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18CS753

Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025
Introduction to Artificial Intelligence

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Solve the 8-puzzle problem given below statement and table. Analyze the problem using Heuristic function appropriate to solve them:
   Statement: "The 8-puzzle is a square tray in which are placed, eight square tiles. The remaining ninth square is uncovered. Each tile has a number on it. A tile that is adjacent to the blank space can be slid into the space. A game consists of a starting position and a specified goal position. The goal is to transform the starting position into the goal position by sliding the tiles around".

Start State

2	8	3
1	6	4
7		5

Goal State

1	2	3
8		4
7	6	5

(10 Marks)

   b. Solve the Tic-Tac-Toe problem series using artificial intelligence technique by addressing the following properties with necessary algorithms using all the versions of the programs and algorithms:
   i)   Its complexity
   ii)   Provide the generalized solution.
   iii) Providing the clarity of knowledge.
   iv)   The extensibility of their approach. Thus it moving toward being representations of what we call AI techniques. (10 Marks)

OR

2 a. Explain and solve the water jug problem using the production rules. (10 Marks)
   b. Solve the following cryptarithmetic problem: SEND + MORE = MONEY? (10 Marks)

Module-2

3 a. Consider the following set of sentences:

   I.   Marcus was a man
   II.   Marcus was a Pompeian
   III. All Pompeians were Romans
   IV.   Caesar was a ruler.
   V.   All Romans were either loyal to Caesar or hated him.
   VI.   Everyone is loyal to someone.
   VII. People only try to assassinate rulers they are not loyal to.
   VIII. Marcus tried to assassinate Caesar.

Continued on next page…

    i)   Translate all the sentences into formulas in predicate logic and prove the statement and answer the question "Did marcus hate Caesar?"

    ii)   Prove the statement:

       $\neg$ alive (Marcus, now)

       Using the resolution to derive proof of the statement using chain of reasoning.

    iii) Convert formulas of 'isa' and 'instance' relationship into clause form of algorithm. **(10 Marks)**

b. State and explain the different approaches of knowledge representation in AI with examples of knowledge representation in AI with examples and also briefly discuss the issues in knowledge representation with examples? **(10 Marks)**

OR

4 a. Discuss and differentiate between the resolution in propositional logic algorithm and resolution in predicate logic algorithm. Providing the resolution proof and using resolution with equality and reduce using examples? **(10 Marks)**

b. Trace the operation of the unification algorithm on each of the following pair of literals:
    i)   f(Marcus) and f(Caesar)
    ii)   f(x) mdf(g(y))
    iii) f(Marcus, g(x, y)) and f(x, g (Caesar, Marcus)). **(05 Marks)**

c. Suppose that we are attempting to resolve the following clauses:
    loves (father (a), a)
    $\neg$ loves (y, x) v loves (x, y).
    i)   What will be the result of the unifications algorithm when applied to clause 1 and the first term of clause 2?
    ii)   What must be generated as a result of resolving these two caluses?
    iii) What does this example show about the order in which the substitution determined by the unification procedure must be performed? **(05 Marks)**

Module-3

5 a. The classic example of nonmonotonic reasoning involves birds and flying. In particular, consider the following facts:
    i)   Most things do not fly.
    ii)   Most birds do fly, unless they are two young or dead or have a broken wing.
    iii) Penguins and Ostriches do not fly.
    iv) Magical Ostriches fly.
    v)   Tweety is a bird.
    vi) Chirpy is either a Penguin or an Ostrich.
    vii) Feathers is a magical Ostrich.

Use one or more of the nonmonotonic systems we have discussed to answer the following questions:
- Does Tweety fly?
- Does Chirpy fly?
- Does Feather fly?
- Does Paul fly? **(10 Marks)**

b. Explain DEMPSTER-SHAFER THEORY. **(10 Marks)**

OR

6 a. Consider the following set of propositions:
  - Patient has spots
  - Patient has measels
  - Patient has high fever
  - Patient has rocky mountain spotted fever.
  - Patient has previous been inoculated against measels.
  - Patient was recently bitten by a tick
  - Patient has an allergy.

  i) Create a Bayesian network that defines the causal connections among these nodes.
  ii) Make it a Bayesian network by constructing the necessary conditional probability matrix? **(05 Marks)**

  b. Consider the same above given propositions again and assume the task is to identify the patients disease using Dempster-Shafter theory and answer the following:
  i) What is Θ?
  ii) Define a set of 'm' function that describe the dependencies among sources of evidence and elements of Θ.
  iii) Suppose we have observed spots fever, and a tick bite. In that case what is our:
      Bel ({RockyMountainSpottedFever})? **(05 Marks)**

  c. Explain and Justify the implementation of DFS and BFS in the context of reasoning with examples. **(10 Marks)**

Module-4

7 a. In the following simple context free, phrase structure grammar for English:

S → NP VP
NP → the NP1
NP → PRO
NP → PN
NP → NP1
NP1 → ADJS N
ADJS → ε | ADJ ADJS
VP → V
VP → V NP
N → file | printer
PN → Bill
PRO → 1
ADJ → Short | long | fast
V → printed | created | went

For each of the following sentences below show a parse tree. For each of them, explain what knowledge, in addition to the grammar of English, is necessary to produce the correct parse. Expand the above given simple grammar given above as necessary to do this for the following sentences:
  - John wanted to go to the movie with Sally.
  - John wanted to go to the movie with Robert Redford.
  - I heard the story listening to the radio.
  - I heard the kids listening to the radio.
  - All books and magazines that deal with controversial topics have been removed from the shelves.
  - All books and magazines that come out quarterly have been removed from the shelves.
  (10 Marks)

b. Discuss MINIMAX (position, depth, player) algorithm with example used for MINIMAX search procedure. **(10 Marks)**

OR

8 a. In the following paragraph, show the antecedents for each of the pronouns. What knowledge is necessary to determine each?
"John went to the store to buy a shirt. The sales clerk asked him if he could help him. He said he wanted a blue shirt. The sales clerk found one and he tried it on. He paid for it and left. **(10 Marks)**

b. Discuss ALPHA-BETA CUTTOFFS algorithm using MINIMAX-A-B (position, depth, player, use-thresh, pass-thresh). **(10 Marks)**

Module-5

9 a. Discuss Winston's learning program with example. **(10 Marks)**

b. Describe the steps involved in knowledge acquisition for building expert systems with example. **(10 Marks)**

OR

10 a. Discuss the expert systems using knowledge representation and using domain knowledge, acquisition and explanation using suitable example. **(10 Marks)**

b. Describe the role of discovery in learning process and explain all the three types of automated discovery systems. **(10 Marks)**

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