

CLASS: MCA  
BRANCH: MCA

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)

SEMESTER: II  
SESSION: SP/2023

TIME: 3 Hours

SUBJECT: CA435 MODERN ARTIFICIAL INTELLIGENCE

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) (I) Differentiate the following terms (any two):

- Rational agent vs Autonomous agent
- Bounded rationality vs Perfect rationality.
- Turing Test vs The Chinese room argument.
- Is AI a science, or is it engineering? Or neither or both? Explain.

Marks [3+2=5] CO CO1 BL BL1 BL4

(II) For the following activity, describe a PEAS description of the task environment and characterize it in terms of the properties: "Shopping for AI books on the Internet."

CO1 BL1 BL2

Q.1(b) (I) Interpret the task environment of the followings:

Task Environm ent	Fully / Partially observe d env.	Single/ Multiagent Env.	Deterministi c/ Stochastic/ Strategic	Episodic / Sequent ial	Discrete/ Continuou s
Chess with a clock					

[2+3=5] CO1 CO5 BL2 BL3

(II) Apply any of the agent designs (listed below) and describe its evolution from simple reflex agent to model-based agent to goal-based agent to utility-based agent in a partially observable environment.

"Vacuum agent" OR "Automated taxi driving as an example".

CO1 BL2 BL3

Q.2(a) (I) Describe the following terms (any two):

- 8-puzzle solution using any heuristic search technique (Apply Hill Climbing/Best first search / A\* algo.).
- Simulated Annealing with example.
- Genetic Algorithm with example.
- Describe A\* search strategy with the help of applying the following characteristics: Admissible heuristic, consistency, monotonicity, triangular inequality, and optimality.

[3+3=6] CO2 CO5 BL2 BL3

(II) In CSP problem, solve the following cryptarithmic problem:

SOME  
+ TIME

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SPENT

CO5 BL3

Q.2(b) A game tree for the game of tic-tac-toe. The top node is the initial state, and MAX moves first, placing an X in an empty square. We show part of the tree, giving alternating moves by MIN (O) and MAX (X), until we eventually reach terminal states, which can be assigned utilities according to the rules of the game. How minmax algorithm solves the tic-tac-toe problem by calculating backed up utility for winning X's or O's. And how Alpha-Beta pruning algorithm reduce the number of steps by pruning branches for this problem and how to measure the performance in terms of time complexity of alpha beta pruning.

[4] CO2 CO5 BL2 BL3

- Q.3(a)** (i) Formulate the following facts to predicate logic form and clausal form. [5] CO3 BL4  
And also proof the conclusion using resolution: BL5  
BL6
- Everyone who loves all animals is loved by someone.
  - Anyone who kills an animal is loved by no one.
  - Jack loves all animals.
  - Either Jack or Curiosity killed the cat, who is named Tuna.
- Conclusion: Did Curiosity kill the cat?
- (ii) Convert these statements in predicate logic.  
(iii) Convert these predicates to Clausal form.  
(iv) proof the question using resolution.
- Q.3(b)** Explain the following terms with example (any two):
- (i) Matching: Quantitative and qualitative measures for matching OR String and Graph Matching with one example. [2.5x2=5] CO3 BL2  
BL4  
BL5
  - (ii) Approaches to knowledge representation: Frame, Conceptual Graph and Conceptual dependencies with one example of each.
  - (iii) Forward vs Backward Reasonings: with one example of each.
- Q.4(a)** Differentiate the following terms with examples:
- (i) Monotonic Reasoning, Non-monotonic Reasoning and Default Reasoning with examples. [2x2.5=5] CO3 BL5  
BL3  
BL4
  - (ii) Open world and Close world assumption with examples.
- Q.4(b)** Make brief notes on the following themes, providing examples as evidence (any two): [2x2.5=5] CO4 BL3  
BL4  
BL5
- I. An illustration of the Dempster-Shafer Theory.
  - II. Goal-stack planning using a block world as an example.
  - III. Example-Based Induction Learning.
- Q.5(a)** Describe the terms NLP, NLU and NLG. Explain briefly - Morphology analysis, syntactic processing, Semantic analysis, and Pragmatic analysis of NLP with examples. [5] CO4 BL2  
BL3
- Q.5(b)** Define the term robotics. Explain the hardware component of robot and evaluate its path planning algorithms in certain and uncertain domains. [5] CO4 BL1  
CO5 BL2  
BL5