2021/TDC/CBCS/ODD/
CSCHCC–102T/083

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

COMPUTER SCIENCE

(1st Semester)

Course No. : CSCHCC–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* of the following questions : 2×10=20

1. Write the importance of discrete structures in computer science.

2. Show that $A = \{2, 3, 4, 5\}$ is a proper subset of $C = \{1, 2, 3, \cdots, 9\}$.

3. Define function with an example.

4. Write down the characteristic of an algorithm.

5. Is $2^{2n} = O(2^N)$?

6. State the difference between O and Ω notations.

7. Define recurrence relation with an example.

8. Find the generating function of 1, 1, 1, 1, 1, 1.

9. Find the recurrence relation of the sequence $\{0, 1, 1, 2, 3, 5, \cdots\}$.

10. What are directed and undirected graphs?

11. What is the difference between Eulerian graph and Hamiltonian graph?

12. What do you mean by minimum cost spanning tree? Give example.

13. Define WFF.

14. What do you mean by universal and existential quantifiers?

15. When are two properties said to be logical equivalent?

SECTION—B

Answer any *five* of the following questions :

10×5=50

16. (a) Define equivalence relation with an example. Let A be a non-zero integer and let $\approx$ be a relation on $A \times A$ defined by $(a, b) \approx (c, d)$, where $ad = bc$. Prove that the given relation is an equivalence relation. 5

(b) State pigeonhole principle. Suppose a laundry bag contains many red, white and blue T-shirts. Find the minimum number of T-shirts that one needs to choose in order to get two pairs (4 T-shirts) of same colour. 5

17. (a) Consider 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 also onto. 3

(b) Discuss the closure properties of relation. 4

(c) Let R and S are the two relations on

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

Find (i) $R \cap S$, (ii) S^2 and (iii) $R \cdot S$. 3

18. What is asymptotic notation? Discuss O, Ω and θ with examples. 1+3+3+3=10

19. (a) Write a short note on bounding summation. 5

(b) Show that $\log n! = O(n \log N)$. 2½

(c) Show that $3n + 2 = \theta(N)$. 2½

20. (a) Find the solution of the recurrence relation $a_n = (x+1)a_{n-1}$ with initial condition $a_0 = 2$. 4

(b) State Master theorem. 2

(c) What is homogeneous recurrence relation? What makes a recurrence relation linear? 2+2=4

21. (a) Find the solution of the recurrence relation $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ with initial condition $a_0 = 2$, $a_1 = 5$ and $a_2 = 15$. 6

(b) Discuss any two techniques of solving recurrence relation. 4

22. (a) Explain with example depth-first search graph traversal algorithm. 7

(b) Write short notes on (i) regular graph, (ii) weighted digraph and (iii) multigraph. 3

23. (a) Explain with algorithm to find the minimum cost spanning tree. 7

(b) Write down the properties of a tree. 3

24. (a) Verify that the proposition $P V \rceil (P \wedge Q)$ is a tautology. 3

(b) Write the negation of each statement : 1½+1½=3

(i) If she wants, she will earn money.

(ii) He swims if and only if the water is warm if it snows, then they do not drive the car.

(c) Show that the following argument is a fallacy : 4

$$P \to Q, \rceil P \vdash \rceil Q$$

25. (a) Explain with examples converse, contra-positive and inverse. 3

(b) Test the validity of the following argument : 4

If two sides of a triangle are equal, then the opposite angles are equal.
Two sides of a triangle are not equal.

The opposite angles are not equal.

(c) Show that—

(i) $P \wedge Q$ logically implies $P \leftrightarrow Q$;

(ii) $P \leftrightarrow \rceil Q$ does not logically imply $P \rightarrow Q$. 1½+1½=3

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