(8 pages) **Reg. No. :** ....

Code No. : 9090 **Sub. Code : PCSM 13**

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2017.

First Semester

Computer Science

MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer:

1. The number of rows in a truth table for a formula with 'n' variables is ———.

   (a) n

   (b) $2n$

   (c) n^2

   (d) 2^n

2. A compound proposition that is always false regardless of the truth values of the propositions in it is called ———.

   (a) contradiction (b) tautology

   (c) normal form (d) none

3. A relation R on a set which reflexive, antisymmetric and transitive is called ———.

   (a) equivalence relation

   (b) partial ordering

   (c) total ordering relation

   (d) none

4. A set on which a partial ordering relation is defined is called ———.

   (a) coset (b) poset

   (c) subset (d) powerset

5. If 3 and 6 are the eigen values of $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$. Find the third eigen value ———.

   (a) 7 (b) 2

   (c) –2 (d) 1

6. If $A = \begin{bmatrix} 2 & 3 & 4 \\ 0 & 3 & 4 \\ 0 & 0 & 5 \end{bmatrix}$ then find the eigen value of A^{-1} ——————.

(a) $\frac{1}{-2}, \frac{1}{-3}, \frac{-1}{5}$ (b) $-2, -3, -5$

(c) $\frac{1}{2}, \frac{1}{3}, \frac{1}{5}$ (d) None of the above

7. In a simple graph with n vertices, the length of any elementary path is less than or equal to ——————.

(a) n (b) $n+1$

(c) $n-1$ (d) $2n$

8. A graph G with n vertices, $n-1$ edges and no circuits is ——————.

(a) isolated

(b) disconnected

(c) connected

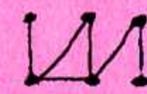
(d) none

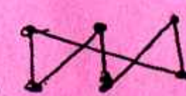
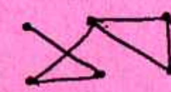
9. The number of labeled trees with n vertices $(n \geq 2)$ is ——————.

(a) n^2 (b) n^{n-1}

(c) n^{n-2} (d) $n+1$

10. Which of the following graph is tree?

(a)  (b) 

(c)  (d) 

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Construct Truth Table for

$$(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R).$$

Or

(b) Obtain the DNF and CNF for

$$(P \rightarrow (Q \wedge R)) \wedge (\neg P \rightarrow (\neg Q \wedge \neg R)).$$

12. (a) Write a note on relations.

Or

(b) If the function f is defined by $f(x) = x^2 + 1$ on the set $A = \{-2, -1, 0, 1, 2\}$. Find the range of f.

13. (a) Test the consistency of the following system of equations and solve them if consistent.

$$x - y + z + 1 = 0, x - 3y + 4z + 6 = 0,$$
$$4x + 3y - 2z + 3 = 0,\ 7x - 4y + 7z + 16 = 0$$

Or

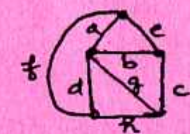
(b) Use Cauley Hamilton theorem to find the inverse of the matrix $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$.

14. (a) Prove that the number of vertices of odd degree in a graph is always even.

Or

(b) Show that the maximum number of edges in a simple graph with n vertices is $\frac{n(n-1)}{2}$.

15. (a) Find all spanning trees of the graph.



Or

(b) Write about incidence of matrix and its degree.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Using Indirect method of proof, derive $P \to \neg S$ from the premises $P \to (Q \vee R)$, $Q \to \neg P$, $S \to \neg R$ and P.

Or

(b) Show that the statement "Every positive integer is the sum of the squares of three integers" is false.

17. (a) Explain about classification of function.

Or

(b) Let A, B, C be any three non empty sets. Let $f: A \to B$ and $g: B \to C$ be mappings. If f and g are onto. Prove that $g \circ f: A \to C$ is onto. Also given an example to show that $g \circ f$ may be onto but both f and g need not be onto.

18. (a) Verify that the matrix $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$ satisfies its own characteristic equation. Hence find A^{-1}.

Or

(b) Find the value of k for which the equations $kx - 2y + z = 1$, $x - 2ky + z = -2$ and $x - 2y + kz = 1$ have (i) no solution (ii) a unique solution (iii) an infinite number of solutions.

19. (a) Explain Isomorphism with example.

Or

(b) Give an example of a graph which is Hamiltonian but not Eulerian and vice-versa.

20. (a) Let G be a simple undirected graph with adjacency matrix A w.r.t the ordering $V_1, V_2 \ldots V_n$. Show that number of different paths of length r from V_i to V_j where r is a positive integer, equal to the $(i, j)^{th}$ entry of A^r.

Or

(b) Write the adjacency matrix of the digraph

$$G = \{(V_1, V_3), (V_1, V_2), (V_2, V_4), (V_3, V_1), (V_2, V_3)$$
$$(V_3, V_4), (V_4, V_1), (V_4, V_2), (V_4, V_3)\}$$

Also draw the graph.
