Code No: 123BN **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, April/May - 2018
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) Find the negations of the following quantified statements:
$\forall x, \exists y, \left[\left(p(x,y) \wedge q(x,y)\right) r(x,y)\right]$ [2]

b) Construct a truth table to show that $(p \wedge q) \rightarrow p$ is a tautology. [3]

c) Let $X = \{1,2,3,4,5,6\}$ and R be a relation defined as $(x, y) \in R$ if and only if $x - y$ is divisible by 3. Find the elements of relation of R. [2]

d) If 'a' is a generator of a cyclic group G, then show that a^{-1} is also a generator of G. [3]

e) Find how many different words that can be formed with the letters in the word "MATHEMATICS"? [2]

f) What is pigeon hole principle? [3]

g) What is homogeneous recurrence relation? [2]

h) Find the number of non-negative integer solutions of the equation $x_1 + x_2 + x_3 = 11$. [3]

i) What is chromatic numbers? [2]

j) Define Euler's circuit and Give an example. [3]

PART-B

(50 Marks)

2.a) Verify the validity of the following arguments.
"Every living thing is a plant or an animal.
Logu's dog is alive and it is not a plant.
All animals have heart. Therefore Logu's dog has a heart."

b) Find the formulas in Disjunctive Normal Form equivalent to the following well formed formulas
$(\neg R) \rightarrow (((P \vee Q) \rightarrow R) \rightarrow \neg Q)$ [5+5]

OR

3. Without using truth tables prove that
$((P \vee Q) \neg (\neg P (\neg Q \vee \neg R))) \vee (\neg P \neg Q) \vee (\neg Q \neg R)$ is a tautology. [10]

4.a) Let $A=\{a,b,c\}$ be a set and relation R on A is as $=\{(a,a),(a,b),(b,c),(c,c)\}$. Is R.
i) Reflexive ii) Symmetric iii)Transitive.

b) Prove that $f^{-1}\bullet g^{-1}=(g\bullet f)^{-1}$, where $f:Q\rightarrow Q$ such that $f(x)=2x$ and $g:Q\rightarrow Q$ Such that $g(x)=x+2$ are two functions. [5+5]

OR

5.a) Prove that the intersection of any two subgroups of a group G is again subgroup of G.

b) In a lattice (L, $\leq$, $\wedge$, $\vee$) state and prove the laws indempotent, commutative, association and absorption. [5+5]

6.a) Find the number of integers between 1 and 250 that are divisible by any of the integers 2, 3 and 6.

b) Find the coefficient of $x^9 y^3$ in the expansion of $(2x - 3y)^{12}$. [5+5]

OR

7.a) How many bit strings of length 10 contain:
i) At most four 1's ii) At least four 1's iii) Exactly four 1's.

b) There are 40 computer programmers for a job. 25 know Java, 28 know Oracle and 7 know neither language. Using principle of inclusion exclusion find how many know both languages. [5+5]

8.a) Find a generating function for the recurrence relation
$a_n - a_{n-1} + 6a_{n-2} = 0$ for $n \geq 2$

b) Express Fibonacci sequence of numbers 1, 1, 2, 3, 5, 8, 13, 21, 34,... in terms of general expression for the r^{th} number a_r and generating function. [5+5]

OR

9.a) Find the number of integer solutions of the equation
$x_1 + x_2 + x_3 + x_4 + x_5 = 30$
Under the constraints $x_i \geq 0$ for all i = 1, 2, 3, 4, 5 and further x_2 is even and x_3 is odd.

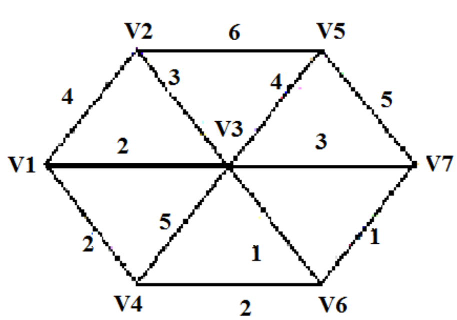
b) Solve the recurrence relation $a_n - 6a_{n-1} + 9a_{n-2} = 0$ for $n \geq 2$. [5+5]

10.a) Show that a simple complete digraph with n nodes has the maximum number of edges $n(n-1)$. Assuming that there are no loops.

b) State and explain graph coloring problem. Give its applications. [5+5]

OR

11.a) Find the minimum spanning tree by using kruskal's algorithm.



b) Write short notes on DFS and BFS. [5+5]

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