BE2-R3: ARTIFICIAL INTELLIGENCE AND APPLICATIONS

NOTE:

1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

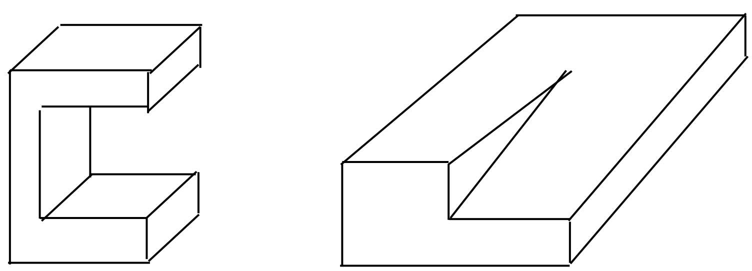
1.

a) Discuss with examples the scope and limitations of knowledge representation using:
   i) Propositional Logic
   ii) First Order Predicate Logic
b) Explain the principles of *means_end-analysis* approach to problem solving.
c) Explain the desirable characteristics of control strategies as used in production systems.
d) Justify the statement-*A game tree is an AND/OR tree.*
e) Draw CD representation of the following sentence:
   `'John broke windows with hammer'`
f) Let Y and R be two fuzzy sets of young and rich people. What is the member grade of person being young and rich if the member grade of a person being is 0.8 and being rich is 0.7?
g) Explain goal stack and goal set approaches in the context of planning.

(7x4)

2.

a) A list is a palindrome if it reads the same in the forward and in backward direction. For example [k,a,n,a,k]. Write a complete Prolog program to check if a list is a palindrome. Give a brief explanation.
b) Using Waltz's junction leveling algorithm, recognize the following line drawings and comment on it.



(9+9)

3.

a) Explain the difference between forward and backward chaining and under what conditions each would be best to use for a given set of problems.
b) Using Prolog clauses, define the relation **dividelist(List, List1, List2)** so that the elements of **List** are partitioned between **List1** and **List2**, where **List1** and **List2** contain old and even position elements of **List**. **List1** and **List2** are of approximately same length. For example, **dividelist([a,b,c,d,e], [a,c,e], [b,d])** is true.

(9+9)

4.

a) Consider the game of tic-tac-toe. Assume MAX marks crosses(X) and MIN marks circles(O); MAX is to play first.
If p is not a winning position for either player, give an evaluation function **e(p)** for use by MAX to evaluate non-terminal positions. Show the game tree up to lookahead depth as 2 and run MINIMAX algorithm on this game tree using your evaluation function.

b) Prove that dog(fido) follows from the following statements by the resolution theorem.
- i) $\forall$ X bark(X) $\rightarrow$ dog(X)
- ii) $\forall$ X $\forall$ Y $\exists$ Z has-master (X, Y) $\wedge$ likes (X, Y) $\wedge$ unprecedented-situation (Z) $\rightarrow$ barks(X)
- iii) Unprecedented-situation(noise).
- iv) Likes (fido, jim).

v) Has-master (fido, jim).

(9+9)

5.

a) What do you mean by consistency of a heuristic function?

b) Validate each of the following statements giving brief explanation.
- i) The heuristic function 'Sum of manhattan distances' for 8-puzzle problem is consistent.
- ii) If heuristic is consistent then the heuristic is admissible but the converse is not true.
- iii) The Algorithm A^* expands a node almost once if the heuristic is consistent.

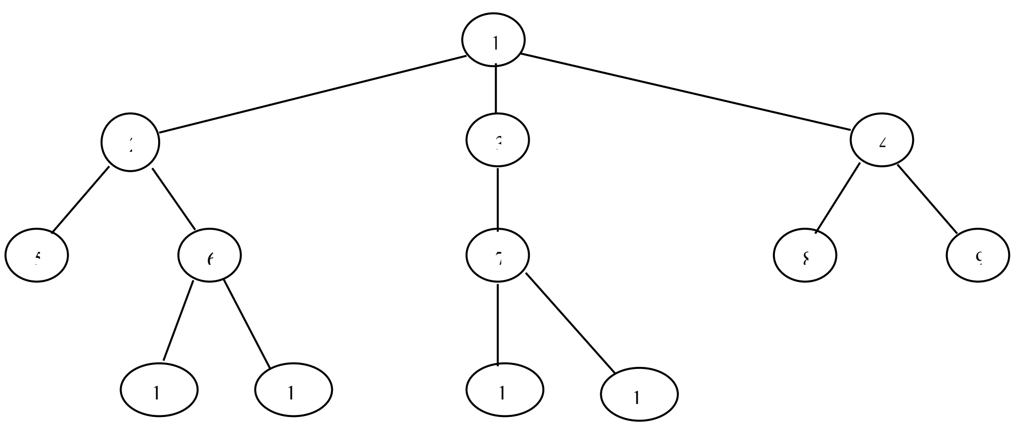
(3+[4+6+5])

6. List the order in which nodes are visited in the tree below for each of the following three search strategies(choosing leftmost branches first in all cases):

a) Depth-first Search

b) Depth-first iterative-deepening Search (increasing the depth by 1 in each iteration)

c) Breadth-first Search



(6+6+6)

7.

a) What is an Expert System? How do you distinguish between a Knowledge Based System and an Expert System? Describe in short the four major problems faced by Expert systems?

b) Explain the key idea of bayesian statistics for representing knowledge. Is it possible to compute P(A|~B) when you are only given P(A), P(B|A) and P(B). Explain your answer.

c) 8-Queens problem seeks to place 8 queens in an 8X8 chessboard such that no two queens attack each other. Formulate this problem as a constrained satisfaction problem.

(6+6+6)