FYUG Odd Semester Exam., 2023
(Held in 2024)

COMPUTER SCIENCE

(1st Semester)

Course No. : CSCDSC–102T

(Discrete Mathematics)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer *ten* questions, selecting any *two* from each Unit :

2×10=20

UNIT—I

1. Define proposition. When can two propositions be said logically equivalent?

2. Write the negation of the statement—"If it rains I will not go to market".

3. What do you mean by inference theory in propositional logic? Mention any two inference rules.

UNIT—II

4. Define power set. Give an example of null set.

5. What do you mean by composition of function? Give example.

6. Consider the relation R on $A = \{4, 5, 6, 7\}$ defined by

$$R = \{(4, 5), (5, 5), (5, 6), (6, 7), (7, 4), (7, 7)\}$$

Find the symmetric closure of R.

UNIT—III

7. A relation R is defined on a set A

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

Is R an equivalence relation? Justify.

8. Define lattice.

9. What is duality principle? Give example.

UNIT—IV

10. What are the properties of tree in discrete mathematics?

11. What is rooted tree?

12. How do you find the number of pendant vertices in a tree?

UNIT—V

13. Define graph. What do you mean by degree of vertex in a graph?

14. Define sub-graph.

15. Write down the difference between Eulerian graph and Hamiltonian graph.

SECTION—B

Answer *five* questions, selecting *one* from each Unit : 10×5=50

UNIT—I

16. *(a)* Verify the proposition $P \vee \urcorner(P \wedge Q)$ is a tautology. 3

(b) Show that $p \rightarrow q \equiv \urcorner p \vee q$. 2

(c) Test the validity of the following argument : 5

If I study, then I will not fail in mathematics. If I don't play football, then I will study. But I failed in mathematics.

$\therefore$ I must have played football.

17. *(a)* Define CNF and DNF with example. Find DNF of $p \wedge (p \to q)$. 2+2=4

(b) Explain conditional and bi-conditional statements with truth table. 3

(c) Negate each of the following propositions : 3

(i) $\forall\, x\, p(x) \wedge \exists\, y\, Q(y)$

(ii) $(\exists\, x \in (v))\ (x + 6 = 25)$

UNIT—II

18. *(a)* What is partially ordered set? Give an example. 2

(b) How do you construct a Hasse diagram for a partially ordered set (poset)? 2

(c) Consider the two functions $f : A \to B$ and $g : B \to C$. Prove that if f and g are onto, then composition function $g \circ f$ is onto. 2

(d) Write the uses of Hasse diagram. Draw the Hasse diagram of the following : 1+3=4

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

(ii) $(D_{12}, /)$

19. *(a)* Prove that—

(i) $A \times (B \cap C) = (A \times B) \cap (A \times C)$

(ii) $A - (B \cap C) = (A - B) \cup (A - C)$ 5

(b) Discuss the closure properties of relation. 5

UNIT—III

20. *(a)* Define Boolean algebra. Show that the following statements are equivalent in a Boolean algebra : 1+4=5

(i) $a + b = b$

(ii) $a * b = a$

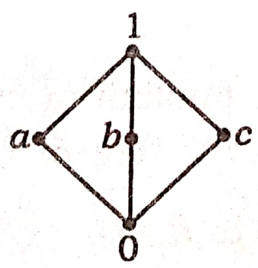
(iii) $a' + b = 1$

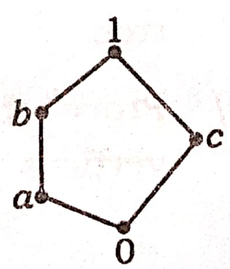
(iv) $a * b' = 0$

(b) Convert the following expression into sum-of-product form : 5

$$E = ((xy)'z)' \cdot ((x' + z)(y' + z'))'$$

21. *(a)* Show that the following are not distributive : 4

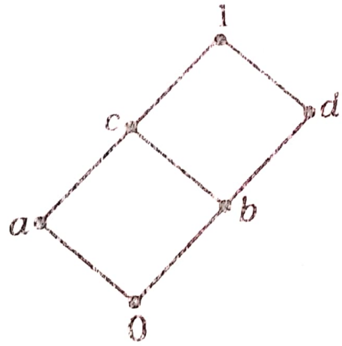
(i) 

(ii) 

(b) Consider a lattice $(L, \leq)$ as shown in the following figure, where $L = \{1, 2\}$. Determine the lattices $(L^2, \leq)$, where $L^2 = L \times L$: 3

$(L, <=)$

(c) Obtain the complemented lattices a and c of the following figure : 3



UNIT—IV

22. (a) Define binary tree and complete binary tree. 3

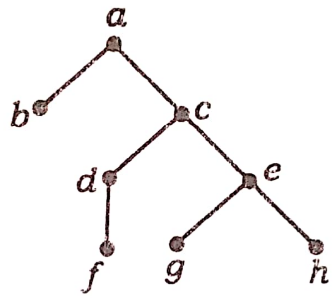
(b) Prove that the maximum number of vertices in a binary tree of height h is 2

$$2^{n+1} - 1, \; h \geq 0$$

(Continued)

(c) What is the minimum cost spanning tree? Take any suitable example to find minimum cost spanning tree. 1+4=5

23. (a) Consider the rooted tree in the following figure :



(i) What is the root of T?

(ii) Find the leaves and the interval vertices of T.

(iii) What are the levels of c and e?

(iv) Find the children of c ane e.

(v) Find the descendants of vertices a and c. 3

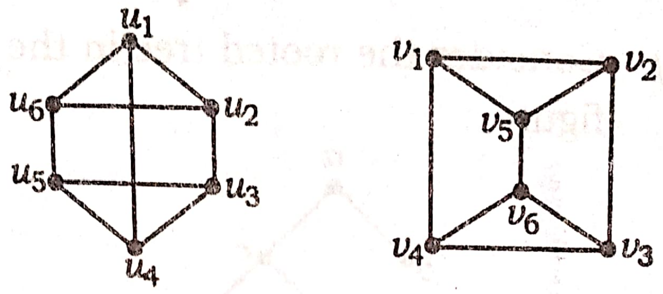
(b) Explain in brief the traversal of binary trees. Give example. 7

UNIT—V

24. (a) Prove that the number of vertices of odd degree in graph is always even. 5

(b) Define complete graph and regular graph with an example of each. Are all the complete graphs regular and vice versa? Justify. 5

25. (a) Define isomorphic graph. Check whether the following two graphs are isomorphic or not : 1+3=4



(b) Draw the graph G for the following adjacency matrix : 3

$$A = \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

(c) Define walks, paths and circuits with diagram. 3

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