

Seat No. CT-23039

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
FIRST YEAR (COMPUTER SCIENCE)
SPRING SEMESTER EXAMINATIONS 2024
 Batch - 2023

Time: 3 Hours

Dated: 26-07-2024

Max. Marks: 60

DISCRETE STRUCTURES - CT-162

Question 1

[CLO 2 - 08 marks]

- Let $A = \{\phi, \{\phi\}, a, \{a\}\}$. Find $|A|$ (01 mark)
- Let $A = \{a, b, c\}$, $B = \{x, y, z\}$ and $C = \{0, 1\}$. Find $B \times C \times A$ (01 mark)
- Suppose that $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 3, 4\}$ and $B = \{0, 1, 3, 6, 9\}$. Find: B' and $A - B$ (02 marks)
- Prove Associative Laws of Boolean Sum and Boolean Product in the context of Boolean Algebra using the truth tables (04 marks)

Question 2

[CLO 2 - 12 marks]

- Find $f(2)$ and $f(3)$ if f is defined recursively by $f(0) = -1$, $f(1) = -2$, for $n = 1, 2, \dots$ (02 marks)
 - $f(n+1) = f(n) + 2f(n-1)$ $(2f(n-1))$
 - $f(n+1) = f(n) \cdot f(n-1)^2$
- Use mathematical induction to show that $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(n+2)}{6}$ for all nonnegative integers n (04 marks)
- Find the coefficient of x^3 in the expansion of $(2x + 3)^5$ using Binomial Theorem (03 marks)
- Find the result of In-Order, Pre-Order & Post-Order traversal of the below tree (03 marks)



Question 3

[CLO 3 - 08 marks]

- Compute the probability that a randomly selected integer chosen from the first 75 positive integers is even (01 mark)
- Two dice are rolled. What is the probability that the sum of the numbers is at least 10? (02 marks)
- From a standard deck of cards, two cards are drawn without replacement. What is the probability that the second card drawn is a queen given that the first card drawn was a heart? (02 marks)
- Let E and F are events of an experiment such that $P(E) = 3/5$, $P(F) = 1/4$ and $P(F|E) = 1/5$. Find the value of (i) $P(E \cap F)$ (ii) $P(E|F)$ (iii) $P(E \cup F)$ (03 marks)

Question 4

[CLO 3 – 12 marks]

- a. Express the following statements using appropriate propositional variables and logical connectives (04 marks)
- If the train arrives on time and I catch a taxi, I will be early.
 - John studies hard only if he has an exam. F T
 - It will rain tomorrow unless it is windy and not humid.
 - Whenever it snows, the roads get icy.
- b. Express following statements using appropriate quantifiers, predicates, and logical connectives (04 marks)
- Every cat in the neighborhood is black.
 - There exists a student who scored above 90% in all subjects.
 - There exist a number that is divisible by both 2 and 3
 - Not every child loves chocolate
- c. Use rules of inference to show that the hypotheses "If it is a sunny day, then Alice goes for a walk", "If Alice wears sunglasses, she gets compliments", "If Alice goes for a walk, she wears sunglasses", "Alice did not get any compliments" imply the conclusion "It is not a sunny day." (04 marks)

Question 5

[CLO 4 – 10 marks]

- a. Imagine you are designing a software application that needs to search through a list of names to find a specific one. The list is sorted alphabetically. Given the scenario which searching algorithm would you choose to implement? Justify your choice based on the characteristic and efficiency of the algorithm considering factors such as its time complexity (03 marks)
- b. Define a graph $G = (V, E)$ with $V = \{1, 2, 3, 4\}$ and $E = \{(1, 2), \{2, 3\}, \{3, 4\}, \{4, 1\}\}$. Identify the degree of each vertex. Also determine if the graph G is connected. Justify your answer. (03 marks)
- c. Expand and simplify Boolean expression $ABC + AB'C + A'BC + A'B'C$ using Boolean algebra identities. (04 marks)

Question 6

[CLO 4 – 10 marks]

- a. A committee of 4 people is to be formed from 7 men and 5 women. In how many ways can this be done if the committee must consist of at least 2 men and 1 woman? (02 marks)
- b. A drawer contains 15 red socks, 20 blue socks, and 25 white socks, all jumbled together. What is the minimum number of socks that must be drawn to ensure that at least three socks for the same color are drawn? (02 marks)
- c. How many bit strings of length 8 can be formed (02 marks)
- Where the first 4 bits are all zero
 - Using exactly 4 zero and 4 ones
- d. In a group of 8 people, how many ways can we select a president, vice-president, and a secretary? (01 mark)
- e. How many different 4-digit numbers can be formed using the digits 0, 1, 2, 3, 4, 5 without repetition? (01 mark)
- f. Draw directed graph represented by given adjacency matrix (02 marks)

	1	2	3	4	5	6
1	0	1	0	0	0	0
2	1	0	1	1	0	0
3	0	0	1	0	0	0
4	1	0	1	0	0	0
5	0	0	0	0	0	1
6	0	0	0	0	0	0