BE2-R3: ARTIFICIAL INTELLIGENCE AND APPLICATIONS

NOTE:

1. **Answer question 1 and any FOUR from questions 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) Show with the help of an example that composition of substitutions is not commutative.

b) 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 young is 0.8 and being rich is 0.7?

c) Explain the difference between blind search and heuristic search techniques. Give one technique of each type of search.

d) When would Best First Search be worse than simple Breadth First Search?

e) Why is it important that an Expert System be able to explain the why and how questions related to a problem?

f) Differentiate between forward and backward reasoning. When you are reaching home from an unknown place which of the reasoning is applied (forward/backward). Justify your answer with reason.

g) Explain the principle of means-end-analysis approach to problem solving.

(7x4)

2.

a) 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.

b) Suggest a good heuristic function for the following problems
   i) TSP
   ii) Tic Tac toe

c) How overestimation and underestimation of a heuristic function change the reachability of an optimal solution? Explain in your words.

d) In the context of Bayesian reasoning, bring out the relevance of prior and posterior probabilities?

(6+4+4+4)

3.

a) Trace the execution of the constraint satisfaction procedure in solving the crypt arithmetic problem

```
  TWO
+
  TWO
 FOUR
```

b) Describe frame based knowledge representation with the help of a suitable example.

c) State whether the following statements are True or False. Justify with reasons.
   i) Repeat and goto are built in predicates in PROLOG
   ii) PROLOG uses DFS strategy to search goal state.

(10+4+4)

4.

a) List the differences and similarities between knowledge based systems and expert systems.

b) Describe the functionality of a multilayer perceptron with the help of an example.

c) Where and how Resolution and Unification algorithms are used?

d) Check if the following is unifiable. If yes, find the most general unifier.
   W={P(a, x, f(g(y))), P(z, f(z), f(u))}

(6+5+4+3)

5.

a) Why does the search in game playing programs proceeds forward from the current position rather than backward from a goal state?

b) Give a CFG for ENGLISH language and give leftmost derivation for the sentence: "That girl plucked the flower".

c) Consider the following set of sentences and convert them into predicate logic form.

i) A computer system is intelligent if it can perform a task which, if performed by a human, requires intelligence.

ii) A formula whose main connective is a $\Rightarrow$ is equivalent to some formula whose main connective is a V.

iii) If a production system is commutative, then, for any database, *D*, each member of the set of rules applicable to *D* is also applicable to any database produced by applying an applicable rule to *D*.

(5+4+9)

6.

a) Explain how cut and fail predicates are used in PROLOG to change the execution of program.

b) Write a recursive PROLOG/LISP program to reverse a given linked list.

c) Write a PROLOG program to split a list into two lists such that one list contains negative numbers and one contains positive numbers.

(6+6+6)

7.

a) What is the significance of planning in AI systems? Explain the main components of a planning system.

b) Define delta rule and give its uses in Back Propagation algorithm. What learning rate should be used for backprop?

c) Where and how knowledge is stored in Neural Networks? Explain with the help of an suitable example.

(6+8+4)