

4E4161

Roll No. _____

Total No. of Pages : **6****4E4161****B. Tech. IV Sem. (Main/Back) Exam; April-May 2017****Computer Science****4CS2A Discrete Mathematical Structure****Time : 3 Hours****Maximum Marks : 80****ersahilkagyan.com****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 :

(a) Cross partition of a set.

(b) Duality

(c) Floor function or greatest integer function.

(d) Bijection.

2×4=8**OR****4E4161 |****1****[P.T.O.**

2 (a) Show that the set of odd positive integers is a countable set.

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(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 ?

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(c) State and prove the generalized pigeonhole principle.

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2+6=8

UNIT - II

2 (i) Define :

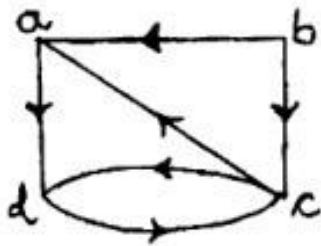
- (a) Boolean matrix
- (b) Product of Boolean matrices
- (c) Join and meet of Boolean matrices.

Also compute the join and meet of matrices :

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

1×4+4=8

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



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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. 2+6
- (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 . 4
- (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

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

1.5×4=6

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

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(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.

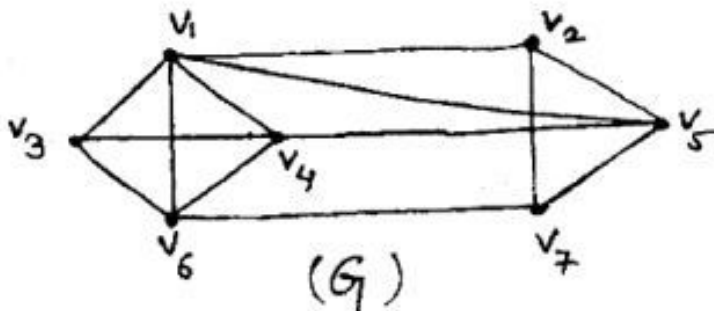
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(iii) Draw graph which is Eulerian as well as Hamiltonian.

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OR

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

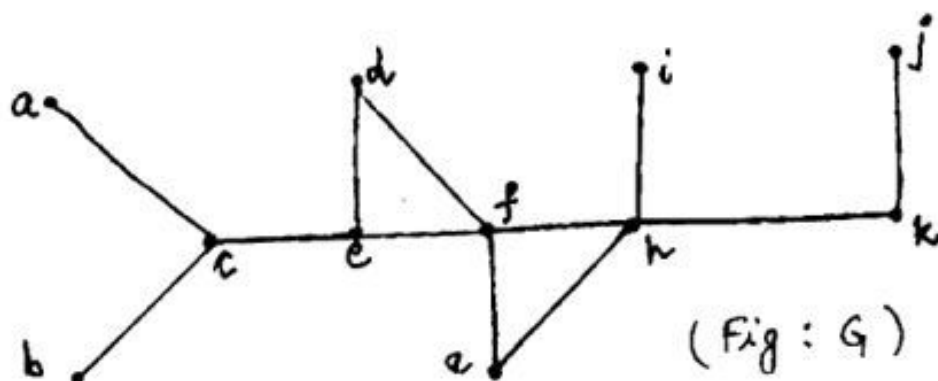


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- (ii) Prove that the chromatic number of a graph will not exceed by more than one, the maximum degree of the vertices in a graph.

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



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UNIT - V

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

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- (ii) Find PCNF of a statement S whose PDNF is

$$(p \wedge q \wedge r) \vee (p \wedge q \wedge \sim r) \vee (\sim p \wedge \sim q \wedge r).$$

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- (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

OR

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OR

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[P.T.O.

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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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