R16

Code No: 133BC

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, April/May - 2023
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
(Common to CSE, IT)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) State De-Morgan's law. [2]
b) Prove that $\neg(P \vee Q) \Leftrightarrow (\neg P \wedge \neg Q)$. [3]
c) Draw the Venn diagrams for $(A \cap B) \cup (C \cap D)$ of the sets A, B, C, and D. [2]
d) Draw the Hasse diagram for the Poset <{2,4,5,10,12,20,25}, /(divides by)>. [3]
e) Define conditional probability. [2]
f) What are the applications of the principle of inclusion and exclusion? [3]
g) Define the term generating functions. [2]
h) Find the generating function for the sequence 1,3,5,7,9,…. [3]
i) What is a planar graph? [2]
j) Write down the properties of binary trees. [3]

PART – B

(50 Marks)

2.a) Show that $P \rightarrow S$ can be derived from the premises $\neg P \vee Q$, $\neg Q \vee R$, $R \rightarrow S$, using rules of inference.
b) Determine whether or not the following arguments are valid:
If a baby is hungry, then the baby cries.
If the baby is not mad, then he does not cry.
If a baby is mad, then he has a red face.
Therefore, if a baby is hungry, then he has a red face. [5+5]

OR

3.a) Find the PDNF and PCNF by constructing the truth table:
$(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R)$
b) Write a brief note on universal quantifiers. [6+4]

4.a) Let Z be the set of integers and Let R be the relation called "congruence modulo 3" defined by R= {<x, y> / $x \in Z \wedge y \in Z \wedge (x-y)$ is divisible by 3}. Determine the equivalence classes generated by the elements of Z.
b) Let $f_1(x) = x+4$, $f_2(x) = x-4$, and $f_3(x) = 4x$ for $x \in R$, where R is the set of real numbers. Find f o g and g o f. [6+4]

OR

5.a) Let <S1, *1> and <S2, *2> be semi groups on the Cartesian product S1 x S2. Let the operation *3 be defined by (a, b) *3 (c, d) = (a*1 c, b *2 d) for all (a, b) , (c, d) S1 x S2. Prove that < S1 x S2, *3> is a semi group.

b) Let R ={ (b,c), (b,e), (c,e), (d,a), (c,b), (e,c)} be a relation on the set A ={ a,b,c,d,e}. Find the transitive closure of the relation R. [5+5]

6.a) How many permutations can be made with letters of the word ENGINEERING?

b) There are 7 men and 3 women. Find the number of ways in which a committee of 6 persons can be formed if the committee is to have (i) exactly 4 men, and (ii) at least 2 women. [4+6]

OR

7.a) What is the probability that a positive integer selected at random from the set of positive integers not exceeding 100 is divisible by either 2 or 5?

b) State and explain Baye's theorem with an example. [5+5]

8.a) Solve the recurrence relation $a_n - 7a_{n-1} + 10a_{n-2} = 0$ where $a_0=10$ and $a_1= 41$.

b) Find a generating function for the recurrence relation $c_n = 3c_{n-1} - 2c_{n-2}$ for $n \geq 2$ given $c_1 = 5$, $c_2 = 3$. [5+5]

OR

9.a) Use generating functions to find the number of k-combinations of a set with n elements. Assume that the binomial theorem has already been established.

b) Find a generating function for the recurrence relation $a_{n+1} - an = n^2$ for $n \geq 0$ where $a_0=1$. [5+5]

10. Explain Prim's and Krushkal's algorithm with an illustrative example. [10]

OR

11.a) What is a graph? Write about various ways of representing graphs.

b) How to determine whether two graphs are isomorphic or not? Explain briefly. [5+5]

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