Reg. No……………………………………………. Name…………………………………………… **20U240S**

B. C. A. DEGREE END SEMESTER EXAMINATION - MARCH 2020

SEMESTER **- 2: BACHELOR OF COMPUTER APPLICATOIN (COMPLEMENTARY)**

COURSE: **16U2CPCMT2 : DISCRETE MATEMATICS**

(Common for Regular 2019 and Supplementary / Improvement 2018 / 2017 / 2016 Admissions)

Time: Three Hours Maximum Marks: 75

PART A

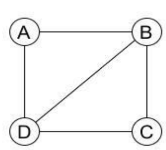
Answer ***all*** questions. Each question carries **1** mark

1. How many nonempty proper subsets are there for {1,2,3,4}.
2. Enumerate the elements of the set{x ∈ R / x^2 -3x +2 =0}.
3. Find the dual of the following compound propositions.
   (p ∧ ¬q) ∨ (q ∧ F).
4. How many numbers are there between 100 and 1000 in which all the digits are distinct?
5. Define a regular graph with an example.
6. Is the following set of ordered pairs from A ={ 2,0,3,4} to B ={5,7,9} represent a function.
   {(-2,7), (0,5), (3,9), (-2,5), (4,5)}
7. If there are 12 persons in a party, and if each two of them shake hands with each other, how many handshakes happen in the party?
8. Let *p* be "Ravi speaks Tamil" and q be "Ravi speaks Hindi". Give a simple verbal sentence which describes the following.
   " $\sim(\sim p \vee \sim q)$ ".
9. Is K_5 planar?
10. Define a binary tree. (1 × 10 = 10)

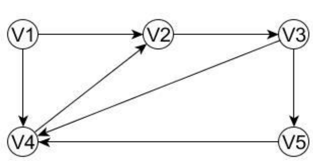
PART B

Answer ***any eight*** questions. Each question carries **2** marks.

11. How many different words can be made out of the letters in the word MISSISSIPPI?
12. If ${}^nP_r$ = 720 and ${}^nC_r$ = 120, then find the value of r.
13. Find the number of ways in which 5 boys and 5 girls be seated in a row so that no two girls may sit together.
14. Find the number of spanning trees of the following graph.



15. Write the adjacency of the following graph.



16. Let A and B be two sets such that $n(A\cup B) = 42$, $n(A) = 20$ and $n(A\cap B) = 4$.
    Find $n(B)$.
17. If A = {2,3}, B = {4,5} and C = {5,6}. Find $A \times (B \cup C)$.
18. Let $f : R \to R$ and $g : R \to R$ defined $f(x) = x^2 + 6$ and $g(x) = 2x - 4$. Find $f o g\,(x)$.
19. State De Morgan's laws in logic.
20. Show that $(p \wedge q) \to (p \vee q)$ is a tautology (2 × 8 = 16)

PART C

Answer ***any five*** questions. Each question carries **5** marks

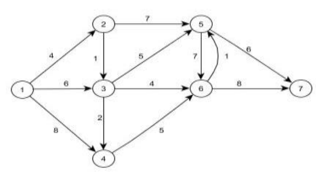
21. Prove by the principle of mathematical induction that for all $n \in N$:
    $1 + 4 + 7 + \ldots + 3n-2 = \frac{n\,(3n-1)}{2}$.
22. State and prove Euler's formula.
23. Show that $p \to (q \to s)$ follows logically from the premises,
    $P,\ p \to (q \to r),\ q \to (r \to s) \ \Rightarrow\ p \to (q \to s)$
24. If the ratio ${}^{2n}C_3 : {}^{n}C_3 = 11 : 1$, find the value of n.
25. In Boolean algebra, prove that the following statements are equivalent.
    (1) $a + b = b$ (2) $a' + b = 1$
26. Let A = {2,4,6,8}, B ={2,3,4,5,6} and $f : A \to B$ defined by $f(x) = \frac{x+2}{2}$. Express f as
    (i) set of ordered pairs (ii) arrow diagram (iii) what type of function is *f.*
27. State and prove Dominance Laws in Boolean Algebra. (5 x 5 = 25)

PART D

Answer ***any two*** questions. Each question carries **12** marks

28. (i) Suppose A = {2, 3, 6, 9, 10, 12, 14, 18, 20} and R is the partial order relation defined on A where xRy if and only if " x is a divisor of y".
    (a) Draw the Hasse diagram for R.
    (b) Find all maximal elements.
    (c) Find all minimal elements. (6 marks)

    (ii) Define an equivalence relation. Let ***m*** be a positive integer. Prove that the relation $a \equiv b \pmod{m}$, is an equivalence relation on the set of integers. (6 marks)
29. (a) How many numbers can be formed with the digits 1,2,3,4,3,2,1 so that the odd digit always occupy the odd places? (4 marks)
    (b) How many four-letter words can be formed using the letter of the word MATHEMATICS. (8 marks)
30. Without using truth table prove the following. (12 marks)
    $\sim(p \leftrightarrow q) \equiv (p \vee q) \wedge \sim(p \wedge q) \equiv (p \ \wedge\ \sim q) \vee (\sim p\ \wedge q)$.
31. Explain Dijkstra's algorithm to find the shortest path. Using Dijkstra's algorithm, find shortest distance arborescence rooted at vertex 1 of the following directed network. (12 marks)



(12 × 2 = 24)

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