

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

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- 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

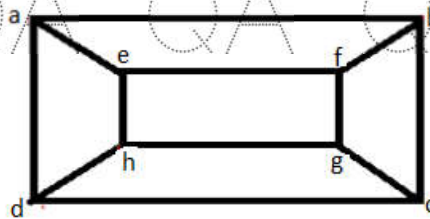
- 7.a) Prove or disprove that whenever $n \geq 3$, $f_n > a^{n-2}$, where $a = (1 + \sqrt{5})/2$ using strong induction principle.
 b) Devise a recursive algorithm for computing $b^n \text{ mod } m$, where b , n , and m are integers with $m \geq 2$, $n \geq 0$, and $1 \leq b < m$. [5+5]

- 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]

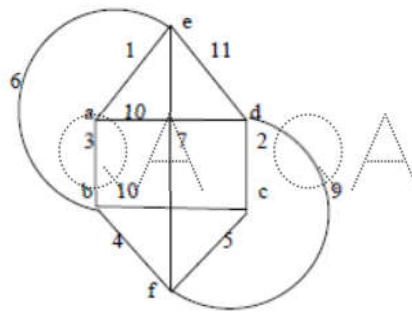
- 10.a) In any planer graph, show that $|V| - |E| + |R| = 2$.
 b) Construct Hamiltonian graph from the following graph 1. [5+5]



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