

Code No: 154AQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, February - 2024

DISCRETE MATHEMATICS

(Common to CSE, IT, ITE, CE(SE), CSE(CS), CSE(N))

Time: 3 Hours

Max. Marks: 75

**Note:** i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART – A****(25 Marks)**

- 1.a) Define conditional statement and write its truth table. [2]
- b) State which rule of inference is the basis of the following argument.  
“It is below freezing and raining now. Therefore, it is below freezing now.” [3]
- c) Let  $A$  represent the set of all students at a university, and let  $B$  represent the set of all courses offered at the university. What is the Cartesian product  $A \times B$  and how can it be used? [2]
- d) Let  $f$  be the function from  $\{a, b, c\}$  to  $\{1, 2, 3\}$  such that  $f(a) = 2$ ,  $f(b) = 3$ , and  $f(c) = 1$ . Is  $f$  invertible, and if it is, what is its inverse? [3]
- e) Define the term “algorithm”. [2]
- f) Give a recursive definition of  $a_n$ , where  $a$  is a nonzero real number and  $n$  is a nonnegative integer. [3]
- g) Find the generating function for the finite sequence 1, 4, 16, 64, 256. [2]
- h) What is meant by conditional probability? Define it. [3]
- i) Define tree. Give an example. [2]
- j) Define complete graph and then draw graph of  $K_{2,2}$ . [3]

**PART – B****(50 Marks)**

- 2.a) Explain universal and existential quantifiers.
- b) Symbolize the following argument and check for its validity:  
Lions are dangerous animals.  
There are Lions.  
Therefore, there are dangerous animals. [3+7]

**OR**

- 3.a) Using the truth table, prove that  $(p \wedge q) \rightarrow (p \vee q)$  is a tautology.
- b) Show that  $\sim P$  follows from the set of premises  
 $R \rightarrow \sim Q$ ,  $R \vee S$ ,  $S \rightarrow \sim Q$ ,  $P \rightarrow Q$   
using indirect method of proof. [4+6]

- 4.a) Define zero–one matrix and Boolean power of  $A$ .

- b) Compute  $A^{[n]}$  for all positive integers when  $A = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{bmatrix}$ . [4+6]

**OR**

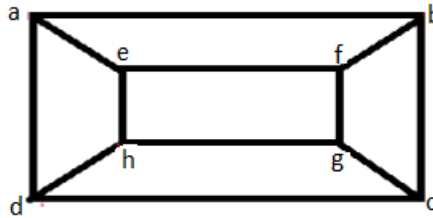
- 5.a) Define partial order and total order of relations.  
 b) If R is a relation defined on the set  $\mathbb{Z}$  by  $aRb$  if  $a - b$  is a non-negative even integer. Verify whether the relation R is partial order and total order or not? [3+7]
- 6.a) Use the insertion sort to put the elements of the list 3, 2, 4, 1, 5 in increasing order.  
 b) What is the worst-case complexity of the bubble sort in terms of the number of comparisons made? [5+5]

**OR**

- 7.a) Prove or disprove that whenever  $n \geq 3$ ,  $f_n > a^{n-2}$ , where  $a = (1 + \sqrt{5})/2$  using strong induction principle.  
 b) Devise a recursive algorithm for computing  $b^n \text{ mod } m$ , where  $b$ ,  $n$ , and  $m$  are integers with  $m \geq 2$ ,  $n \geq 0$ , and  $1 \leq b < m$ . [5+5]
- 8.a) Define mean and variance of a random variable.  
 b) A pair of fair dice is tossed. Let  $X$  denote minimum of the number appearing i.e.,  $X(a, b) = a + b$ . Evaluate the probability distribution of X. Also, estimate the mean and variance of the distribution. [8+2]

**OR**

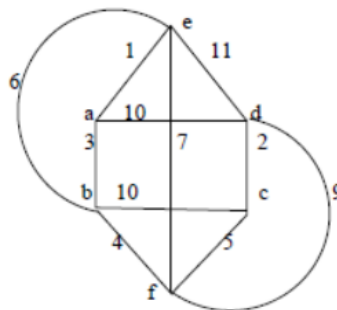
9. Determine the number of non-negative integer solutions of the equation  $x_1 + x_2 + x_3 + x_4 = 18$  under the condition  $x_i \leq 7$ , for  $i = 1, 2, 3, 4$ . [10]
- 10.a) In any planer graph, show that  $|V| - |E| + |R| = 2$ .  
 b) Construct Hamiltonian graph from the following graph 1. [5+5]



Graph 1

**OR**

11. Evaluate the minimum spanning tree for the graph 2 shown below using Kruskal algorithm. Hence, obtain the cost of the minimum spanning tree. [10]



Graph 2