TDC (CBCS) Odd Semester Exam., 2021
held in March, 2022

COMPUTER APPLICATION

(1st Semester)

Course No. : BCACC–102T

(Discrete Structures)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer *any* **ten** questions from the following : 2×10=20

1. Define conditional and biconditional statements.

2. Write the negation of each of the following conjunctions :

(a) Paris is in France and London is in England.

(b) $2+4=6$ and $7<12$.

3. Show that contrapositive and conditional proposition are logically equivalent.

4. What is power set? Give example.

5. State De Morgan's law.

6. Define equivalence relation with example.

7. Define complemented and distributive lattices with example.

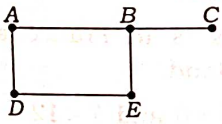
8. Show that 1 is the only complement of 0.

9. What is duality principle? Give example.

10. Define isomorphic graph with example.

11. Write a short note on Eulerian graph.

12. Find the adjacency matrix of the following graph :



13. Write down the difference between graph and tree.

14. Prove that the number of vertices in a binary tree is always odd.

15. Define complete binary tree with example.

SECTION—B

Answer *any* **five** questions from the following : 10×5=50

16. *(a)* Prove that the following argument is valid : 4

$$P \to \neg Q,\ R \to Q,\ R \vdash \neg P$$

(b) What is normal form? Define CNF and DNF. 1+(1+1)=3

(c) Find the PDNF and PCNF of

$$(\neg P \to R) \wedge (Q \leftrightarrow R)$$ 3

17. *(a)* Show that

$$\alpha = (P \to (Q \to R)) \to ((P \to Q) \to (P \to R))$$

is tautology. 3

(b) Show that

$$(P \to Q) \wedge (R \to Q) \equiv (P \vee R) \to Q$$ 3

(c) Determine the validity of the following argument : 4

If 7 is less than 4,
then 7 is not a prime number.

7 is not less than 4.

∴ 7 is a prime number.

18. (a) Given $A = \{1, 2, 3, 4\}$ and $B = \{x, y, z\}$. Let R be the following relation from A to B :

$R = \{(1, y), (1, z), (3, y), (4, x), (4, z)\}$

(i) Determine the matrix of the relation.

(ii) Draw the arrow diagram of R.

(iii) Find the inverse relation R^{-1} of R.

(iv) Determine the domain and range of R. 1+1+1+1=4

(b) Show that $A - (B - C) = (A - B) \cup (A \cap C)$. 3

(c) Given the relation

$R = \{(1, 1), (2, 2), (2, 3), (3, 2), (4, 2), (4, 4)\}$

(i) Is R reflexive or transitive?

(ii) Is R antisymmetric?

(iii) Determine R^2. 1+1+1=3

19. (a) In a group of 50 persons, 30 like tea, 25 like coffee and 16 like both. How many like—

(i) either tea or coffee;

(ii) neither tea nor coffee? 2+2=4

(b) Given f is a function $f : A \to B$ where $A = \{a, b, c, d\}$ and $B = \{1, 2, 3\}$ with $f(a) = 3$, $f(b) = 2$, $f(c) = 1$ and $f(d) = 3$. Is the function f an onto function? 2

(c) Convert the following infix to RPN : 4

$((A + B) * B) \uparrow (E - F)$

20. (a) In a Boolean algebra B, show that—

(i) $(a + b)' = a' * b'$;

(ii) $(a * b)' = a' + b'$. 2½+2½=5

(b) Let a be any element of a Boolean algebra B. Show that if—

(i) $a + x = 1$ and $a * x = 0$, then $x = a'$;

(ii) $(a')' = a$;

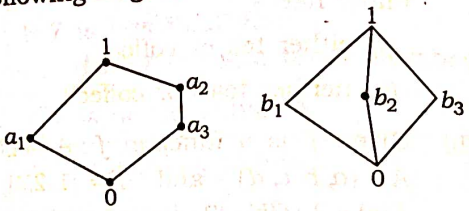
(iii) $0' = 1$ and $1' = 0$. 2+1+2=5

21. (a) Draw the Hasse diagram for

$(\{3, 4, 12, 24, 48, 72\}, /)$ 3

(b) Show that every chain is a lattice. 3

(c) Show that the lattices given by the following diagrams are not distributive : 4



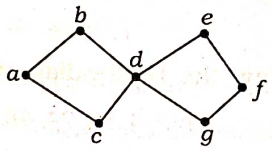
22. (a) Explain breadth-first search with example. 7

(b) How do you find the minimum spanning tree using Kruskal's algorithm? 3

23. (a) Explain Warshall's algorithm to find all-pair shortest path. 7

(b) Define adjacency list and incidence matrix in a graph with suitable example. 3

24. (a) Find the DFS spanning tree of the following : 7



(b) Explain inorder traversal with example. 3

(Continued)

25. (a) Explain Prim's algorithm with example. 7

(b) Define the following : 1×3=3

(i) Chord

(ii) Leaf node

(iii) Circuit

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