

**AC-2338**

**M.Sc. (CS) I Semester Examination, Dec.-2022**

(Held in April - 2023)

(NEP Fresh Course)

**Foundation of Artificial Intelligence**

**Paper : C-102 (B070702T)**

**Time : Three Hours ]**

**[ Maximum Marks : 75**

**Note :** Attempt any **five** questions out of **eight**. Each question carries equal marks.

1. (a) Define the following terms: (3+2+2)
  - (i) Problem Domain of AI
  - (ii) Physical symbol system hypothesis
  - (iii) Intelligent Agents
- (b) Find the Probability of the event A occurring when it is known that some event B has occurred. From experiment, it has been determined that  $P(B/A)=0.80$ ,  $P(A)=0.20$  and  $P(B)=0.30$ . Prove that if A and B are independent,  $P(A/B)=P(A)$ . Note that A and B are independent if and only if  $P(A \cap B)=P(A)P(B)$ . Also prove that  $P(\bar{A})=1-P(A)$  and that  $P(\bar{B}/A)=1-P(B/A)$ . 5
- (c) Represent the following with conceptual dependencies: 3

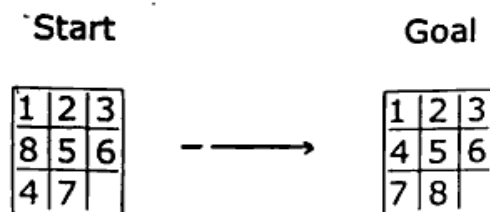
A fast food restaurant
2. (a) Define the following terms: 8
  - (i) State space
  - (ii) Search space
  - (iii) Production system
  - (iv) Control strategies
- (b) Consider a finite search tree of depth d and branching factor b (A tree consisting of only a root node has depth zero a tree consisting of a root node and its  $b^s$  successors has depth 2 etc) Suppose the shallowest goal node is at depth  $g=d$  and the last node has been expanded at the level d. Now prove that the number of nodes gen-

erated in breadth first search and in iterative deeping will satisfy the following relationship : 7

$$\frac{N_{id}}{N_{bfs}} = \frac{b}{b-1}$$

If  $b=20$ , then how many more number of nodes will generate in iterative deeping with respect to BFS.

3. (a) What is Heuristic Search? Consider trying to solve the 8-puzzle using the hill climbing heuristic. Can you find a heuristic function that makes this work? Make sure it works on the following example: 7



- (b) What is the Admissibility of  $A^*$  algorithm? Give a simple example to show that if the state evaluation function returns very high values, the search will not necessarily find the optimal solution. If the monotone restriction is satisfied the  $f'$  value of the sequence of nodes expanded by  $A^*$  is non decreasing. How does  $AO^*$  differs from the  $A^*$  algorithm? 8

4. (a) Prove that validity of the given wff using the method of resolution: 3

$$(\exists x)(\exists y)\{[P(f(x) \wedge Q(f(B)))] \Rightarrow [P(f(A)) \wedge P(y) \wedge Q(y)]\}$$

- (b) Show by the resolution refutation that the following formula is a tautology: 3

$$(P \rightarrow Q) \rightarrow [(R \vee P) \rightarrow (R \vee Q)]$$

- (c) Consider the following factors: 3

- (i) Who ever can read is literate
- (ii) Dolphins are not literate
- (iii) Some Dolphins are intelligent

From these statements, Prove the following using resolution:

"Some who are intelligent can not read."

(d) What do you understand with object centered structure of knowledge representation? What are its advantages? Define the following: 6

- (i) Class inclusion
- (ii) Class membership
- (iii) Meta class
- (iv) Regular class

Construct the semantic net for the following statement

"Every better hit a Ball"

8

5. (a) Consider the following fact and rules:

F1: Fido is a Dog

F2: Fido does not bark

F3: Fido wags the tail

F4: Pusy is meows

R1: All the dogs those wage the tail are friendly

R2: All the dogs are animals

R3: All the cats are meows

R4: All the cats are animals

R5: All the friendlies and all those do not bark are not affraid.

Now, with the help of Backward deduction system Prove that: "Is there are cat and a dog such that the cat is unafraid of the dog"

(b) What is learning? What are the different form of the learning? Discuss the following with example: 7

- (i) Inductive learning
- (ii) Decision tree
- (iii) Senseless learning
- (iv) Knowledge in learning

6. (a) What is expert system? Explain basic components of an Expert system with the help of a diagram. What is the role of Truth Maintenance System (TMS) in expert system? A doctor knows that the disease X causes the patient to have Y, say 40% of the time. The doctor also knows some unconditional facts: The prior probability that a patient has X is  $1/500$ , and the Prior probabilities that any Patient has a Y is  $1/10$ . Letting s be the proposition that the patient has a y and m be the proposition that the patient has X. Now find  $P(s/m)$ . 9

(b) Define the following terms: 6

- (i) Representational Adequacy

(ii) Inferential Adequacy

(iii) Inferential Efficiency

7. (a) Discuss the constraint Satisfaction algorithm. Trace the constraint satisfaction procedure for solving the following cryptarithmic problem: 7

$$\begin{array}{r} \text{C R O S S} \\ + \text{R O A D S} \\ \hline \text{D A N G E R} \end{array}$$

- (b) What is frame structure? In which way it differs from the Semantic Net? Draw the Semantic Net for the following: 5

(i) Merry gave the green flowered to her favourite cousin

(ii) John is a Programmer or Merry is a lawyer.

- (c) The logic operator  $\leftrightarrow$  is read as "If and only if".  $P \leftrightarrow Q$  is defined as being equivalent to  $(P \rightarrow Q) \wedge (Q \rightarrow P)$ . Based on this definition. Show that:  $(P \rightarrow Q)$  is logically equivalent to  $(P \vee Q) \rightarrow (Q \wedge P)$  without using truth table. 3

8. (a) Differentiate between the following: 5

(i) Uniform cost search & Branch-and-board search

(ii) Max-min search and  $\alpha$ - $\beta$  cut off search

- (b) Consider the following Joint Probability distribution 5

	toothache		7 toothache	
	Catch	7Catch	Catch	7Catch
Cavity	0.108	0.012	0.072	0.008
7 Cavity	0.016	0.064	0.144	0.576

Calculate the following:

(i)  $P(\text{toothache})$

(ii)  $P(\text{Cavity})$

(iii)  $P(\text{Toothache}/\text{Cavity})$

(iv)  $P(\text{Cavity}/\text{Toothache} \vee \text{Catch})$

- (c) Define the following terms: 5

(i) Simulated Annealing

(ii) Bayesian Network

(iii) Natural Deduction System