

**VIT**

Vellore Institute of Technology

**Final Assessment Test (FAT) – May 2022**

Programme	B.Tech	Semester	Winter Semester 2021-22
Course Title	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	Course Code	CSE2039
Faculty Name	Prof. Umitty Srinivasa Rao	Slot	F1
		Class Nbr	CH2021225000978
Time	3 Hours	Max. Marks	100

1. Answer All Questions
2. If any assumptions are required, assume the same and mention that assumption in the answer script.

**Section-1 (10 X 10 Marks)****Answer All questions**

1. A farmer with his wolf, goat, and cabbage come to the edge of a river they wish to cross. There is a boat at the river's edge, but, of course, only the farmer can row. The boat also can carry only two things (including the rower) at a time. If the wolf is ever left alone with the goat, the wolf will eat the goat; similarly, if the goat is left alone with the cabbage, the goat will eat the cabbage. [10]

- (i) Devise a sequence of crossings of the river banks so that all four characters arrive safely on the other side of the river. (3 marks)
- (ii) Find a path from the start state to the goal state by drawing the Breadth First Search tree. (7 marks)

2. Consider the 16-puzzle problem with the following initial and final configuration given below. From the initial configuration, tiles may be moved up, down, left and right to obtain the final configuration. [10]

**Initial Configuration**

2	1	3	4
5	6	7	8
9	10	11	12
13	14	15	X

**Final Configuration**

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	X

Assume a suitable heuristic function and apply Best First Search Algorithm to solve the given problem.

3. **Travelling Salesman Problem:** Given a set of cities and distance between every pair of cities, the problem is to find the *shortest possible route* that visits every city exactly once and returns to the starting point. [10]

Write a hill climbing algorithm to find a sequence of cities that minimizes traveling distance (or cost). Illustrate your algorithm on the given following graph for 5 cities A, B, C, D and E. Assume an initial solution as A-B-E-C-D-A with the cost 59 and your algorithm must update the cost of the initial solution at every step.



6. Use rules of inference to infer the conclusion from the following hypotheses:

[10]

1. All the dated letters in this room are written on blue paper.
2. None of them are in black ink, except those that are written in the third person.
3. I have not filed any of those that I can read.
4. None of those that are written on one sheet are undated.
5. All of those that are not crossed out are in black ink.
6. All of those that are written by Brown begin with "Dear Sir."
7. All of those that are written on blue paper are filed.
8. None of those that are written on more than one sheet are crossed out.
9. None of those that begin with "Dear sir" are written in the third person.

Conclusion: I cannot read any of Brown's letters.



Write the following argument in symbolic form. Then establish the validity of the argument or give a counterexample to show that it is invalid.

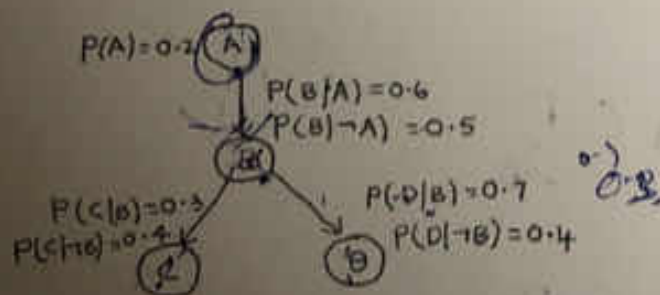
[10]

If Dominic goes to the racetrack, then Helen will be mad. If Ralph plays cards all night, then Carmela will be mad. If either Helen or Carmela gets mad, then Veronica (their attorney) will be notified. Veronica has not heard from either of these two clients. Consequently, Dominic didn't make it to racetracks and Ralph didn't play cards all night.

Handwritten symbols:  $\neg$  and  $\wedge$ .

Consider the following Bayesian network and the corresponding conditional probability distributions:

[10]



Handwritten:  $P(B, A)$ .

Handwritten:  $P(B)$ .

- (1) Calculate marginal probability  $P(C)$ . [5m]
- (2) Calculate conditional probability  $P(C|D)$ . [5m]





We will use the dataset below to learn a decision tree which predicts if people pass machine learning (True or False), based on their previous GPA (High, Medium, or Low) and whether or not they studied for exam (True or False).

[10]

Sno	GPA	Studied	Passed
1	L	F	F
2	L	T	T
3	M	F	F
4	M	T	T
5	H	F	T
6	H	T	T

Build a decision tree for above dataset using entropy measure.

A. Suppose you use the K-means algorithm and Euclidean distance to cluster the following 8 samples into 3 clusters:

[10]

$A1=(2,10)$ ,  $A2=(2,5)$ ,  $A3=(8,4)$ ,  $A4=(5,8)$ ,  $A5=(7,5)$ ,  $A6=(6,4)$ ,  $A7=(1,2)$ ,  $A8=(4,9)$ .

Assume that the initial seeds (centers of each cluster) are  $A1$ ,  $A4$  and  $A7$ . Run the k-means algorithm for 1 epoch only. At the end of this epoch show:

- The new clusters (i.e. the samples belonging to each cluster) (5 marks)
- The centers of the new clusters (2 marks)

B. Do you get same clustering results for two runs of K-Means algorithm? Justify your answer. (3 marks)