



Continuous Assessment Test (CAT) – II OCTOBER 2025

Programme	:	B.Tech	Semester	:	Fall Semester 2025-2026
Course Code & Course Title	:	BCSE306L Artificial Intelligence	Class Number	:	CH2025260101623 CH2025260101625 CH2025260101627
Faculty	:	Dr.Reena Roy, Dr.Deepika Roselind, Dr.Kavipriya	Slot	:	C1+TC1
Duration	:	90 Minutes	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks	CO	BT Level
1		Perform alpha beta pruning for the given game tree. i) Explain the step by step process in detail.(5 Marks) ii) Give the pruned tree and the values of alpha and beta cut-offs. (5 Marks)	10	CO3	K3/K4
2		A smart home system uses propositional logic to manage safety and comfort. The knowledge base (KB) is: 1. If it is raining (R), then the windows are closed (C). 2. If the windows are closed (C) and the fan is ON (F), then the room is comfortable (Comf). 3. If there is a fire alarm (A), then the windows are open ($\neg C$) or the sprinkler is activated (S).	10	CO2	K4

	4. If the sprinkler is activated (S), then the floor becomes wet (W). Facts: It is raining ($R = \text{true}$), the fan is ON ($F = \text{true}$), and the fire alarm is triggered ($A = \text{true}$). i. Write the KB in propositional logic notation using operators. (4 marks) ii. Using the facts, determine whether the windows (C) will be closed or open. (2 marks) iii. Infer whether the room is comfortable (Comf). (2 marks) iv. Infer whether the floor will be wet (W). (2 marks)			
3	Consider the following statements 1. Every student who completes assignments and attends classes is eligible for exams. 2. Any student who is eligible for exams and submits the exam form is allowed to write exams. 3. Whoever writes exams and clears them successfully will graduate. 4. Any graduate receives a degree certificate. 5. Raj completes assignments. 6. Raj attends classes. 7. Raj submits the exam form. 8. Raj clears exams. (a) Convert the above statements to First-Order Logic (FOL). (4 marks) (b) Use Forward Chaining and Backward Chaining to infer whether Raj receives a degree certificate. (3+3 marks)	10	CO3	K4
4	An urgent-care clinic must quickly admit patients showing fever (F) and cough (C). The possible causes are Flu (FL) or Allergy (AL). The historical data is provided as follows, • Prior probabilities: $P(\text{FL}) = 0.15$, $P(\text{AL}) = 0.85$ Symptom likelihoods: • $P(F=\text{true} \mid \text{FL}) = 0.80$, $P(C=\text{true} \mid \text{FL}) = 0.70$ $P(F=\text{true} \mid \text{AL}) = 0.20$, $P(C=\text{true} \mid \text{AL}) = 0.40$ Assume conditional independence of symptoms given the cause. A new patient presents with fever and cough: $F = \text{true}$ and $C = \text{true}$. Additionally, the clinic can order a Rapid Flu Test (RFT) with sensitivity 0.85 and specificity 0.90. The clinic's actions and utilities are: • Treat as Flu (T_{FL}): If Flu, +8 utility; if Allergy, -3 utility. • Treat as Allergy (T_{AL}): If Allergy, +6 utility; if Flu, -6 utility. • Order RFT then treat optimally: Utility reduced by 1 (test cost) plus the utility of the subsequent optimal treatment. i. Using Bayes' theorem, compute $P(\text{FL} \mid F = \text{true}, C = \text{true})$. (4 Marks)	10	CO3	K3/K4

	ii. Specify which action (T_FL or T_AL) maximizes expected utility for this patient with calculations. (3 marks) iii. If the clinic first performs RFT and then treats optimally based on the result, calculate the expected utility of this strategy. Should the clinic test or act immediately? Justify. (3 marks)			
5	A company deploys a Bayesian Belief Network to detect possible cyber intrusions. The network has the following nodes: - Hacker Activity (H): Prior $P(H=\text{true})=0.1$. - Unusual Login (L): Depends on H. $P(L=\text{true} \mid H=\text{true}) = 0.85$ $P(L=\text{true} \mid H=\text{false}) = 0.2$ - Malware Alert (M): Depends on H. $P(M=\text{true} \mid H=\text{true}) = 0.9$ $P(M=\text{true} \mid H=\text{false}) = 0.05$ - System Lockdown (S): Triggered when either Login or Malware is flagged. $P(S=\text{true} \mid L=\text{true} \vee M=\text{true}) = 0.95$ $P(S=\text{true} \mid L=\text{false} \wedge M=\text{false}) = 0.1$ Suppose the system observes $S = \text{true}$ (system lockdown activated). i. Write the full expression for $P(H=\text{true} \mid S=\text{true})$ using Bayes' rule, accounting for hidden variables. (3 marks) ii. Compute $P(S \mid H)$ and $P(S \mid \neg H)$ when $H=\text{True}$, $H=\text{False}$ (3 marks) iii. Explain how approximate inference would estimate $P(H=\text{true} \mid S=\text{true})$ in this case. (4 marks)	10	CO2	K3/K4

*****All the best *****

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VIT

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CHENNAI

Reg. Number:

