

**ARTIFICIAL INTELLIGENCE
(INFO 4111)**

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) A* follows the heuristic function given in
(a) $f(n)=g^*(n)+h(n)$ (b) $f(n)=g^*(n)+h^*(n)$
(c) $f(n)=g(n)+h^*(n)$ (d) None of the above
- (ii) Which agent deals with the happy and unhappy states?
(a) Utility based agent (b) Goal based agent
(c) Learning agent (d) Model based agent
- (iii) According to Modus Ponens Inference rule from P and $P \rightarrow Q$ infer
(a) P (b) Q (c) $\sim P$ (d) $\sim Q$
- (iv) A Horn Clause is a Clause with _____ positive literal.
(a) at most one (b) at most two
(c) at most four (d) at least one
- (v) An algorithm gives optimal solution.
(a) BFS (b) DFS
(c) A* (d) Blind Search
- (vi) The Skolem function used to remove
(a) α (b) β (c) \forall (d) \exists
- (vii) Local maximum plateau, Ridge are the difficulties in which searching algorithms?
(a) A* (b) Hill Climbing
(c) Stimulated Annealing (d) Best First Search
- (viii) Given $U=\{1,2,3,4,5,6,7\}$, Fuzzy Set $K=\{(3,0.7),(5,1),(6,0.8)\}$ then $\sim K$ will be
(a) $\{(7,0.3),(5,0),(4,0.2)\}$ (b) $\{(3,0.3),(5,0),(4,0.2)\}$
(c) $\{(3,0.3),(4,0.2)\}$ (d) $\{(3,0.3),(5,0),(4,0.2),(9,1)\}$

- (ix) The search algorithm removes the branches that don't affect the final output?
 (a) Max-Min (b) Alpha-Beta Pruning
 (c) Uniform Cost Search (d) A*
- (x) If h_1 and h_2 are two admissible heuristic functions then which of the following may not be admissible?
 (a) $\min(h_1, h_2)$ (b) $\max(h_1, h_2)$ (c) $h_1 + h_2$ (d) $(h_1 + h_2)/2$

Group- B

- 2 (a) You are given two jugs, a 4-gallon one and a 3-gallon one. Neither have any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into the 4-gallon jug? Give the state space diagram. [(CO2) (Apply/IOCQ)]
 - (b) Solve 8 puzzle problem using heuristic. [(CO2) (Apply/IOCQ)]
- 6 + 6 = 12**

- 3. (a) What is tautology? [(CO4) (Remember/LOCQ)]
 - (b) Justify that, $(P \rightarrow Q) \vee (Q \rightarrow P)$ is a tautology. [(CO4) (Evaluate/HOCQ)]
 - (c) Three missionary and three cannibals are standing in a left bank of a river. There is a boat having a capacity of taking two people and it can be driven by a missionary or cannibal. If the number of missionaries is less than the number of cannibals at any bank then cannibal will eat missionary. How is it possible for all the missionaries and cannibals to cross the river such that no missionary is getting eaten? Give state space diagram. [(CO2) (Apply/IOCQ)]
 - (d) Describe PEAS for hospital management system. [(CO1)(Understand/LOCQ)]
- 2 + 3 + 5 + 2 = 12**

Group - C

- 4. (a) What is heuristic function? [(CO3) (Remember/LOCQ)]
- (b) When an algorithm is said to be admissible? [(CO3) (Understand/LOCQ)]
- (c) Apply A* algorithm to find out the shortest path from start node a to goal node z for the following graph given in fig.1:

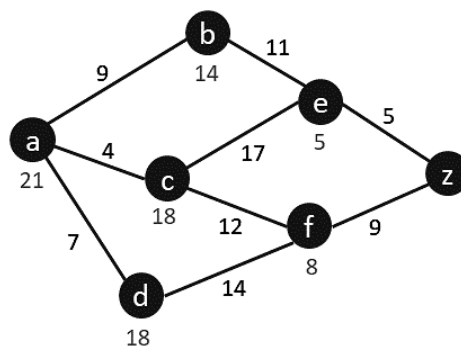


Fig.1

[(CO3) (Apply/IOCQ)]
3 + 3 + 6 = 12

5. (a) Discuss the complexity of bidirectional search. [(CO3) (Remember/LOCQ)]
(b) Write the advantages of alpha beta pruning algorithm with a suitable diagram. [(CO3) (Understand/LOCQ)]
(c) Prove that if a heuristic is consistent, it must be admissible. [(CO3) (Evaluate/HOCQ)]
(d) Differentiate between Greedy best first search and best first search. [(CO3)(Understand/LOCQ)]
- 3 + 3 + 3 + 3 = 12**

Group - D

6. (a) What do you mean by Horn Clause? Give example. [(CO4)(Understand/LOCQ)]
(b) Write the predicate logic representations for the following sentences:
(i) Anything anyone eats and not killed is food.
(ii) Anil eats peanuts and still alive
(iii) Harry eats everything that Anil eats
(iv) Every person in the party loves every child. [(CO4)(Analyze/IOCQ)]
- 4 + (4 × 2) = 12**

7. (a) Write a prolog programme to
(i) find the factorial of a given number
(ii) check whether a input number is prime or not. [(CO4) (Apply/IOCQ)]
(b) Let R and S be two fuzzy relations defined here in fig.2:

$$R = \begin{matrix} & y_1 & y_2 \\ x_1 & \begin{bmatrix} 0.7 & 0.5 \end{bmatrix} \\ x_2 & \begin{bmatrix} 0.8 & 0.4 \end{bmatrix} \end{matrix} \quad S = \begin{matrix} & z_1 & z_2 & z_3 \\ y_1 & \begin{bmatrix} 0.9 & 0.6 & 0.2 \end{bmatrix} \\ y_2 & \begin{bmatrix} 0.1 & 0.7 & 0.5 \end{bmatrix} \end{matrix}$$

Fig.2

Compute the result R_oS using max-min composition and R.S using max product composition. [(CO4) (Apply/IOCQ)]

(3 + 3) + 6 = 12

Group - E

8. (a) What do you mean by total order planning? [(CO6) (Remember/LOCQ)]
(b) Formulate Monkey banana problem by STRIPS. [(CO6) (Apply/IOCQ)]
- 4 + 8 = 12**
9. (a) Explain the components of an expert system with a suitable diagram. [(CO5) (Understand/LOCQ)]
(b) Write the flowchart of perceptron algorithm. [(CO5) (Remember/LOCQ)]
(c) Describe different activation functions used in neural network. [(CO5)(Remember/LOCQ)]
- 3 + 5 + 4 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	40.63%	53.12%	6.25%

Course Outcome (CO):

- 1) Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
- 2) Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- 3) Explore various searching algorithms (uninformed, informed, heuristic, Adversarial Search etc).
- 4) Represent knowledge using propositional and first-order predicate logic in order to solve complex problems based on the intelligent behaviour of humans.
- 5) Use different machine learning techniques to design AI machine and developing applications for real world problems.
- 6) Attain the capability to represent various real life problem domains using logic-based techniques and use this to perform inference or planning.

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

Department & Section	Submission Link
IT	https://classroom.google.com/c/NDA1MjM5MzM2MDMy/a/NDYzNjgwMzU5ODUx/details