



**NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI**  
**End Semester Examinations – July 2021 Session**

DEPARTMENT : Computer Science and Engineering  
DATE & TIME OF EXAM : 6<sup>th</sup> December 2021 & 12.00 noon  
SUB CODE : CSPC51 – Introduction to AI and ML  
SEMESTER & YEAR : V / III / B section  
DURATION : 2 hrs  
**MARKS : 30 marks**

**ANSWER ALL QUESTIONS**

1. Define PEAS for an automated NURSE to take care of a geriatric patient. What type of agent will you use it for designing the NURSE? Describe diagrammatically the representation of the various actions and percept sequence for such an agent. (3)

2. Consider the travelling salesman problem with the following distances: (3)

	A	B	C	D	E
A	-	110	125	175	150
B	110	-	140	170	160
C	125	140	-	130	155
D	175	170	130	--	120
E	150	160	155	120	--

If the starting city is A, then find the path for minimum distance during a round trip using any 2 heuristic methods. Compare their performances.

3. Solve the following 8-puzzle problem using any approach. State the heuristics and approach used and draw the complete state space tree. (4)

Initial State

2	3	
1	8	4
7	6	5

Goal State

1	2	3
5		4
8	7	6

4. A proposition 2-CNF expression is a conjunction of clauses, each containing exactly two literals, (5)  
 $(A \vee \sim B) \wedge (\sim A \vee \sim C) \wedge (B \vee D) \wedge (\sim C \vee G) \wedge (\sim D \vee \sim G)$   
a. Verify using resolution whether the above sentence entails G



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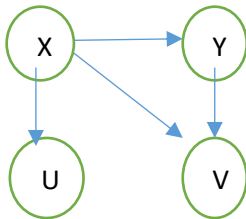
- b. Two clauses are semantically distinct if they are not logically equivalent. How many semantically distinct 2-CNF clauses can be constructed from 'n' propositional symbols.

5. Suppose you are given the following axioms: (5)

- $0 \leq 8$
- $10 \leq 15$
- $\forall x, x \leq x$
- $\forall x, x \leq x + 0$
- $\forall x, x + 0 \leq x$
- $\forall x, y, x + y \leq y + x$
- $\forall w, x, y, z, w \leq y \wedge x \leq z \Rightarrow w + x \leq y + z$
- $\forall x, y, z, x \leq y \wedge y \leq z \Rightarrow x \leq z$

Use incremental forward chaining proof of the sentence  $10 \leq 8 + 15$  by using the axioms. Show all the steps that leads to the success. Verify the same using resolution

6. Consider the following Bayesian belief network (5)



The probabilities are given as follows:

$$P(X) = 0.35, P(Y|X) = 0.25, P(Y|\sim X) = 0.1, P(U|X) = 0.55, P(U|\sim X) = 0.35, \\ P(V|X,Y) = 0.65, P(V|X,\sim Y) = 0.25, P(V|\sim X,Y) = 0.3, P(V|\sim X,\sim Y) = 0.2$$

Compute the probability of  $P(X|Y)$  and  $P(X, Y, U, V)$ .

7. Cluster the following points using complete link clustering and show the clusters. Show the no. of epochs as well. Draw the dendrogram.  $A_1 = (12, 18, 15)$ ,  $A_2 = (20, 15, 21)$ ,  $A_3 = (16, 14, 21)$ ,  $A_4 = (19, 8, 12)$ ,  $A_5 = (17, 15, 1)$ ,  $A_6 = (16, 4, 12)$ ,  $A_7 = (11, 2, 14)$ ,  $A_8 = (14, 9, 12)$ .

Use K-means clustering to cluster the points with centroids as  $A_2, A_7$ .

(5)

Best Wishes