# ARTIFICIAL INTELLIGENCE
## (ECE3131)

**Time Allotted : 2½ hrs** **Full Marks : 60**

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

***Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.***

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

## Group – A

1. Answer any twelve: **12 × 1 = 12**

*Choose the correct alternative for the following*

(i) Among the given options, which search algorithm requires less memory?
(a) Optimal Search (b) Depth First Search
(c) Breadth-First Search (d) Linear Search

(ii) Which rule is applied for the Simple reflex agent?
(a) Simple-action rule (b) Simple &Condition-action rule
(c) Condition-action rule (d) None of the above

(iii) Choose an algorithm where a loop that continually moves in the direction of increasing value – that is uphill.
(a) Up-Hill Search (b) Hill-Climbing
(c) Hill algorithm (d) Reverse-Down-Hill search

(iv) First order logic Statements contains_____.
(a) Predicate and Preposition (b) Subject and an Object
(c) Predicate and Subject (d) None of the above

(v) What are the two main features of Genetic Algorithm?
(a) Fitness function & Crossover techniques
(b) Crossover techniques & Random mutation
(c) Individuals among the population & Random mutation
(d) Random mutation & Fitness function

(vi) The inference engine works on _____.
(a) Forward Chaining (b) Backward Chaining
(c) Both (a) and (b) (d) None of the above

(vii) In Bayesian networks, what do directed edges represent?
(a) Dependency between variables (b) Independence between variables
(c) Conditional probability tables (d) Prior probabilities

(viii) P(A|B) is the conditional probability of
(a) occurring B, when A has occurred (b) occurring A, when B has occurred.
(c) occurring A & B jointly (d) None of above.

(ix) Which of the following is a disadvantage of decision trees?
(a) Factor analysis
(b) Decision trees are robust to outliers
(c) Decision trees are prone to be overfit
(d) None of the above

(x) The most widely used metrics and tools to assess a classification model are:
(a) Confusion matrix (b) Cost-sensitive accuracy
(c) Area under the ROC curve (d) All of the above

*Fill in the blanks with the correct word*

(xi) The environment of crossword puzzle is ____.

(xii) "For every a, if a is a PhD student, then a has a master degree" is represented in FOL as _____.

(xiii) Inference engines work on the principle of _____ chaining and _____ chaining.

(xiv) In K mean algorithm K stand for _____.

(xv) Hill-Climbing approach stuck at _____.

## Group - B

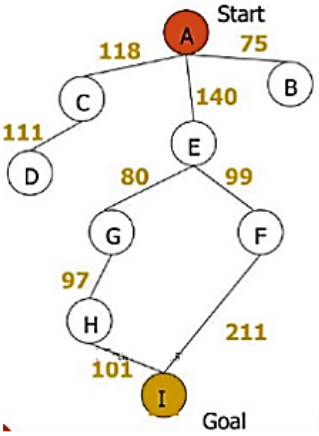
2. (a) Define intelligent agent. Distinguish between fully observable & partially observable environment. *[(CO1)(Remember/LOCQ, Analyze/IOCQ)]*

(b) List different types of agent present in Artificial Intelligence. Compare the features of simple reflex agent and model based reflex agent.
*[(CO1)(Remember/LOCQ, Analyse/IOCQ)]*

**(2 + 3) + (2 + 5) = 12**

3. (a) Define optimality of a searching algorithm. Distinguish between informed and uninformed searching. *[(CO2)(Remember/LOCQ, Analyse/IOCQ)]*

(b) Carry out greedy best first searching algorithm to find the path to the goal.




| State | Heuristic: h(n) |
|---|---|
| A | 366 |
| B | 374 |
| C | 329 |
| D | 244 |
| E | 253 |
| F | 178 |
| G | 193 |
| H | 98 |
| I | 0 |

***f(n) = h (n) = straight-line distance heuristic***

*[(CO2)(Apply/IOCQ]*

**(1 + 4) + (3 + 4) = 12**

## Group - C

4. (a) Identify the fundamental differences between Hill Climbing & Simulated Annealing algorithms. *[(CO2)(Analyse/IOCQ)]*

   (b) Follow the Simulated Annealing algorithm to find the minimum value of the function $f(x) = 500 - 20x_1 - 25x_2 - 4x_1 * x_2$. $-2 < x_1 < 10$; $-1 < x_2 < 11$. Perform single iteration only. *(CO2, Evaluate/HOCQ)*

**7 + (2 + 3) = 12**

5. (a) Explain local search. What is the significance of the term 'local' in local search? *[(CO2)(Analyse/IOCQ)]*

   (b) Follow Genetic algorithm to maximize $f(y) = y^3$ with y in the interval (1, 15). Perform single iteration only. *[(CO2,CO6)(Apply/IOCQ)]*

**(2 + 2) + 8 = 12**

## Group - D

6. (a) From the given rules and facts, conclude Kapil is an all-rounder using forward chaining.
   Rule1: IF a player is good in bowling session AND excellent in batting, THEN he is an all-rounder.
   Rule 2: IF a player gets 4 wickets in a session AND saves 20 runs during fielding THEN he is good in bowling session
   Rule 3 : IF the player is making century, THEN he is excellent in batting
   Facts (Data) : 1. Kapil got 4 wickets in a session. 2. Kapil is making century. 3. Kapil Saves 20 runs during fielding *[(CO3,CO6)(Evaluate/HOCQ)]*

   (b) Define prior probability. With proper example explain Bayesian network *[(CO3)(Remember/LOCQ, Analyze/IOCQ)]*

**6 + (2 + 4) = 12**

7. (a) The joint probabilities of cavity, toothache and catch of a patient be given as

| | *toothache* | | ¬ *toothache* | |
|---|---|---|---|---|
| | *catch* | ¬ *catch* | *catch* | ¬ *catch* |
| *cavity* | .108 | .012 | .072 | .008 |
| ¬ *cavity* | .016 | .064 | .144 | .576 |

   Find the probability of toothache, joint probability of toothache and cavity, conditional probability of having cavity when one has toothache. *[(CO4)(Apply/IOCQ)]*

   (b) Explain the concept of Bayesian network with an example. *[(CO4)(Analyse/IOCQ)]*

**6 + 6 = 12**

## Group - E

8. (a) What are Decision Trees? Explain the structure of Decision Tree. *[(CO5)(Remember/LOCQ,Analysis /IOCQ)]*

   (b) For the given dataset construct a decision tree to predict whether a customer will be a computer or not

| Age | Student | Buys Computer | Age | Student | Buys Computer |
|---|---|---|---|---|---|
| <=30 | No | No | <=30 | No | No |
| <=30 | No | No | <=30 | Yes | Yes |
| >30 | No | Yes | <=30 | Yes | Yes |
| >30 | No | Yes | >30 | Yes | Yes |
| >30 | Yes | Yes | >30 | No | Yes |

*[(CO5,CO6)(Analysis/IOCQ)]*

**(2 + 3) + 7 = 12**

9. (a) Define Margin. What are Hard-Margin and Soft-Margin SVMs? *[(CO5)(Remember/LOCQ)]*

(b) Apply Z-score algorithm for the following data

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| Subject | Credit |
|---|---|
| MA | 2 |
| Project | 6 |
| PHY | 4 |
| ECE | 3 |
| Design | 5 |

*[(CO5)(Apply/IOCQ)]*

(c) Write down the advantages of SVM. *[(CO5)(Analyse/IOCQ)]*

**(2 + 3) + 3 + 4 = 12**

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| Cognition Level | LOCQ | IOCQ | HOCQ |
|---|---|---|---|
| Percentage distribution | 14.58 | 73.96 | 11.96 |