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 strategy is also called as blind search?
(a) Uninformed search (b) Informed search
(c) Simple reflex search (d) All of the above.

(ii) 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.

(iii) Which of the given language is not commonly used for AI?
(a) LISP (b) PROLOG (c) Python (d) Perl.

(iv) A perceptron is
(a) a single layer feed-forward neural network with pre-processing
(b) an auto-associative neural network
(c) a double layer auto-associative neural network
(d) a neural network that contains feedback.

(v) The performance of an agent can be better by which of the following?
(a) Learning (b) Observing
(c) Perceiving (d) None of these.

(vi) A* algorithm is based on
(a) Breadth-First-Search (b) Depth-First –Search
(c) Best-First-Search (d) Hill climbing.

(vii) Which value is assigned to alpha and beta in the alpha-beta pruning?
(a) Alpha = max (b) Beta = min.
(c) Beta = max (d) Both Alpha = max & Beta = min.

(viii) Which of the following methods is effective for escaping from local minima?
(a) Hill-climbing search algorithm (b) Simulated annealing
(c) Eliminating heuristic estimate (d) None of these.

(ix) Which of the following is tautology?
(a) $p \vee q \rightarrow p$ (b) $p \wedge q \rightarrow p$ (c) $p \rightarrow q$ (d) None of these.

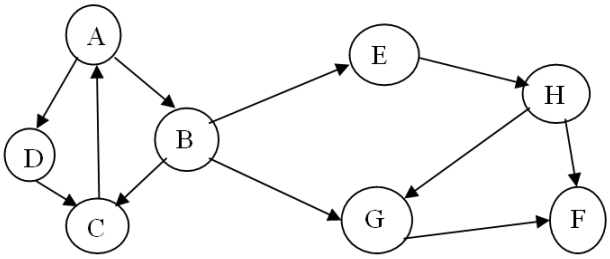
(x) What does the Bayesian network provide?
(a) Partial description of the domain
(b) Complete description of the problem
(c) Complete description of the domain
(d) None of the mentioned.

Group – B

2. (a) Briefly describe the relationships among AI, ML, DL and Data Science. Explain the difference between strong AI and weak AI with example. [(CO1)(Remember/LOCQ)]
(b) Explain A* algorithm as an Informed search technique with suitable example. [(CO2)(Exemplifying/LOCQ)]

(4 + 4) + 4 = 12

3. (a)



Consider the above graph. If there is ever a decision between multiple neighbour nodes in the BFS or DFS algorithms, we always choose the letter closest to the beginning of the alphabet first. In what order will the nodes be visited using a Breadth First Search? In what order will the nodes be visited using a Depth First Search? Explain briefly. [(CO2)(Apply/HOCQ)]

(b) Solve the 8-puzzle problem with heuristic as the "number of misplaced tiles" where the start and goal states are shown below. [(CO2)(Finding/IOCQ)]

START

1	2	3
	4	6
7	5	8

GOAL

1	2	3
4	5	6
7	8	

6 + 6 = 12

Group – C

4. (a) "To reduce the time and cost alpha-beta pruning method is used"- Justify the statement. [(CO4)(Evaluate/HOCQ)]
(b) Let us consider the premises: "Ram works hard". "If Ram works hard then he is a dull boy". "If Ram is a dull boy, then he will not get the job". Now make a conclusion that "Ram will not get the job". [(CO3)(Apply/IOCQ)]
(c) Verify that the proposition $p \vee \neg(p \wedge q)$ is a tautology. [(CO3)(Analyze/IOCQ)]

4 + 4 + 4 = 12

5. (a) "The most-constrained variable heuristic provides a way to select the next variable to assign in a backtracking search for solving a CSP" – Justify the statement. [(CO4)(Evaluate/HOCQ)]

(b) Consider the following classroom scheduling problem: There are four classes, C1, C2, C3, C4 and three class rooms, R1, R2, and R3. The following table shows the class schedule:

Class	Schedule
C1	8:00AM-10:30AM
C2	9:00AM-11:30AM
C3	10:00AM-12:30PM
C4	11:00AM-1:30PM

In addition, there are the following restrictions:
Each class must use one of the three rooms, R1, R2, R3.
R3 is too small for C3.
R2 and R3 are too small for C4.
Now, formulate the above problem as CSP. Provide the constraint graph.

