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:
$$p \to ((p \to q) \wedge \neg(\neg q \vee \neg p))$$

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
$$[(p \to r) \wedge (q \to r)] \to [(p \vee q) \to r] \text{ is Tautology}$$

$x_1\ x_2\ x_3\ x$

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 (*gof*).

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 $<S_1, *_1>$ and $<S_2, *_2>$ 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

$$C(n,r)\,.\,C\,(r,k) = C(n,k)\,.\,C(n-k,\ r-k),\ for\ n \geq r\ \geq k$$

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 $X = \{x$ is an integer $|\ 100 \leq x \leq 999$. 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

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

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).

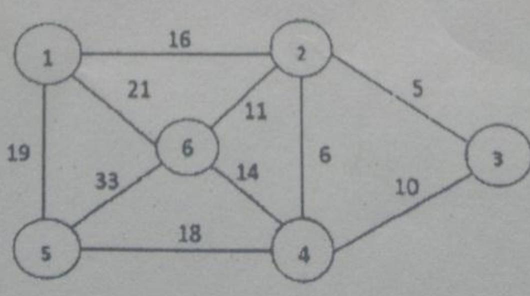
b) Solve the recurrence relation $a_n = 3a_{n-1} - 2a_{n-2}$ for $n \geq 2$, given that $a_1 = 5$ and $a_2 = 3$.

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 Prims algorithm.



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