



বাংলাদেশ আর্মি ইন্টারন্যাশনাল ইউনিভার্সিটি অব সায়েন্স এন্ড টেকনোলজি, কুমিল্লা
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Mid Term Examination, Spring 2025
 Department of Computer Science and Engineering
 Level-1 Term-I
 Course Code: CSE 113
 Course Title: Discrete Mathematics
 Credit Hour: 3.0
 Exam Duration: 1 hour 30 Minutes
 Full Marks: 90

Notes:

- Figure on the right of each question indicates the marks for the respective question.
- Answer all THREE questions.
- The Course Outcomes (COs) are:
 - CO1:** Solve and verify logical reasoning problems using different concepts of logical operations and proof.
 - CO2:** Apply the concept of set theory, function, and relation in terms of representing discrete entities.
 - CO3:** Use the concept of number theory for various problem-solving and security purposes in Computer Science.
 - CO4:** Apply different counting techniques for various types of events.
 - CO5:** Apply the concept of probability in different problem-solving processes in various domains.
 - CO6:** Analyze various problems in context with graphs and trees for solving purposes.

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- Write an example of a Bidirectional Conditional Statement. Determine 15 whether $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$ is a tautology. [CO1→C3]
 - Show that the premises “It is not sunny this afternoon and it is colder than 15 yesterday,” “We will go swimming only if it is sunny,” “If we do not go swimming, then we will take a canoe trip,” and “If we take a canoe trip, then we will be home by sunset” lead to the conclusion “We will be home by sunset.” [CO1→C3]

OR

- Show that $p \leftrightarrow q$ and $(p \wedge q) \vee (\neg p \wedge \neg q)$ are logically equivalent without 15 using truth table. [CO1→C2]

- b. Let p , q , and r be the propositions 15

p : You get an A on the final exam.

q : You do every exercise in this book.

r : You get an A in this class.

Write these propositions using p , q , and r and logical connectives:

[CO1→C3]

- i. You get an A in this class, but you do not do every exercise in this book.
- ii. You get an A on the final, you do every exercise in this book, and you get an A in this class.
- iii. You get an A on the final, but you don't do every exercise in this book; nevertheless, you get an A in this class.

2. (a) Determine the truth value of each of these statements if the domain consists of all real numbers. 15
[CO1→C4]

- i. $\exists x (x^2 < 0)$
- ii. $\exists x (x^4 < x^2)$
- iii. $\forall x ((-x)^2 = x^2)$

- (b) Let $P(x)$ be the statement "X has visited Cox's Bazar". Where the domain consists of the students in your class. Express each of the following quantifications in English: 15
[CO1→C3]

- i. $\exists x P(x)$
- ii. $\forall x P(x)$
- iii. $\exists x \neg P(x)$

3. (a) Prove that: $\overline{A \cup (B \cap C)} = (\overline{C} \cup \overline{B}) \cap \overline{A}$. 10
[CO2 → C3]

- (b) In a universal set $U = \{1,2,3,4,5,6,7,8\}$, let $M = \{2,4,6,8\}$ and $N = \{1,2,3,4\}$.

Find the following: 10
[CO2 → C3]

- I. M^c
- II. $M \cup N$
- III. $M \cap N$

- (c) If $A = \{2,4,6, 8, 9, 10\}$, $B = \{1, 5,7\}$ and $C = \{1,2,3\}$, is $A \subseteq B$? Why or why not? 10
[CO2 → C4]