Reg. No.															

Question Paper Code	13858

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Seventh Semester

Artificial Intelligence and Data Science

20AIEL721 - ARTIFICIAL INTELLIGENCE CONSTRAINT SATISFACTION

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	A Constraint Satisfaction Problem (CSP) is defined by: (a) A set of goals and operators (b) A set of variables, domains, and constraints (c) A single search state and heuristic (d) A set of actions and percepts	*1*	*K1*	*CO1*
2.	Which of the following is an example of a CSP application? (a) Sorting a list of numbers (b) Solving Sudoku or crosswords (c) Searching for a web page (d) Performing addition	*1*	*K2*	*CO1*
3.	In a Binary Constraint Network (BCN), each constraint relates: (a) One variable only (b) Two variables (c) Three or more variables (d) None of the above	*1*	*K2*	*CO2*
4.	What is the main purpose of the AC-3 algorithm in CSPs? (a) To find the optimal path (b) To ensure arc consistency in a constraint network (c) To detect inconsistent variable assignments (d) To compute heuristic values	*1*	*K1*	*CO2*
5.	What is the main advantage of the AC-4 algorithm over AC-3? (a) It is simpler but slower. (b) It achieves arc consistency more efficiently by maintaining support counts. (c) It ignores redundant constraints. (d) It does not use any data structure.	*1*	*K1*	*CO3*
6.	Path consistency ensures consistency among: (a) A single variable (b) A pair of variables (c) A triple of variables (d) All variables simultaneously	*1*	*K2*	*CO3*
7.	What does the Bucket Elimination Algorithm mainly aim to do in CSPs? (a) Randomly assign variable values (b) Systematically eliminate variables using constraints to simplify the problem (c) Find inconsistent assignments only (d) Build heuristic trees	*1*	*K1*	*CO4*
8.	Directional Arc Consistency (DAC) is defined with respect to: (a) A single variable only (b) A particular ordering of variables (c) Random domain selection (d) Graph cycles only	*1*	*K2*	*CO4*
9.	What is the main purpose of the Backtracking Algorithm in CSP solving? (a) To eliminate variables (b) To find one or all solutions by exploring variable assignments systematically (c) To randomly select solutions (d) To compute constraint networks only	*1*	*K2*	*CO5*
10.	Which of the following techniques is used to improve simple backtracking in CSPs? (a) Depth-First Search (b) Forward Checking and Constraint Propagation (c) Random Sampling (d) Greedy Search	*1*	*K1*	*CO5*

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Define Constraint Satisfaction Problem.	*2*	*K1*	*CO1*
12.	Define consistent assignment with an example.	*2*	*K2*	*CO1*
13.	Define a Binary Constraint Network.	*2*	*K1*	*CO2*
14.	What is the time complexity of the AC-3 algorithm?	*2*	*K2*	*CO2*
15.	Define arc consistency in a CSP.	*2*	*K1*	*CO3*
16.	What is meant by constraint propagation?	*2*	*K1*	*CO3*
17.	What is an induced graph in CSP?	*2*	*K1*	*CO4*
18.	Define Directional Arc Consistency.	*2*	*K2*	*CO4*
19.	What is a Search Space in CSP?	*2*	*K1*	*CO5*
20.	Define Forward Checking.	*2*	*K2*	*CO5*
21.	Define Full Look-Ahead (FLA) in CSP solving.	*2*	*K1*	*CO6*
22.	What is the main purpose of the DPLL algorithm?	*2*	*K2*	*CO6*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Examine the concept of Constraint Satisfaction Problem (CSP), its classes, and how reasoning is combined with search in solving CSPs.	*11*	*K2*	*CO1*
		OR			
	b)	Categorize any two real-world applications of CSP - Scene Labelling and Crosswords and explain how they are represented as CSPs.	*11*	*K2*	*CO1*
24.	a)	Construct the notions of Equivalent Networks and Minimal/Tightest Networks with examples.	*11*	*K3*	*CO2*
		OR			
	b)	Develop the AC-1 and AC-3 algorithms used to establish arc consistency in CSPs. Explain with examples and analyse their complexity.	*11*	*K3*	*CO2*
25.	a)	Explain the AC-4 Algorithm. How does it improve arc consistency enforcement compared to AC-3?	*11*	*K2*	*CO3*
		OR			
	b)	Explain Path Consistency, the Revise-3 Algorithm, and how it can be generalized to i-Consistency. Illustrate the concept of Directional Consistency using a Map-Colouring example.	*11*	*K2*	*CO3*
26.	a)	Analyse the Directional Local Consistency, Directional Arc Consistency (DAC), and Directional Path Consistency (DPC) with suitable examples.	*11*	*K4*	*CO4*
		OR			
	b)	Compare Adaptive Consistency and the Bucket Elimination Algorithm with an illustrative example.	*11*	*K4*	*CO4*
27.	a)	Build the Search Space Method for solving CSPs. How do variable ordering and consistency levels affect the search tree? Give examples.	*11*	*K3*	*CO5*
		OR			
	b)	Apply the Backtracking Algorithm for CSP solving. Describe its limitations and improvements such as Forward Checking and Generalized Look-Ahead Search Algorithm.	*11*	*K3*	*CO5*
28.	a)	Develop Forward Checking, Full Look-Ahead, and Partial Look-Ahead techniques in CSP solving. Illustrate with examples.	*11*	*K3*	*CO6*
		OR			
	b)	Construct how Constraint Propagation can be combined with Search using the DPLL Algorithm. Illustrate DPLL with an example.	*11*	*K3*	*CO6*