VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)
CHENNAI

Reg. Number:	

Continuous Assessment Test (CAT) – II - OCTOBER 2024

Programme	:	B.Tech	Semester	:	FALL 2024-25
Course Code & Course Title	:	BCSE306L Artificial Intelligence	Slot	:	E1+TE1
Faculty	:	Dr. B Radhika Selvamani Dr. Tahir Mujtaba Dr. Modigari Narendra Dr. Bhavadharini Dr.Sharmila Dr. Suganya	Class Number	:	CH2024250101163 CH2024250101175 CH2024250101165 CH2024250101167 CH2024250101169 CH2024250101173
Duration	:	1 ½ hours	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.

Answer all questions

Q. No		Description	Mark
1		In a small town called Greenfield, there are several individuals who help each other by performing various tasks. The following knowledge is available about them: i. If someone is helpful, they help others in need. ii. If a person helps others, they are considered kind. iii. Alice is helpful. iv. Bob is kind. v. Anyone who is kind will eventually be helped by Charlie. vi. David is not helpful.	
	a)	Represent the given statements in First-Order Logic and convert all the statements in the knowledge base to Conjunctive Normal Form	5
	b)	Use refutation resolution to prove that Charlie will eventually help Alice.	5
2		In the context of knowledge representation, consider a scenario involving three statements: a. All cats are mammals b. All mammals are animals	

		c. A specific cat named Whiskers is a cat. Based on these statements, can we conclude, "*Therefore, Whiskers is an animal.*"	
	a)	Represent these statements in Propositional Logic and examine if you can derive the conclusion from the propositions.	2
	b)	Convert the above statements into First-Order Logic and demonstrate how this representation allows for valid inference as opposed to the propositional logic, highlighting at least 3 common limitations of propositional logic.	8
3		This network illustrates the probabilistic relationships among five variables. **Family History(F)** and **Age(A)** both influence the likelihood of having a disease. **Disease(D)** is directly linked to both **Symptoms(S)** and **Test Result(T)**, indicating whether the patient presents certain symptoms, reflecting the outcome of a medical test. Additionally, the presence of **Symptoms** can further influence the **Test Result**. The priors and conditional probabilities are given below. **P(F=yes)** = 0.4, **P(A=young)** =0.5 **D** / **P(S)** Yes 0.8 No 0.2 **D** / **S** / **P(T = +ve)** Yes Yes 0.95 Yes No 0.7 No Yes 0.4 No No 0.1 **F** / **A** / **P(D=yes)** Yes Young 0.7 Yes Old 0.9 No Young 0.1 No Old 0.3	
	a)	Draw the Bayesian network diagram representing the relationships between the variables.	2
	b)	Find the probability of having the disease if the test result is positive and the patient is young.	5
4		A university admissions office is using a **Bayesian Inference** model to predict the likelihood of students succeeding in a particular academic program based on various factors, such as high school GPA, standardized test scores, extracurricular activities, and letters of recommendation. The office starts with initial beliefs about student success rates derived from historical data and refines these beliefs as new student data which is collected during each admissions cycle.	
	a)	Design a Bayesian Network for the above scenario with the discussed factors and their complex dependencies. List atleast three common queries in the given domain to illustrate the difficulties in using direct inference approach.	6
	b)	A new variable has been introduced to consider students with special abilities. But it is a rare event with a prior as low as 0.001. Which among Rejection Sampling and Weighted Sampling (Importance Sampling) can be applied to manage the complexity of the new variable. Justify.	4
5		An AI system is being developed to assist a cricket team's captain in making strategic decisions during a match. The AI needs to decide which batsmen to	

select for the final three overs of the game, where the batting team requires 20 runs to win from 3 overs. The captain of team **MoonLight** uses AI for choosing from the 3 batsmen on the team namely Virat, Ruturaj and Dinesh Karthik. The opponent team "**KolkataTiger**" has two bowlers to choose from, Sunil and Amit each with varying strengths and weaknesses.

Assumptions:

1. **KolkataTiger** is allowed to change the bowler only after 2 overs.
2. **MoonLight** can change the batsman after a single over.
3. The AI can only look ahead for 2 overs.
4. Given below are the most probable runs possible for each batsman against each bowler in an over.
5. A Batsman who is out cannot play again.

Rules for Calculating Heuristics:

1. The heuristic value is runs in over 1+ runs in over 2+ wickets left –runs to win
2. The maxplayer tries to maximize the score.

Table.1 Possible Runs for Player Combinations

Bowler	Batsman	Possible Runs in a over
Sunil	Virat	6
Sunil	Ruturaj	out
Sunil	Dinesh	1
Amit	Virat	out
Amit	Ruturaj	10
Amit	Dinesh	0

	a)	Draw the possible minimax tree for the players with Moonlight being the max player. Hint: There are only 15 leaf nodes possible because of assumption 5.	8
	b)	Calculate the best first batsman to choose for the Kolkata Tiger at max move. Explain your observation about why Rituraj will not be picked by AI even though he can score highest no. of runs (10) as in the table 1.	5
		Total Marks	**50**

******* All the Best *******