DEPARTMENT : Computer Science and Engineering

DATE & TIME OF EXAM : 6th 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.

1. 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 Goal State

|  |  |  |
| --- | --- | --- |
| 2 | 3 |  |
| 1 | 8 | 4 |
| 7 | 6 | 5 |

|  |  |  |
| --- | --- | --- |
| 1 | 2 | 3 |
| 5 |  | 4 |
| 8 | 7 | 6 |

1. A proposition 2-CNF expression is a conjunction of clauses, each containing exactly two literals, (5)

(A V ~B) ∧ (~A V ~C) ∧ (B V D) ∧ (~C V G) ∧ (~D V ~G)

1. Verify using resolution whether the above sentence entails G
2. 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.
3. Suppose you are given the following axioms: (5)

* 0 ≤ 8
* 10 ≤ 15
* ∀ x, x ≤ x
* ∀ x, x ≤ x + 0
* ∀ x, x + 0 ≤ x
* ∀ x, y, x + y ≤ y + x
* ∀ w, x, y, z, w ≤ y ∧ x ≤ z ⇒ w + x ≤ y + z
* ∀ x, y, z, x ≤ y ∧ y ≤ z ⇒ x ≤ z

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

1. Consider the following Bayesian belief network (5)

The probabilities are given as follows:

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

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

1. Cluster the following points using complete link clustering and show the clusters. Show the no. of epochs as well. Draw the dendogram. A1= (12,18, 15), A2=(20,15, 21), A3=(16, 14, 21), A4=(19, 8, 12), A5=(17,15, 1), A6=(16, 4, 12), A7=(11, 2, 14), A8=(14, 9, 12).

Use K-means clustering to cluster the points with centroids as A2, A7. (5)

Best Wishes