Code No: 871AA

R20

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
MCA I Semester Examinations, July/August - 2021
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

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

Answer any five questions
All questions carry equal marks
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1.a) Prove that the following statement is valid
$p \wedge q$
$p \rightarrow \neg(q \wedge r)$
$s \rightarrow r$
$\therefore \neg s$

b) Find the conjunctive normal form of $q \vee (p \wedge \neg q) \vee (\neg p \wedge \neg q)$. [7+8]

2.a) Write the following sentences in the symbolic form
i) Arjun is a student
ii) All students like easy courses
iii) Sociology is an easy course.

b) Prove that the following argument is valid.
No mathematicians are fools.,
No one who is not a fool is an administrator.
Sita is a Mathematician.
$\therefore$ Sita is not an administrator. [7+8]

3.a) Let A = (0, 1, 2, 3, 4) Show that the relation
R = [(0, 0), (0, 4), (1, 1), (1, 3), (2, 2), (3, 1), (3, 3), (4, 0), (4, 4)]
is an equivalence relation.

b) Let X={1,2,3} and f, g, h and s be functions from X to X given by
f={(1,2), (2,3), (3,1)}, g={(1,2), (2,1), (3,3)} h={(1,1), (2,2), (3,1)}
Find: i) *fog*, ii) *fohog*. [8+7]

4.a) A={1,2,3,4}is a Relation R from A to A.
R={(1,1),(1,2),(2,3), (3,4),}. S = [(3, 1), (4, 4),(2, 4), (1, 4)]
Determine RoS,SoR, R^2, S^2.

b) If f(x) = x+2, g(x) = x-2, h(x) = 3x, then find: i) *gof* ii) *foh* iii) *hog*. [8+7]

5.a) Using the principle of mathematical induction, prove that
$1 \times 2 + 3 \times 4 + 5 \times 6 + \ldots + (2n - 1) \times 2n = \frac{n(n+1)(4n-1)}{3}$

b) Prove that for any positive integer number n, prove that $n^3 + 2n$ is divisible by 3. [7+8]

6.a) Use the mathematical induction to prove that $3^n > n^2$ for n a positive integer greater than 2.

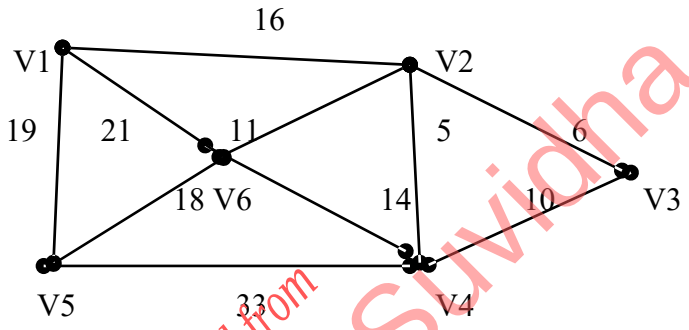
b) Using the principle of mathematical induction, prove that
$1/(1 \cdot 2) + 1/(2 \cdot 3) + 1/(3 \cdot 4) + ... + 1/\{n(n+1)\} = n/(n+1)$ [7+8]

7.a) There are Three boxes I ,II and III Box I contains 4 Red 5 Blue and 6 White balls. BoxII contains 3 Red 4 Blue and 5 White balls.
BoxIII contains 5Red 10 Blue and 5 White balls. One box is chosen and one ball is drawn from it. What is the probability that
i) Red ball is chosen ii) Blue ball is chosen iii) White ball is chosen

b) Solve the recurrence relation. $a_{n+2} + a_{n+1} - 12a_n = 10,\ a_0 = 0,\ a_1 = \frac{1}{3}$. [7+8]

8.a) Prove that a graph G is a tree with n vertices if and only if It has (n-1) edges.

b) Construct the minimum spanning tree for the following graph using Prim's algorithm. [7+8]



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