

ALCCS – NEW SCHEME

Time: 3 Hours

AUGUST 2012

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE:

- Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.
- Parts of a question should be answered at the same place.

Q.1 a. One of the results to come out of the first three decades of AI research is that intelligence requires knowledge. What disadvantages does knowledge possess?

b. What properties should be possessed by a knowledge representation system?

c. Consider the following function of two variables:

A	B	Desired Output
0	0	1
1	0	0
0	1	0
1	1	1

Prove that this function cannot be learned by a single perceptron that uses the step function as its activation function.

d. Describe the salient features of an agent.

e. State the conditions under which A^* is admissible.

f. Compare and contrast declarative and procedural knowledge.

g. What are constraint satisfaction problems (CSPs)? State N-queen problem as CSP.

(7×4)

Q.2 a. Given a full 5-gallon jug and an empty 2-gallon jug, the goal is to fill the 2-gallon jug with exactly one gallon of water. You may use the following state space formulation. State = (x,y), where x is the number of gallons of water in the 5-gallon jug and y is number of gallons in the 2-gallon jug

Initial State = (5,0)

Goal State = (*, 1), where * means any amount

Create the search tree. Discuss which search strategy is appropriate for this problem.

(10)

b. Consider a knowledge base KB that contains the following propositional logic sentences:

$$Q \Rightarrow P$$

$$P \Rightarrow \neg Q$$

$$Q \vee R$$

(i) Construct a truth table that shows the truth value of each sentence in KB and indicate the models in which the KB is true.

(ii) Does KB entail R ? Use the definition of entailment to justify your answer.

(iii) Does KB entail $R \Rightarrow P$? Extend the truth table and use the definition of entailment to justify your answer.

(iv) Does KB entail $Q \Rightarrow R$? Extend the truth table and use the definition of entailment to justify your answer. (8)

Q.3 a. What is an expert system? Discuss different problems solved by expert systems. (6)

b. Given the following information in a database

A1: If x is on top of y , y supports x .

A2: If x is above y and they are touching each other, x is on top of y .

A3: A cup is above a book.

A4: A cup is touching a book.

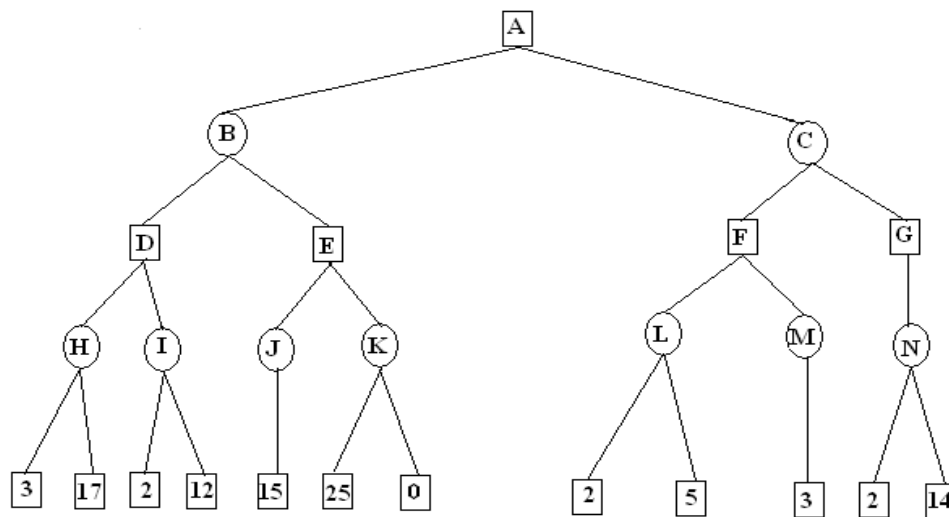
(i) Translate statements A1 through A4 into clausal form.

(ii) Show that the predicate support (book, cup) is true using resolution. (6)

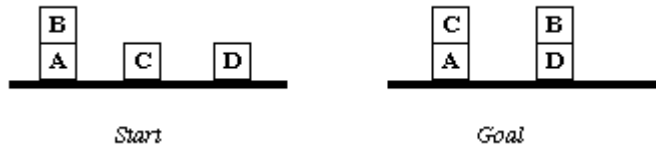
c. Discuss various applications of Genetic Algorithm (GA). (6)

Q.4 a. Construct a partitioned net: Every parent loves child (6)

b. Explain minimax algorithm with alpha-beta pruning. Show alpha-beta pruning on the following minimax graph. (12)



- Q.5** a. Construct by hand a perceptron that can calculate the logic function implies (\Rightarrow). Assume that 1 = true and 0 = false for all inputs and outputs. (8)
- b. Discuss goal stack planning using the following initial and goal state. (10)



- Q.6** a. Consider the following Context free Grammer for English

- (i) $S \rightarrow NP, VP_PPS$
- (ii) $NP \rightarrow DET, ADJS_NOUN$
- (iii) $ADJS_NOUN \rightarrow ADJ, ADJS_NOUN$
- (iv) $ADJS_NOUN \rightarrow NOUN$
- (v) $VP_PPS \rightarrow VP_PPS, PP$
- (vi) $VP_PPS \rightarrow VP$
- (vii) $VP \rightarrow VERB, NP$
- (viii) $PP \rightarrow PREP, NP$
- (ix) $DET \rightarrow a/the/this/that$
- (x) $ADJ \rightarrow silly/red/big$
- (xi) $NOUN \rightarrow robot/pyramid/top/table/telescope$
- (xii) $VERB \rightarrow moved$
- (xiii) $PREP \rightarrow to/of/on/with$

Give bottom-up parser (sequence of rules used) for the following sentence:
 "the silly robot moved the pyramid to the big table" (10)

- b. Given the rule base

- If (cloudy) then (rain), C.F.=0.7
- If (warm) and (early summer) then (rain), C.F.=0.9
- If (sunny) then (warm), C.F.=0.8

And the facts

- cloudy with C.F.=0.4
- sunny with C.F.=0.7
- early summer with C.F.=0.9

Calculate C.F.(rain). (8)

- Q.7** Write a brief note on **FOUR** of the following:

- (i) Hopfield Network
- (ii) A general genetic algorithm
- (iii) Agent Architecture
- (iv) Explanation module in Expert System Architecture
- (v) Bayesian Belief Network

(4.5×4)