[(CO4)(Implement/IOCQ)]

4 + 8 = 12

Group – D

6. (a) "First Order Logic (FOL) is more sophisticated and far better than propositional logic" — Justify the statement. [(CO3)(Evaluate/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:
(i) The cat likes fish.
(ii) Cat eats everything they like.
(iii) Nany is a Cat.
Prove by Resolution that "Nany eats fish". [(CO3)(Apply/IOCQ)]

4 + 8 = 12

7. (a) Name the different ways of representing knowledge in AI. Represent the following information using a semantic network.
Animals can be divided into various categories such as mammals and birds. Mammals have hair. They give milk too. Birds can fly and lay eggs. Animals who eat meat, are known as carnivore. These carnivore animals have pointed teeth, claws and forward eyes. Mammals who have hoofs or chew cud are known as ungulate. Cheetah is a mammal as well as a carnivore. It has tawny colour and dark spots. Giraffe is an ungulate. It has a long neck, long legs and dark spots. Zebra is also an ungulate with black stripes. Although a penguin is a bird, it cannot fly, but it can swim. It is coloured black and white. [(CO4)(Implement/IOCQ)]

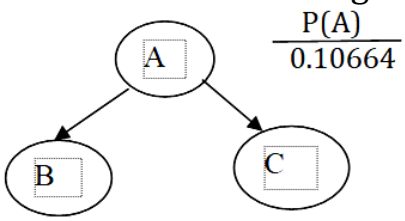
(b) Consider the following five statements:
(i) John likes all kind of food.
(ii) Apple and vegetables are food.
(iii) Anything anyone eats and not killed is food.
(iv) Anil eats peanuts and still alive.
(v) Harry eats everything that Anil eats.
Now prove by resolution that: "John likes peanuts". [(CO3)(Apply/IOCQ)]

4 + 8 = 12

Group – E

8. (a) Explain "conditional independence" between two events. State Bayes' Theorem with suitable example. [(CO6)(Explain/LOCQ)]

(b) Consider the following Bayesian Network containing 3 Boolean random variables.



A	P(B)
T	0.85
F	0.04

A	P(C)
T	0.75
F	0.1

Compute the following:
(i) P(¬B,C|A)
(ii) P(A|¬B,C). [(CO6)(Evaluate/HOCQ)]

(3 + 3) + (3 + 3) = 12

9. (a) Explain the failure of goal stack planning with an emphasis on "Sussman Anomaly". Using a suitable diagram. [(CO5)(Explain/LOCQ)]

(b) Define plan-space search. [(CO5)(Remember/LOCQ)]

(c) Given the causal dependencies of events: A→B→C where A→B means A causes B to happen. Compute P(A,B,C) when P(C|B) = 0.8, P(B | A) = 0.4 and P(A) = 0.9. [(CO6)(Execute/IOCQ)]

5 + 2 + 5 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	26.04	43.75	30.20

Course Outcome (CO):

After the completion of the course students will be able to

MCAP1103.1: Describe the role of agents and how it is related to environment and the way of performing it.

MCAP1103.2: Formalize the problem using searching algorithms (Uninformed, Informed, Heuristic, Adversarial Search etc) as a state space, graph.

MCAP1103.3: Solve complex problems based on the intelligent behaviour of humans using propositional and first-order predicate logic.

MCAP1103.4: Design AI machine and developing applications for real world problems using different learning techniques mentioned in syllabus.

MCAP1103.5: Recommend various logical techniques to perform logic based planning and it's representation of action.

MCAP1103.6: Apply the concept of Probabilistic Reasoning, Inference and Bayesian Networks to solve the real world problem.

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