

**ARTIFICIAL INTELLIGENCE  
(MCAP 1103)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group - A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which of the following search methods is equal to MINIMAX search but eliminates the branches that can't influence the final decision?  
(a) DFS (b) BFS  
(c) Alpha-beta pruning (d) None of the mentioned.
- (ii) When is breadth-first-search optimal?  
(a) When there is less number of nodes (b) When all step costs are equal.  
(c) When all step costs are unequal. (d) Both (a) & (c).
- (iii) In Bays' theorem, what is the meant by  $P(X|Y)$ ?  
(a) The probability that hypotheses X is true given evidence Y  
(b) The probability that hypotheses X is false given evidence Y  
(c) The probability that hypotheses X is true given false evidence Y  
(d) The probability that hypotheses X is false given false evidence Y.
- (iv) Truth value of any propositional sentence can be computed by using which of the following:  
(a) Syntax of propositional logic (b) Semantics of propositional logic  
(c) both (a) and (b) (d) none of these.
- (v) In A\* algorithm,  $f(n) = g(n) + h(n)$ . Now, if  $h(n) = 0$  then the algorithm  
(a) becomes purely informed search (b) becomes purely BFS  
(c) cannot give any solution (d) will stop to a wrong solution
- (vi) Which part of the learning agent makes it adaptive?  
(a) Environment (b) Sensor  
(c) Critic (d) Actuator.

- (vii) The process of capturing the inference process as Single Inference Rule is known as:  
(a) Clauses (b) Ponens  
(c) Generalized Modus Ponens (d) Variables.
- (viii) If in a problem, the number of initial state is much more than the number of final state, then we should use  
(a) forward reasoning (b) backward reasoning.  
(c) both (a) & (b) (d) none of these.
- (ix) Which of the following is a proposition?  
(a) You may get 8.5 SGPA in the semester.  
(b) Be contented with what you are doing!  
(c) What an enchanting Rainbow!!  
(d)  $2 + 2 = 5$
- (x) Which of the following system can perform Turing test?  
(a) Eliza (b) MYCIN (c) Lisp (d) Honda Asimo.

### Group- B

2. (a) Illustrate the Goal based agent with suitable diagram. [(CO1) (Illustrate/LOCQ)]  
(b) Differentiate the Deep-Learning, Machine-Learning and Data-Sciences related with AI. [(CO1) (Differentiate/IOCQ)]  
(c) Generate the branching factor of the 8-Puzzle problem without heuristic. [(CO1)(Generate/HOCQ)]  
**4 + 5 + 3 = 12**
3. (a) Differentiate the informed and uninformed search techniques with example. [(CO1) (Differentiate/IOCQ)]  
(b) Illustrate the terms (1) sensors (2) activators (3) effectors. [(CO1) (Illustrate/LOCQ)]  
(c) Uninformed searching technique is optimal- Justify. [(CO1)(Judging/HOCQ)]  
**5 + 4 + 3 = 12**

### Group - C

4. (a) Illustrate how Alpha-Beta pruning modifies adversarial search? Explain with suitable example. [(CO2) (Illustrate/LOCQ)]  
(b) Consider the following set of premises.  
"If it does not rain or if it is not foggy, then the sailing race will be held and the lifesaving demonstration will go on".  
"If the sailing race is held, then the trophy will be awarded".  
"The trophy was not awarded"  
From the above set of premises interpret that - "It rained". [(CO2)(Interpreting/IOCQ)]  
(c) We have a pile of 5 stones and Alice and Bob are playing. Alice plays the first and Bob plays the second in an alternate fashion such that Alice removes odd

number of stones and Bob removes even number of stones. Whoever makes the pile empty will win. Construct the Game-Tree for the above.

[[CO2](Critiquing/HOCQ)]

4 + 5 + 3 = 12

5. (a) Given premises.