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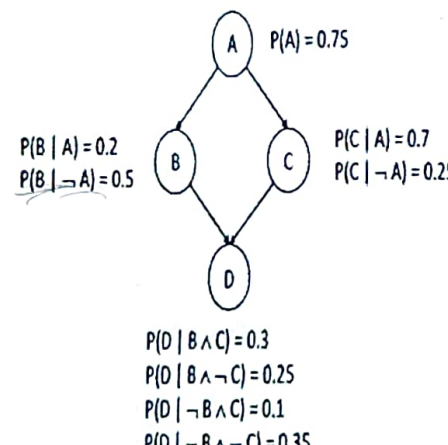
Programme	: B.Tech-CSE(BRS,CPS,AI ML) B.Tech-MECHANICAL(ELECTRIC VEHICLES)	Semester	: FALL-SEMESTER 2025-26
Course Code & Course Title	: BCSE306L ARTIFICIAL INTELLIGENCE	Class Number	: CH2025260101628 CH2025260101626 CH2025260101624
Faculty	: Dr.R.REENA ROY Dr.NOEL JEYGAR ROBERT V Dr.DEEPIKA ROSELIND	Slot	: C2+TC2
Duration	: 90 MINUTES	Max. Mark	: 50

General Instructions: < Use this space to provide additional information such as graph sheet, data book etc.>

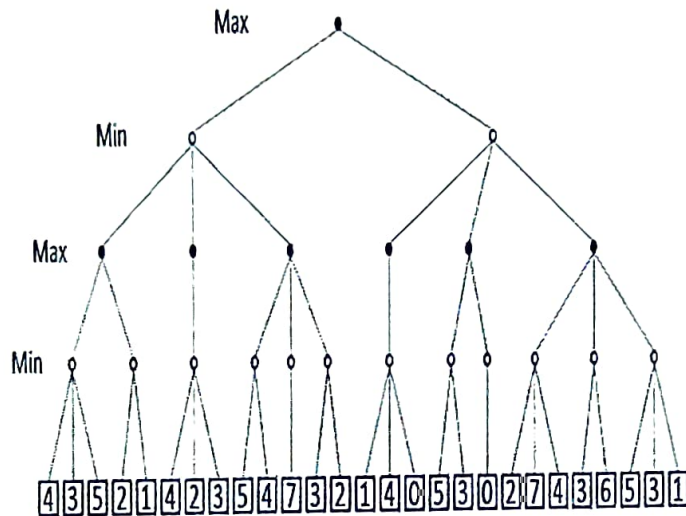
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Answer all questions

Q. No	Sub Sec. c.	Description	Marks	CO	BT Level
1		A smart classroom system is controlled using propositional logic. The following knowledge base (KB) is defined: 1. If it is daytime (D), then the lights (L) are off. 2. If it is night (N) or cloudy (C), then the lights are on. 3. If the lights are on exactly when the projector (P) is working, then students (E) can take notes effectively. 4. If the lights are off and the security system (S) is enabled, then the classroom is safe. The facts are given below: It is night. It is cloudy. The security system is enabled. Answer the following: i. Write the above knowledge base (KB) in formal propositional logic notation using appropriate operators. (4 Marks) ii. From the facts, infer whether the lights (L) will be on or off. (2 Marks) iii. Based on the KB, determine whether students can take notes effectively (N). (2 Marks) iv. Check whether the classroom is safe (Safe) under the given conditions. (2 Marks)	10	2	K3

2	A smart healthcare system is represented in First-Order Logic: - If a person is a patient and has a fever, then they need a Covid test. - If a person needs a Covid test and tests positive, then they are infected with Covid. - If a person is infected with Covid, then they must be isolated. - If a person is isolated, then they are safe for the community. - John and Sara are patients. - John and Sara both have a fever. - John tested positive for Covid. - Sara did not test positive for Covid. Answer the following: - Write the above scenario as formal FOL equations using valid operators. (4 Marks) - Using backward chaining, check whether Sara is infected with Covid. Explain why the inference fails or succeeds. (3 Marks) - Using resolution, prove that John must be Isolated is entailed by the KB. Write the key CNF clauses and show the resolution steps. (3 Marks)	10	2	K4
3	Consider the following Bayesian network A, B, C and D are Boolean Random Variables.  $P(A) = 0.75$ $P(B A) = 0.2$ $P(B \neg A) = 0.5$ $P(C A) = 0.7$ $P(C \neg A) = 0.25$ $P(D B \wedge C) = 0.3$ $P(D B \wedge \neg C) = 0.25$ $P(D \neg B \wedge C) = 0.1$ $P(D \neg B \wedge \neg C) = 0.35$ - If we know that A is true, what is the probability of D being True (4 Marks). - Compute the probability of C being true given that A is false? (2 Marks) - Compute the probability that B is true given that D is true? (4 Marks)	10	3	K4

- a) Using the given game tree, apply the Minimax algorithm. Compute the minimax value of the root node and show the step-by-step evaluation of all nodes. (5 Marks)
- b) Apply alpha beta pruning on the same game tree. Determine the value of the root node and clearly indicate which branches are pruned during the search process. (5 Marks)



The following table gives the data about individuals in response to promotional offers made in the areas of finance, trade, magazines, health and gender.

- a) Compute the prior probabilities $P(\text{Male})$ and $P(\text{Female})$. (3 Marks)

- b) Compute the conditional probabilities $P(X|\text{Male})$, $P(X|\text{Female})$ using Maximum likelihood estimation. (4 Marks)

- c) Calculate the posterior probabilities and predict the gender of the individual for the given data sample. (3 Marks)

$X = \{\text{Finance}=\text{No}, \text{Trade}=\text{Yes}, \text{Magazines}=\text{Yes}, \text{Health}=\text{No}\}$

FINANCE	TRADE	MAGAZINE	HEALTH	GENDER
YES	NO	YES	NO	MALE
YES	YES	NO	NO	MALE
NO	YES	YES	YES	FEMALE
NO	YES	NO	YES	MALE
YES	YES	YES	YES	FEMALE

		NO	NO	YES	NO	FEMALE				
		YES	NO	NO	NO	MALE				
		YES	YES	NO	NO	MALE				
		NO	NO	NO	YES	FEMALE				
		YES	NO	NO	NO	MALE				

*****All the best*****

Burra