Question Paper

Exam Date & Time: 14-Jun-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH END SEMESTER MAKEUP EXAMINATIONS, JUN 2024

ARTIFICIAL INTELLIGENCE [CSE 2225]

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Analyse the capabilities a computer would need to pass Turing test? (2)

A)

B) Give schematic diagram for the simple reflex and model based reflex agent. What kind of knowledge are required in order to update the internal state of a model-based agent? Explain with examples. (4)

C) List the different types of task environment in which agent has to operate. Assess the type of task environment of a taxi driving agent and give reasoning for the chosen types. (4)

2) You are given two jugs, a 4-gallon and a 3-gallon jug. Neither has any measuring marks on it. There is a pump that can be used to fill the jugs with water. (2)

A) Measure exactly 2 gallons of water in the 4-gallon jug.

Give the production rules to solve water jug problem.

Use (X,Y) format where X represents the number of gallons of water in the 4-gallon jug and Y represents the quantity of water in the 3-gallon jug.

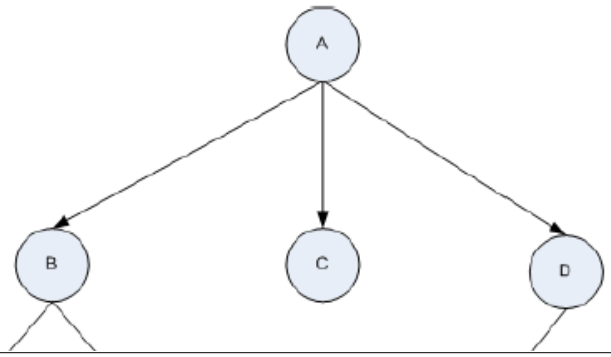
B) In the following graph shown in Figure Q2B, if A is the start vertex and G is the goal state determine the order of traversal with steps using graph search strategy (follow alphabetical order during the traversal) if the search algorithm uses (4)

i. Breadth First Search

ii. Depth First Search

iii. Depth limited search limit =2 (level starts at 1)

iv. Iterative deepening depth first search



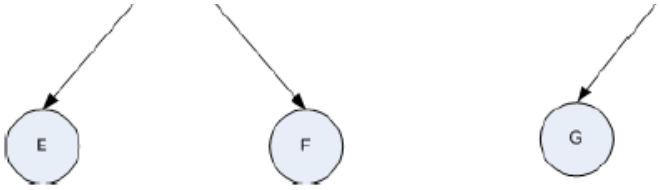


Figure Q2B

C) Suppose a genetic algorithm uses chromosomes of the form **x= abcdefgh** with a fixed length of 8 genes. Each gene can be any digit between 0 and 9. Let the fitness of the individual x be calculated as: (4)

F(x) = (a+b) - (c+d) + (e+f) - (g+h)

And let the initial population consist of 4 individuals with the following chromosomes:

x1 = 65413532

x2 = 87126601

x3 = 23921285

x4 = 41852094

i. Evaluate the fitness of each individual, showing all your workings, and arrange them in order with the fittest first and the least fit last. (1M)

ii. Perform the following crossover operations:

1. Cross the fittest two individuals using one-point crossover at the middle point. (0.5M)
2. Cross the second and third fittest individuals using a two-point crossover (points b and f). (0.5M)
3. Cross the first and third fittest individuals (ranked 1st and 3rd) using a uniform crossover. (random exchange of genes at positions a, d and f) (1M)

iii. Suppose the new population consists of the six offspring individuals received by the crossover operations in the above question. Evaluate the fitness of the new population, showing all your workings. Has the overall fitness improved? (1+0.5 M)

3) Considering **S** and **G** as the source node and the goal node respectively find the path using A*(star) search algorithm from **S** to **G** using graph search strategy for the graph in Figure Q3A. Show the result in steps showing each iteration as a tree and display the Frontier and Explored Set for each step. (3)

A)

The heuristics value of each node is specified in the table.

