## 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) Why Backtracking (or depth-first-graph search) control strategies should be used when there are multiple paths between problem states. Explain your answer with the help of an example.
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) What are the desirable properties of Natural Language as a medium for human-machine interaction?
d) What do you mean by planning? How it is useful in achieving goals and strategy?
e) Define the term "pattern recognition" and "learning from experience" with respect to Neural Networks.
f) A Bayesian Network is a graphical representation of a probability distribution. What are the advantages of it? How does Bayesian Network learn?
g) The usefulness of current expert systems depends on their users having common sense and explanation facility. Justify the sentence by giving an example.
2.
a) What do you understand by underestimation and overestimation of a heuristic function? Why is it must for the heuristic function to underestimate in case of $A^{*}$ algorithm.
b) Prove each of the following statements:
i) Breadth First Search is a special case of uniform cost search.
ii) Random search is a special case of $A^{*}$ algorithm.
c) State and explain unification algorithm. Trace the operation of unification algorithm on each of the following pairs of literals:

1. $P(x, f(x))$ and $P(y, y)$
2. $P(g(f(v)), g(u))$ and $P(x, x)$
d) Differentiate between declarative and procedural knowledge.
(4+4+6+4)
3. 

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

$+$| LOGIC |
| ---: |
| LOGIC |

b) What do you mean by partitioned semantic nets? Draw the partitioned semantic net for "Andrew believes that the earth is flat".
c) What are the components in which knowledge is composed in Expert System? Explain the formalization with reference to development cycle of an Expert System.
$(10+4+4)$
4.
a) Explain in detail CUT and NEGATION facility in PROLOG.
b) Enlist some features of language that make it both difficult and useful. Explain steps in NLP by giving examples in each.
c) Write grammar rules, which can handle the following sentence and generates the parse tree for:
'I shoot the wumpus'.
d) Prove that means ends analysis technique could be used to solve the problem by combining forward and backward reasoning.
(4+7+4+3)
5.
a) Justify the statement -"A game tree is basically an AND OR Graph."
b) Why, there is a need to use a bias/threshold in Neural Network? What is the role of activation function in Neural Networks?
c) Is it true that fuzzy logic does not obey the law of 'excluded middle'? Prove the sentence with example.
d) Convert following sentences to propositional logic. Using the logical rules and proof by resolution; answer the question that "which course Steve would like?"
i) Steve only likes easy courses.
ii) Science courses are hard.
iii) All courses in the basketweaving department are easy.
iv) BK301 is a basketweaving course.
$(5+3+3+7)$
6.
a) Write a complete prolog program for Define the Relation translate (List1, List2) to translate a list of numbers from 0 to 9 to a list of corresponding word.
e.g.

Translate ([3,5,1],[Three,Five,One])
Use the Predicate: means (0,Zero)
means (1,One)
b) Write a predicate intersect (List1, List2, List3) in prolog to find the common elements of List1 and List2 and generate List3 having common elements.
7.
a) Given the following initial and the goal state for the Blocks world problem. Construct a set of operators (Rules) and hence generate a plan to reach the goal state from the initial state.

Initial state: On (C, A),
Clear (C),
On (B, Table),
Clear (B).
Goal State: On (B, A), On (C, B).
b) What is the back propogation? Is it possible to use back propogation for batch training as well as incremental training? What should be the learning rate used for back propogation?
c) Using the following rewrite rules, replace the numerals on the left hand side with the string of numerals on the right and using these rules to transform the numeral 6 into a string of 1 's.

$$
\begin{array}{ll}
6 \rightarrow 3,3 & 4 \rightarrow 3,1 \\
6 \rightarrow 4,2 & 3 \rightarrow 2,1 \\
4 \rightarrow 2,2 & 2 \rightarrow 1,1
\end{array}
$$

