

Sixth Semester B. E. (Computer Science and Engineering) Examination

ARTIFICIAL INTELLIGENCE

Time : 3 Hours]

[Max. Marks : 60

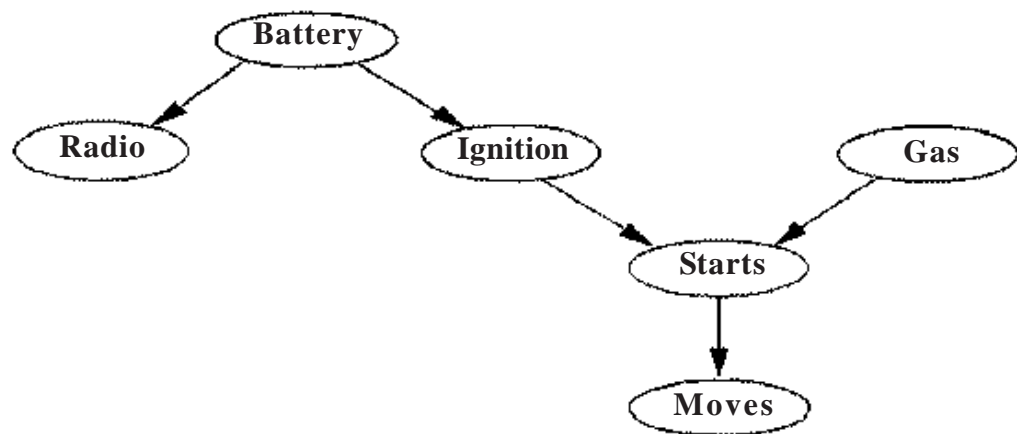
Instructions to Candidates :—

- (1) Attempt any **Two** sub questions from each question.
- (2) All questions carry equal marks.
- (3) Explain your answer with neat sketches, wherever applicable.

1. (a) For each of the following activities, give a PEAS description of the task environment and characterize it in terms of the properties of task environments.
 - (i) Shopping for used AI books on the Internet.
 - (ii) Playing a tennis match. 5(CO1)
- (b) Suppose two friends live in different cities on a map, such as the Romania map. On every turn, we can simultaneously move each friend to a neighboring city on the map. The amount of time needed to move from city i to neighbor j is equal to the road distance $d(i, j)$ between the cities, but on each turn the friend that arrives first must wait until the other one arrives (and calls the first on his/her cell phone) before the next turn can begin. We want the two friends to meet as quickly as possible.
 - (i) Write a detailed formulation for this search problem. (You will find it helpful to define some formal notation here).
 - (ii) Let $D(i, j)$ be the straight–line distance between cities i and j . Which of the following heuristic functions are admissible ?
 - (1) $D(i, j)$; (2) $2 \times D(i, j)$; (3) $D(i, j) / 2$.
 - (iii) Are there completely connected maps for which no solution exists ?
 - (ic) Are there maps in which all solutions require one friend to visit the same city twice ? 5(CO1)

- (c) Give the algorithm for breadth first search. Use BFS to solve 3 – water jug problem. 5(CO1)
2. (a) Write a condition with an example to justify each of the following statement.
- (i) Breadth – first search is a special case of uniform – cost search.
 - (ii) Uniform – cost search is a special case of A* search.
 - (iii) Best first search is a special case of A* search. 5(CO2)
- (b) Summarises the A* algorithm and explain it with 8 – puzzel problem up to 3 iterations. 5(CO2)
- (c) Write an algorithm for Hill Climbing. "A local maximum is a problem in Hall Climbing", Explain this statement with 8 – queen problem. Given : Initially all the 8 – queens are on the chessboard. 5(CO2)
3. (a) Consider a vocabulary with the following symbols :
- Occupation (p , o) : Predicate. Person p has occuption o.
 Customer (p1 , p2) : Predicate. Person p1 is a customer of person p2.
 Boss (p1 , p2) : Predicate. Person p1 is a boss of person p2.
 Doctor , Surgeon , Lawyer , Actor : Constants denoting occupations.
 Emily , Joe : Constants denoting people.
 Use these symbols to write the following assertions in first – order predicate logic :
- (a) Emily is either a surgeon or a lawyer.
 - (b) Joe is an actor, but he also holds another job.
 - (c) All surgeons are doctors.
 - (d) Joe does not have a lawyer. (i. e., is not a customer of any lawyer).
 - (e) Emily has a boss who is a lawyer. 5(CO3)
- (b) Write a Unification algorithm with an example. 5(CO3)
- (c) Write a Script for "Eating in a Restaurants". 5(CO3)

4. (a)



Consider the network for car diagnosis shown in above Figure.

- (a) Extend the network with the Boolean variables IcyWeather and StarterMotor.
 - (b) Give reasonable conditional probability tables for all the nodes.
 - (c) How many independent values are contained in the joint probability distribution for eight Boolean nodes, assuming that no conditional independence relations are known to hold among them ?
5(CO4)
- (b) We have a bag of three biased coins a, b and c with probabilities of coming up heads of 20% ,60% and 80% repsectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins), and then the coin is flipped three times to generate the outcomes X1 ,X2 and X3.
 - (a) Define the necessary CPTs for this setup.
 - (b) Calculate which coin was most likely to have been drawn from the bag if the observed flips come out heads twice and tails once.
5(CO4)
 - (c) How the basic operations like Union, Intersection and set difference are defined in terms of membership function on the fuzzy sets. Explain with an example.
5(CO4)

5. (a) Consider the following data set comprised of three binary input attributes (A₁, A₂ and A₃) and one binary output :

Example	A ₁	A ₂	A ₃	Output y
x ₁	1	0	0	0
x ₂	1	0	1	0
x ₃	0	1	0	0
x ₄	1	1	1	1
x ₅	1	1	0	1

Use the corresponding algorithm to learn a decision tree for these data. Show the computations made to determine the attribute to split at each node. 5(CO5)

- (b) Construct a neural network that compute the AND function of three inputs. Make sure to specify what sort of units you are using. 5(CO5)
- (c) Write a short note — Probabilistic learning model. 5(CO5)

6. (a) Consider the knowledge base given as

Y & D → Z
 X & B & E → Y
 A → X
 C → L
 L & M → N

And the contents in the database are A, B, C, D, E.

Prove that 'Z' is true by using forward and backward chaining. Also List down the difference between forward and backward chaining. 5(CO6)

- (b) Write in detail about following expert systems
 (1) MYCIN (2) DENDRAL 5(CO6)
- (c) List and explain the main players involved in expert system development. 5(CO6)