S	A	B	C	D	E	G
30	4	6	12	6	9	0

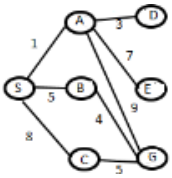


Figure Q3A

B) Compare the breadth first search algorithm and uniform cost search algorithm. Comment on the performance analysis of these algorithms. (2)

C) Elucidate the need for constraint satisfaction problem and its applications. Further solve the following cryptarithmetic problem by uniquely assigning a value between 0 - 9 for the given alphabets. (5)

B L A C K

G R E E N

O R A N G E

4) Convert the given sentence into a Conjunctive Normal Form (CNF) and outline the advantages & disadvantages of CNF sentences. (2)

A) $B_{1,1} \Leftrightarrow (P_{1,2} \vee P_{2,1})$

B) Represent the following sentences using first order predicate logic. (4)

1

a. Anything anyone eats and not killed is food.

b. Anil eats peanuts and still alive

c. Harry eats everything that Anil eats.

d. There is someone who eats fruits and fell sick

e. Anil eats fruits and fell sick

f. All men either likes fruits or hates vegetables**(represent using inclusive-or and exclusive-or)**

g. All animals like fruits **(show quantifier duality)**

h. Not all men like vegetables **(show quantifier duality)**

C) The diagram depicts digital circuit C1, purported to function as a one-bit full adder. The first two inputs represent the bits to be added, while the third input denotes a carry bit. The first output provides the sum, and the second output furnishes the carry bit for subsequent addition. This circuit comprises two XOR gates (X1, X2), two AND gates (A1, A2), and one OR gate (O1). For a given digital circuit, analyze the seven-step process for knowledge engineering with appropriate predicates. (4)

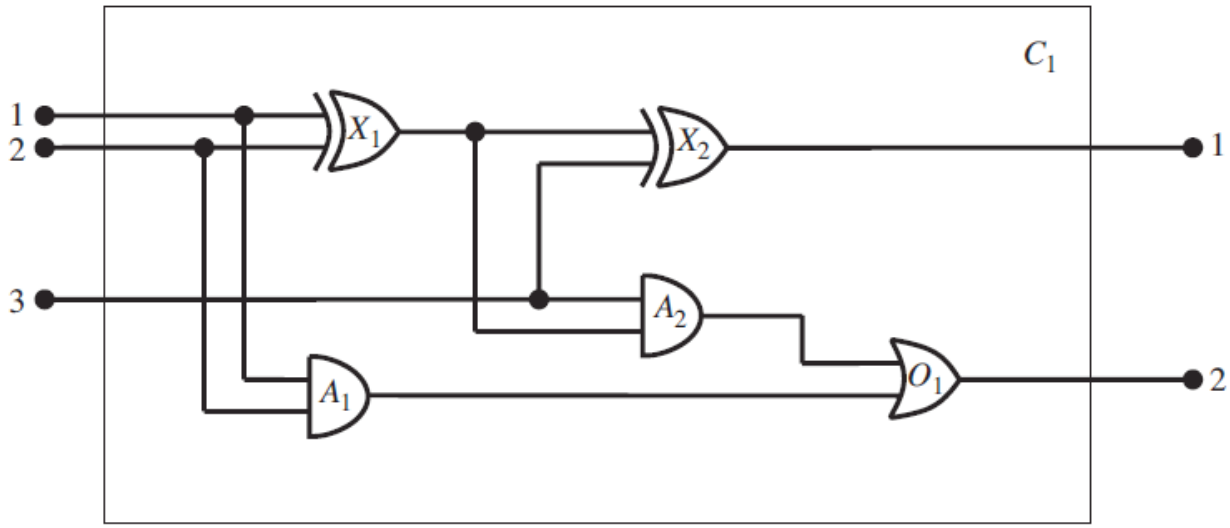


Figure Q4C

5) Compare procedural and declarative knowledge within the realm of knowledge representation in Artificial Intelligence. (2)

A)

B) Provide a comprehensive overview of expert systems, including their architecture, knowledge representation methods, inference mechanisms, and practical applications in various domains. (3)

C) Discuss the necessity of quantifying uncertainty and provide an example illustrating why propositional or first-order logic is inadequate for quantifying uncertainty. Additionally, outline various probability theorems used for quantifying uncertainty. (5)

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