Code No: 154AQ **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, September/ October - 2023
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) Write the Converse and Contrapositive of P→Q? [2]
b) Write few applications of Propositional logic? [3]
c) Find the cardinality of the set of even positive integers less than 20? [2]
d) How many relations exist from set X to set Y if the set X and set Y has 7 and 8 elements? [3]
e) Show that the program segment y := 2 z := x + y is correct with respect to the initial assertion p: x = 1 and the final assertion q: z = 3. [2]
f) Use strong induction to prove that $\sqrt{2}$ is irrational. [Hint: Let P (n) be the statement that $\sqrt{2}$ = n/b for any positive integer b.] [3]
g) Define an Expected Value? Give one example? [2]
h) A sequence of 10 bits is randomly generated. What is the probability that at least one of these bits is 0? [3]
i) How many vertices does a full 5-ary tree with 100 internal vertices have? [2]
j) Write about 3 Graph representations. [3]

PART – B

(50 Marks)

2.a) Show that S ∨ R is tautologically implied by (P ∨ Q) ∧ (P → R) ∧ (Q → S) using rules of inference?.
b) Symbolize the statements (i) "All men are giants." (ii) "Any integer is either positive or negative" [5+5]

OR

3.a) Symbolize the statements (i) "The crop will be destroyed if there is a flood". (ii) "The product of two negative real numbers is not negative."
b) Show that M→N can be derived from the premises P→ (Q → N), ~M ∨ P, and Q using rule CP? [5+5]

4.a) Let f1 and f2 be functions from R to R such that $f_1(x) = x2$ and $f_2(x) = x - x2$. What are the functions $f_1 + f_2$ and f_1f_2?
b) Consider the relation R on Z^+ X Z^+ defined by (a,b)R(c,d) if and only if ad=bc. Find the equivalence class [(1, 2)]? List at least five elements. [5+5]

OR

5.a) Let A, B, and C be sets. Show that $\overline{A \cup (B \cap C)} = (\overline{C} \cup \overline{B}) \cap \overline{A}$.

b) Determine whether the following relation is a Partial Ordering relation. Let the relation R on the set of real numbers be defined by aRb if and only if a≤b. [5+5]

6.a) Write a recursive algorithm to find the sum of the first N Natural numbers.

b) How can Big-O notation be used to estimate the sum of the first n positive integers? [6+4]

OR

7.a) Define Algorithm? Write the properties of it?

b) Use mathematical induction to show that $1 + 2 + 2^2 + \cdots + 2^n = 2^{n+1} - 1$ for all nonnegative integers n. [4+6]

8.a) What is the generating function for the finite sequence 2,2,2,2,2,2 ?

b) A total of 1232 students have taken a course in Spanish, 879 have taken a course in French, and 114 have taken a course in Russian. Further, 103 have taken courses in both Spanish and French, 23 have taken courses in both Spanish and Russian, and 14 have taken courses in both French and Russian. If 2092 students have taken at least one of Spanish, French, and Russian, how many students have taken a course in all three languages? [5+5]

OR

9.a) Solve the recurrence relation $a_k = 3a_{k-1}$ for k = 1, 2, 3,... and initial condition $a_0 = 2$.

b) Write the Principle of Inclusion-Exclusion? Give an example? [7+3]

10.a) Show that K_n has a Hamilton circuit whenever $n \geq 3$.

b) Use Prim's algorithm to find a minimum spanning tree in the graph shown in Figure 1. [5+5]

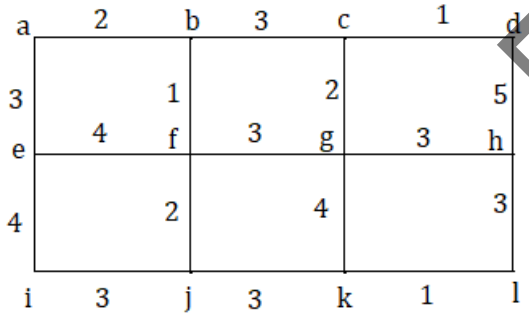

Figure:1

OR

11.a) Explain Tree Traversal Methods with suitable examples?

b) Determine whether the graphs G and G' shown in Figure 2 are isomorphic. [6+4]

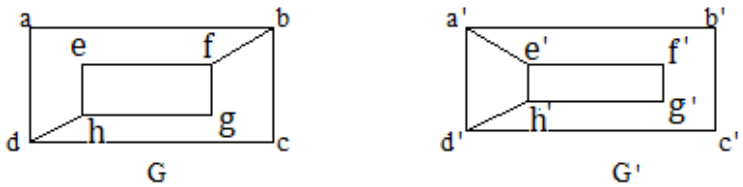

Figure: 2

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