

4E4161

Roll No. _____

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B. Tech. IV Sem. (Main/Back) Exam; April-May 2017

Computer Science

4CS2A Discrete Mathematical Structure

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 26

Instructions to Candidates :-

Attempt any **five questions**, selecting **one question** from each unit. All Questions carry **equal marks**. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL2. NIL

UNIT - I

1 (i) Define power set. If S be a finite set of order n then prove that power set $P(S)$ is a finite set of order 2^n .

2+6=8

(ii) Define the following :

- Cross partition of a set.
- Duality
- Floor function or greatest integer function.
- Bijection.

2×4=8

OR

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[P.T.O.

- 2 (a) Show that the set of odd positive integers is a countable set. 4
- (b) A survey is taken on method of commuter travel. Each respondent is asked to check BUS, TRAIN or AUTOMOBILE as a major method of travelling to work. More than one answer is permitted. The results reported were as follows :
- (i) 30 people checked BUS;
 - (ii) 35 people checked TRAIN;
 - (iii) 100 people checked AUTOMOBILE;
 - (iv) 15 people checked BUS and TRAIN;
 - (v) 15 people checked BUS and AUTOMOBILE;
 - (vi) 20 people checked TRAIN and AUTOMOBILE;
 - (vii) 5 people checked all three methods.
- How many respondents completed their surveys ? 4
- (c) State and prove the generalized pigeonhole principle. 4

2+6=8

UNIT - II

- 2 (i) Define :
- (a) Boolean matrix
 - (b) Product of Boolean matrices
 - (c) Join and meet of Boolean matrices.
- Also compute the join and meet of matrices :

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

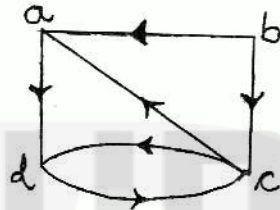
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1×4+4=8

[P.T.O.

- (ii) Let R be the relation with digraph shown below. Find the transitive closure of R using Warshall's algorithm.



OR

- 2 (i) Define congruency relation in Modulo system. If $A = Z$ (the set of integers), Relation R defined in A set by aRb as " a is congruent to $b \pmod{2}$ ", then prove that R is an equivalence relation. 8
- (ii) If the set of integers $I = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$ be partitioned by the equivalence relation aRb as $a \equiv b \pmod{3}$. Obtain the set I/R . 2+6
- (iii) If $A = \{1, 2, 3, 4, 12\}$, the partial order of divisibility on A is $a \leq b$ (i.e. if a divides b). Then draw the digraph and Hasse diagram of the poset (A, \leq) . 4

UNIT - III

- 3 (i) Prove by mathematical Induction that $3^n > n^3$ for all integers $n \geq 4$. 8
- (ii) Prove the implication "If n is an integer not divisible by 3, then $n^2 \equiv 1 \pmod{3}$ ". 8

OR

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[P.T.O.

- 3 (i) Write short notes on :
- (a) Vacuous proof
 - (b) Trivial proof
 - (c) Constructive proof
 - (d) Non-constructive proof

1.5×4=6

(ii) Prove that the linear search algorithm works correctly for every $n \geq 0$.

4

(iii) Sort the list $X = [64, 25, 12, 22, 11]$ using selection sort algorithm.

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UNIT - IV

- 4 (i) Sketch the complete graphs K_n , $1 \leq n \leq 6$.

1×6=6

(ii) Show that the complete digraph with n -nodes has the maximum number of edges i.e. $n(n-1)$ edges, assuming there are no loops.

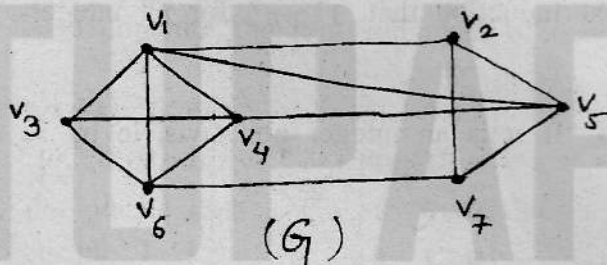
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(iii) Draw graph which is Eulerian as well as Hamiltonian.

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OR

- 4 (i) Use Welch-Powell algorithm to paint the following graph with minimum number of colors.

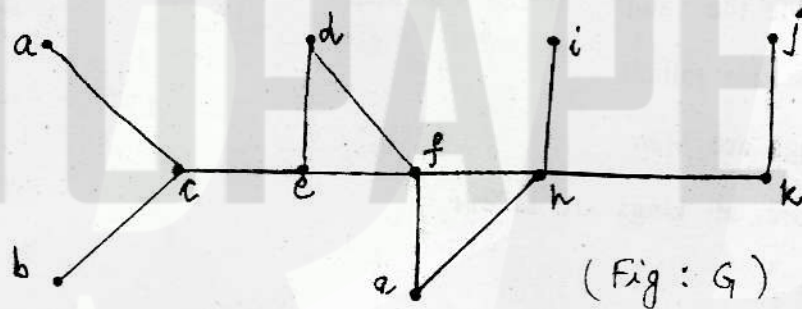


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- (ii) Prove that the chromatic number of a graph will not exceed by more than one, the maximum degree of the vertices in a graph.

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- (iii) Use Depth-first search to find a spanning tree for the following graph G .



6

UNIT - V

- 5 (i) Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.

- (ii) Find PCNF of a statement S whose PDNF is $(p \wedge q \wedge r) \vee (p \wedge q \wedge \sim r) \vee (\sim p \wedge \sim q \wedge r)$.

4

- (iii) Is the following argument valid ?

Dhruv, a student in this class, knows how to write programs in JAVA.
Everyone who knows how to write programs in JAVA can get a high - paying job. Therefore, someone in this class can get a high paying job.

6

6

OR

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5

[P.T.O.

5 (i) Define Tautology, contradiction and contingency. Determine the contrapositive of each statement :

(a) If John is a poet, then he is poor.

(b) Only if Mary studies will she pass the test.

2×4=8

(ii) Determine the validity of the argument :

All men are fallible

All kings are Men.

Therefore, all kings are fallible.

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