(1)  $P \wedge Q$

(2)  $P \rightarrow (Q \wedge R)$

(3)  $S \rightarrow R$

[[CO2] (Implementing/LOCQ)]

Applying the rules of inference prove the conclusion :  $S$

(b) Let us consider the premises: "If it does not rain or if it is not foggy then the sailing race will be held and life saving demonstration will go on". "If the sailing race is held then the trophy will be awarded "."The trophy was not awarded". Now make a conclusion that "It rained". [[CO2] (Illustrating/IOCQ)]

(c) Detect the soundness and completeness properties of the propositional Logic. [[CO2](Detecting/HOCQ)]

5 + 4 + 3 = 12

### Group - D

6. (a) "First Order Logic(FOL) is more sophisticated and far better than propositional logic"—Justify the statement. [[CO3] (Testing/HOCQ)]

(b) Explain the Unification rule in FOL.

Describe the step by step methods for proving a conclusion by Resolution.

The following statements are given:

1) The cat likes fish.

[[CO3] (Implementing/LOCQ)]

2) Cat eats everything they like.

3) Nany is a Cat.

Prove by Resolution that " Nany eats fish".

(c) Interpret with the FOL statements that

"some boys in the class are taller than all the girls"- [[CO3](Interpret/IOCQ)]

3 + 5 + 4 = 12

7. (a) If  $F(x, y, t): \neg \text{Person } x \text{ can fool person } y \text{ at time } t$ .

Now what is represented by the FOL formula

$\forall x \exists y \exists t (\sim F(x, y, t))$

[[CO3] (Identifying/LOCQ)]

(b) The following knowledge base is given

Rule-1: If A and C then E.

Rule-2: If A and E then G.

Rule-3: If B then E.

Rule-4: If G then D.

Now with the help of forward chaining technique implement that

If A and B is true then D is true.

[[CO3] (Understand/IOCQ)]

(c) Construct a semantic network for the following statements.

Tom is a cat. Tom caught a bird. Tom is owned by John. Tom is ginger in colour.

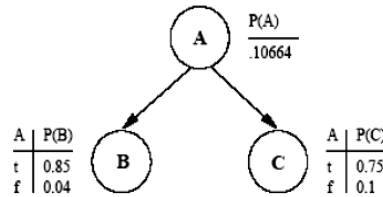
Cats like cream. The cat sat on the mat. A cat is mammal. A bird is an animal. All

mammals are animals. Mammals have fur. [[CO3](Criticizing/HOCQ)]

4 + 5 + 3 = 12

**Group - E**

8. (a) Illustrate with an emphasis on conditional probability with suitable example. [(CO4) (Remember/LOCQ)]  
 (b) Find the sources of uncertainty in Probabilistic reasoning. [(CO4) (Finding/IOCQ)]  
 (c) Construct Bays' Theorem. [(CO4)(Construct/HOCQ)]
- 4 + 5 + 3 = 12.**
9. (a) Consider the following Bayesian Network containing 3 Boolean random variables:



Compute the following quantities:

- (i)  $P(\sim B, C | A)$       (ii)  $P(A | \sim B, C)$       [(CO4) (Explaining/LOCQ)]  
 (b) Execute the failure of goal stack planning with an emphasis on 'Sussman Anomaly' using suitable diagram. [(CO4)(Execute/IOCQ)]  
 (c) Explain the terms Forward state space planning and Backward state space planning with their advantages and disadvantages. [(CO4)(Planning/HOCQ)]

**4 + 5 + 3 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	30%	43.33%	26.67%

**Course Outcome (CO):**

After the completion of the course students will be able to

1. Recognize the historical perspective of human endeavour to know about the nature of intelligence and the related mathematical models and also the role of intelligent agents to solve various real time problems.
2. Recognize knowledge representation using mathematical logic.
3. Recognize knowledge representation using First order logic and Rule based system.
4. Analyze uncertainty using planning, probabilistic reasoning, and use of certainty factors.
5. Able to understand the different forms of the learning models and intelligent agents related to various real life problems with the help of rule based system and uncertainty.
6. Perform the problem solving methodologies with the help of single agents, multi agents, propositional logic and first order logic with probabilistic reasoning.

\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

<b>Department &amp; Section</b>	<b>Submission Link</b>
<b>MCA</b>	<a href="https://classroom.google.com/c/NDQyMjAzMzY4MDc2/a/NDY0MzEwNjE0MDAw/details">https://classroom.google.com/c/NDQyMjAzMzY4MDc2/a/NDY0MzEwNjE0MDAw/details</a>