

R13

Code No: 113BN

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, December-2014

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Common to CSE, IT)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

Part- A

(25 Marks)

- 1.a) Represent the proposition "If all triangles are right angled, then no triangle is Equiangular" into symbolic form and also its negation. [2M]
- b) Provide a proof by contradiction of the following statement "For every integer n, if n^2 is odd, then n is odd". [3M]
- c) Let $A = \{1, 2, 3, 4\}$. Show that the relation 'divides' is a partial ordering on A. Draw the Hasse Diagram. [2M]
- d) Define Lattice and write its properties. [3M]
- e) Find out how many 5-digit numbers greater than 30,000 can be formed from the digits 1, 2, 3, 4 and 5. [2M]
- f) Show that at least 2 people out of 13 must have their birthday in the same month when they are assembled in the same room. [3M]
- g) Find the recurrence relation and the initial condition for the sequence 2, 10, 50, 250, Hence find the general term of the sequence. [2M]
- h) Solve the recurrence relation $a_{n+2} - 3a_{n+1} + 2a_n = 0$ [3M]
- i) Define Complete, Euler and Bipartite graph. [2M]
- j) Differentiate DFS and BFS. [3M]

Part- B

(50 Marks)

- 2.a) Test the validity of the following argument:
If I study, I will not fail in the examination.
If I do not watch TV in the evenings, I will study.
I failed in the examination.
Therefore, I must be watched TV in the evenings
- b) Obtain the principal disjunctive normal forms of the following logical expression:
 $p \rightarrow ((p \rightarrow q) \wedge \neg(\neg q \vee \neg p))$
OR
- 3.a) Prove logical equivalence of the expression:
 $[\neg p \wedge (\neg q \wedge r)] \vee [(q \wedge r) \vee (p \wedge r)] \equiv r$
- b) Prove that
 $[(p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow [(p \vee q) \rightarrow r]$ is Tautology

- 4.a) Show that the relation ' \subseteq ' defined on the power set $P(A)$ of the set A is partial order relation
- b) Let $A = \{1, 2, 3, 4\}$, $B = \{a, b, c, d\}$ and $C = \{x, y, z\}$. Consider the function $f: A \rightarrow B$ and $g: B \rightarrow C$ defined by $f = \{(1, a), (2, c), (3, b), (4, a)\}$ and $g = \{(a, x), (b, x), (c, y), (d, y)\}$. Find the composition function ($g \circ f$).

OR

- 5.a) On the set Q of all rational numbers, the operation $*$ is define by $a*b = a + b - ab$. Show that, under this operation, Q forms a commutative monoid.
- b) Let $\langle S_1, *_1 \rangle$ and $\langle S_2, *_2 \rangle$ be two semi groups. Show that the product $S_1 \times S_2$ and $S_2 \times S_1$ are Isomorphic.

- 6.a) Out of 30 students in a hostel, 15 study History, 8 study Economics and 6 study Geography. It is known that 3 students study all these subjects. Show that 7 or more students study none of these subjects.

- b) Prove the identity

$$C(n, r) \cdot C(r, k) = C(n, k) \cdot C(n - k, r - k), \text{ for } n \geq r \geq k$$

Deduce that, if n is a prime number, then $C(n, r)$ is divisible by n .

OR

- 7.a) Let X be the set of all three digit integers; that is $X = \{x \text{ is an integer} \mid 100 \leq x \leq 999\}$. If A_i is the set of numbers in X whose i^{th} digit is i , compute the cardinality of the set $A_1 \cup A_2 \cup A_3$.

- b) Find the non-negative integer solutions to the equation: $x_1 + x_2 + x_3 + x_4 = 13$ with extra condition that $x_i \leq 5$, for all $1 \leq i \leq 4$.

8. Solve the following difference equation by method of generating function

$$a_r - 7a_{r-1} + 10a_{r-2} = 3^r, r \geq 2$$

with boundary conditions $a_0 = 0$ and $a_1 = 1$.

OR

- 9.a) Using the generating function, prove that the number of ways of choosing, with repetitions, r of n objects is $C(n+r-1, r)$.

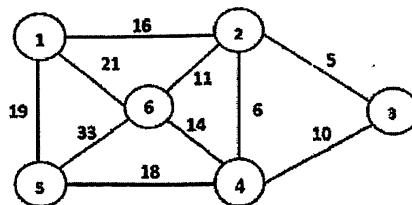
- b) Solve the recurrence relation $a_n = 3a_{n-1} - 2a_{n-2}$ for $n \geq 2$, given that $a_1 = 5$ and $a_2 = 3$.

- 10.a) Show that the sum of degree of all vertices in G is twice the number of edges in G .

- b) Explain the concept of chromatic numbers with suitable example.

OR

11. Construct the minimum spanning tree for the following graph using Prim's algorithm.



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