



## Discrete Structure & Graph Theory (1020)

P. Pages : 3

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** sub questions from each question.
5. Assume suitable data if necessary.
6. Figures to the right indicate full marks.

### UNIT – I

1. a) Two cards are drawn from 52 cards. Find probability that 10
  - i) One is king and other is queen.
  - ii) Both are of same colour.
  - iii) One is diamond and other is spade.
  - iv) Both are aces.
- b) i) Prove by mathematical induction, 5  
 $8^n - 3^n$  is multiple of 5 for  $n \geq 1$
- ii) What do you mean by proposition ? What are different types of proposition ? Prepare truth table for different proposition connectives. 5
- c) Find how many integers between 1 to 60 are – 10
  - i) divisible by 2, 3 or 5
  - ii) Not divisible by 2 nor by 3 and nor by 5.
  - iii) Not divisible by 2 nor by 3
  - iv) Divisible by 2 but not by 5.

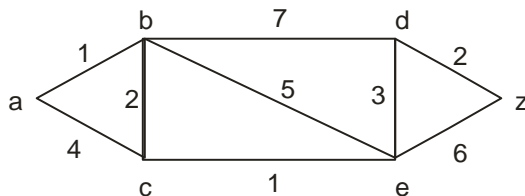
### UNIT – II

2. a) i) Explain properties of binary relation. 5

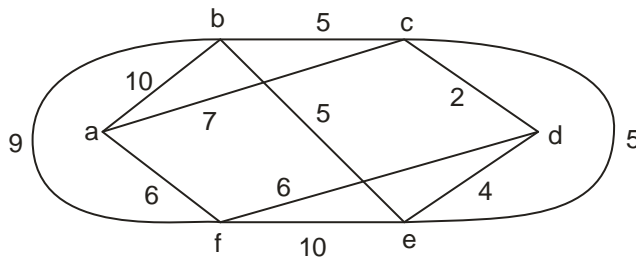
- ii) Write short notes on : 5  
 a) chain                      b) Transitive closure
- b) i) Functions  $f, g, h$  are defined on a set  $A = \{1, 2, 3\}$  8  
 $f = \{(1, 2) (2, 3) (3, 1)\}$   
 $g = \{(1, 2) (2, 1) (3, 3)\}$   
 $h = \{(1, 1) (2, 2) (3, 1)\}$   
 i) Check  $f \circ g$  and  $g \circ f$  are equal or not.  
 ii) Find  $f \circ g \circ h$  and  $f \circ h \circ g$ .
- ii) Find partitions of set  $A = \{a, b, c\}$  2
- c) i) Let  $A = \{1, 2, 3, 4, 5, 6\}$ ,  $R$  is equivalence relation such that, 6  
 $R = \{(1, 1) (1, 5) (2, 2) (2, 3) (2, 6) (3, 2) (3, 3) (3, 6) (4, 4) (5, 1) (5, 5) (6, 2) (6, 3) (6, 6)\}$   
 Find equivalence classes of  $R$   
 Find rank and  $A/R$  ( $A$  modulus  $R$ )
- ii) Write short notes on : 4  
 i) Pigeonhole principle                      ii) Numeric function

### UNIT – III

3. a) i) Determine shortest path from vertex  $a$  to  $z$  using Dijkstra's algorithm in the following graph. 8



- ii) Explain complete graph with example. 2
- b) i) Find minimum spanning tree for the graph. 6



- ii) Explain the term Handshaking Lemma with example. 4

- c) i) Construct optimal binary prefix code for weight sequences, 1, 3, 5, 7, 8, 9, 10. **6**
- ii) Explain fundamental circuit with example. **4**

#### UNIT – IV

4. a) i) Explain the time complexity of bubble sort algorithm. **6**
- ii) Explain binary operation with properties. **4**
- b) i) Explain group with suitable example. **6**
- ii) Explain field and integral domain. **4**
- c) i) Explain ring with suitable example. List of properties of ring. **6**
- ii) Check  $(N, *)$  for commutative and associative if  $(a * b) = a + b + 2$ , where  $N = \text{set of natural numbers}$ . **4**

#### UNIT – V

5. a) What do you mean by DNF and CNF ? Explain with suitable example. **10**
- b) i) Explain distributive and complemented lattice with suitable example. **6**
- ii) Explain properties of algebraic system defined by lattice. **4**
- c) i) Convert the following – i)  $(11001)_2 = ( )_{10}$  ii)  $(753)_8 = ( )_{10}$  **6**
- ii) State the following – i) Principle of duality ii) Demorgan's Law. **4**

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