of relation is possible from these sets (at least four relations should be expressed with explanation). | [Marks-5] | CLO-2<br>*Level-3* |
| 4 | A={x\|x is an integer and 1≤x≤10} | [Marks-5] | CLO-2<br>*Level-3* |





| | | | |
|---|---|---|---|
| | B={x\|x is an integer and 5≤x≤25}<br>Calculate the following by applying Set theory Concept:<br>a) Set of all positive even numbers from A set.<br>b) Set of prime Numbers less than 20 from B set.<br>c) Are Set A & B an equal set or not show it with justification. | | |

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**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.** | | **Interpret** the following compound propositional statements and determine whether they are logically equivalent. You must justify your answer.<br>*(a)* $\overline{P \oplus Q} \leftrightarrow (\sim(p \wedge q))$<br>*(b)* $(P \uparrow Q) \wedge (Q \rightarrow P)$<br>*(c)* $X \oplus Y \cong (X \wedge \sim Y) \vee (\sim X \wedge Y)$ | [Marks-9] | **CLO-1** *Level-2* |
| **2.** | | **Apply** the concept of propositional logic and prove the following laws:<br>(a) DeMorgan's : $\sim(p \wedge q) \equiv \sim p \vee \sim q$ & $\sim(p \vee q) \equiv \sim p \wedge \sim q$<br>(b) Distributive : $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$ &<br>$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$ <br>(c) Absorption : $p \vee (p \wedge q) \equiv p$ & $p \wedge (p \vee q) \equiv p$ | [Mark-11] | **CLO-2** *Level-3* |
| **3** | | X is the set of prime numbers less than 15<br>Y is the set of odd numbers less than 15<br>Z is the set of even numbers less than 15<br>How many of the following statements are true? **Analyze it & provide answers.**<br>$X \subset Y$<br>$Y \subset X$<br>$X \subset Z$<br>$Z \subset X$<br>$Y \subset Z$<br>$Z \subset X$ | [Mark-5] | **CLO-3** *Level-4* |