4E1301

B. Tech. IV - Sem. (Main) Exam., - 2022
Artificial Intelligence & Data Science
4AID2 – 01 Discrete Mathematics Structure
CS, IT, AID, CAI

Time: 3 Hours

Maximum Marks: 70

Instructions to Candidates:

Attempt all ten questions from Part A. Five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may 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. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)   [10×2=20]

All questions are compulsory

Q.1 If A = {4, 1, 8}, then find the power set of A.

Q.2 For a relation R on a set A = {1, 2, 3, 4} given by R = {(1, 3), (1, 2), (2, 2), (3, 4)}, then find reflexive and transitive closure of R on the given set.

Q.3 What is the domain of the function $f(x) = x/(x^2 + 3x + 2)$?

Q.4 If $f(x) = e^x$ and $g(x) = x^3$, then find the composition f o g.

Q.5 Find the negation of the following statement –

"He is rich and unhappy."

Q.6 What is a finite state machine?

Q.7 Define generating function.

Q.8 Define homomorphism and isomorphism of groups.

Q.9 What do you mean by a regular graph?

Q.10 Define Hamiltonian graph with example.

PART – B

(Analytical/Problem solving questions)

[5×4=20]

Attempt any five questions (Word limit 100)

Q.1 If in a city 60% of the residents can speak German and 50% can speak French. What percentage of residents can speak both the language, If 20% residents cannot speak any of these two languages?

Q.2 Let Q be the set of rational numbers. Show that the function f:Q→Q defined by f(x)=2x+7, x∈Q is a bijective function. Also find f^{-1} (0) and f^{-1} (2).

Q.3 Prove the following logical implication with constructing truth table –

$(\sim PVQ) \wedge (PVR) \wedge (\sim QVR) \Rightarrow R$

Q.4 Design a deterministic FSA that accepts strings of 0s and 1s as input for which the number of 1s is divisible by 3.

Q.5 How many words can be formed from the letter of the word "DAUGHTER" if the vowels always coming together?

Q.6 Show that the set $G = \{2^n \mid n \in Z\}$ is a group for multiplication.

Q.7 Determine whether the graph given below by its adjacency matrix is connected or not -

$$\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{pmatrix}$$

PART – C

Attempt any three questions

Q.1 Let U be the set of positive integer not exceeding 1000, that is $|U|=1000$. Then using the pigeonhole principle find $|S|$, where S is the set of such integer which is not divisible by 3, 5 or 7?

Q.2 Find the disjunctive normal form of $P \rightarrow ((P \rightarrow Q) \wedge \sim(\sim P \vee \sim P))$.

Q.3 Solve the recurrence relation $s_n - 7s_{n-1} + 10s_{n-2} = 0$, $s_0 = 0$ and $s_1 = 3$ by using generating function where, $n \geq 2$.

Q.4 Show that the set of all square matrix of order (m×m) under the binary operations addition and multiplication is a non-commutative ring.

Q.5 Using Dijkstra's algorithm, find the shortest distance of all vertices from the vertex A for the graph shown in figure -