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

Code No. : 41365 E **Sub. Code : JACA 21/ SACA 21**

B.C.A. (CBCS) DEGREE EXAMINATION, APRIL 2019.

Second Semester

Computer Application — Allied

MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

(For those who joined in July 2016 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Let $S = \{1,2,3,4\}$. Define a relation ρ on S as $a \rho b \Leftrightarrow a < b$. Then ρ is

   (a) $\{(1, 2), (1, 3), (1, 4)\}$

   (b) $\{(1, 2), (1, 3), (1, 4), (2, 3), (2, 4)\}$

   (c) $\{(1, 2), (1, 3), (1, 4), (2, 3), (2, 4), (3, 4)\}$

   (d) $\{(1, 1), (2, 2), (3, 3), (4, 4)\}$

2. ———————— of any two equivalence relation need not be an equivalence relation.

   (a) intersection

   (b) union

   (c) product

   (d) complement

3. The range of the function $f : R \to R$ given by $f(x) = 1$ is

   (a) 1 (b) R

   (c) $\{1\}$ (d) ϕ

4. The inverse of $f : R \to R$ given by $f(x) = x + 3$

   (a) $f^{-1}(x) = 3 - x$

   (b) $f^{-1}(x) = x - 3$

   (c) $f^{-1}(x) = 3 + \dfrac{1}{x}$

   (d) $f^{-1}(x) = \dfrac{1}{x+3}$

5. $P \rightleftarrows Q = F$

   (a) $P = T$ and $Q = T$

   (b) $P = T$ and $Q = F$

   (c) $P = F$ and $Q = F$

   (d) none

6. $P \vee P \Leftrightarrow P$

(a) Idempotent

(b) Commutative

(c) Associative

(d) Identity

7. The number of vertices of odd degree in a graph is always ————————.

(a) odd (b) even

(c) 2 (d) 3

8. A vertex of degree one is ————————.

(a) none (b) odd

(c) pendant (d) isolated

9. The number of pendant vertices in a binary tree is

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

(c) $\frac{n+1}{2}$ (d) none

10. A tree with n vertices has ———————— edges.

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

(c) $2n$ (d) n

PART B — (5 × 5 = 25 marks)

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

11. (a) Show that $(A \cap B)^C = A^C \cup B^C$.

Or

(b) Let $A = \{a,b,c,d,e,f\}$, $B = \{a,d,n,m\}$. Then (i) $A \cup B$ (ii) $A \cap B$ (iii) $A - B$.

12. (a) Let $f : X \to Y$ and $g : Y \to Z$ be two functions. Then

(i) $g \circ f$ is one-one $\Rightarrow f$ is one-one

(ii) $g \circ f$ is onto $\Rightarrow g$ is onto.

Or

(b) Let $f : X \to X$ be any function, then $f \circ i_x = i_x \circ f = f$.

13. (a) Construct the truth table for $\neg(P \to Q) \to P$.

Or

(b) Show that $(P \wedge Q) \to (P \vee Q)$ is a tautology.

14. (a) Define :

(i) Regular graph

(ii) Pseudo graph

(iii) Complete graph.

Or

(b) The number of vertices of odd degree in a graph G is always even.

15. (a) Prove that a tree with n vertices has $n-1$ edges.

Or

(b) Define :

(i) Walk

(ii) Path

(iii) Connected graph.

PART C — (5 × 8 = 40 marks)

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

16. (a) Show that $A\cap(B\cup C)=(A\cap B)\cup(A\cap C)$.

Or

(b) Show that $A-B=A-(A\cap B)=(A\cup B)-B$.

17. (a) Show that $f:R\to R$ defined by $f(x)=2x-3$ is a bijection and find its inverse. Compute $f^{-1}\circ f$ and $f\circ f^{-1}$.

Or

(b) If $f:N\to N$, $g:N\to N$ and $h:N\to R$ defined as $f(x)=2x$, $g(y)=3y+4$ and $h(z)=\sin z$ for every x,y,z in N. Show that $h\circ(g\circ f)=(h\circ g)\circ f$.

18. (a) Construct the truth table to show that $\neg P\vee(Q\wedge R))\rightleftarrows(P\vee Q)\wedge(P\vee R)$.

Or

(b) Construct the truth table to show that $(P\vee(Q\wedge R))\rightleftarrows(P\vee Q)\wedge(P\vee R)$ is a Tautology.

19. (a) Explain the types of graphs and examples.

Or

(b) The maximum number of edges among all n vertex graphs with no triangles is $\left[\frac{n^2}{4}\right]$.

20\. (a) A graph G is connected iff for any partition of V into disjoint subsets V_1 and V_2 there is an edge of G joining a vertex of V_1 to a vertex of V_2.

Or

(b) A connected graph is Eulerian iff every vertex of has an even degree.
