

## BE2-R4: ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS

### 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) What do you understand with Artificial Intelligence? What are basic AI techniques? List the name of problems those falls into the formal, mundane and expert tasks.
- b) What is production system? What are the characteristics of the good control strategy? What are the issues related with problem characteristics?
- c) What is meant by Heuristic? What is Heuristic function? Specify the nearest neighbor heuristic algorithm for solving the travelling sales man problem.
- d) Define the Knowledge base. What are the three levels in describing knowledge based agent?
- e) What do you mean by uncertainty? Why uncertainty arises?
- f) Define learning? How does the process of learning achieve? What are the types of learning?
- g) Explain the steps of Natural Language Processing.

(7x4)

2.

- a) Explain how the PROLOG is suitable for A.I. programming? Write a PROLOG program to solve the Tower of Hanoi problem.
- b) Explain the Architecture and Applications of expert system with example.
- c) Solve "Water Jug problem" using Production rule system technique.

(6+6+6)

3.

- a) Explain Artificial Neural Network in brief.
- b) Differentiate between Predicate logic and propositional logic.
- c) Compare the Breadth first search and depth first search in brief.

(6+6+6)

4.

- a) What do you understand with constraint satisfaction technique? What is constraint space? Discuss the constraint satisfaction algorithm in detail. Trace the execution of the constraint satisfaction procedure in solving the crypt arithmetic problem: **SEND + MORE = MONEY**
- b) Explain the resolution algorithm for proposition logic. Now consider the following set of facts as the knowledge:
  - i) The humidity is high and the sky is cloudy.
  - ii) If the sky is cloudy then it will rain.
  - iii) If the humidity is high it is hot.
  - iv) It is not hot.

**Goal:** It will rain.

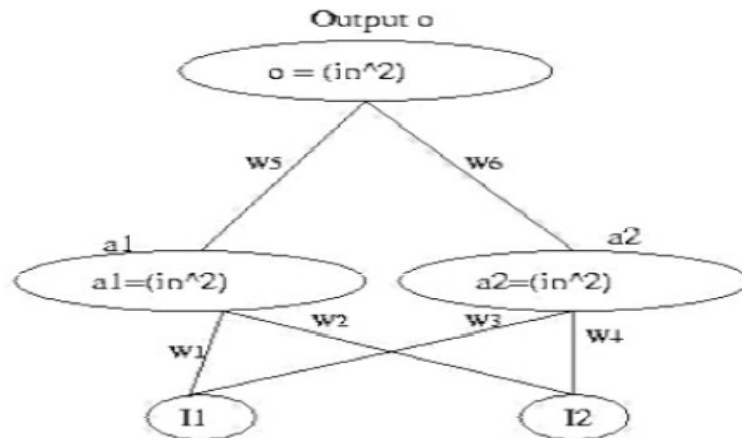
Now prove by resolution that the goal is derivable from the given knowledge base.

(10+8)

5. What is pattern mapping network? Define multilayer feed forward neural network architecture. Discuss Backpropagation algorithm in detail and derive the expression for weight change for neural network architecture with three layer i.e. input, hidden and output layers using Backpropagation algorithm. Apply the Backpropagation algorithm for the following network. Your training examples are as follows:

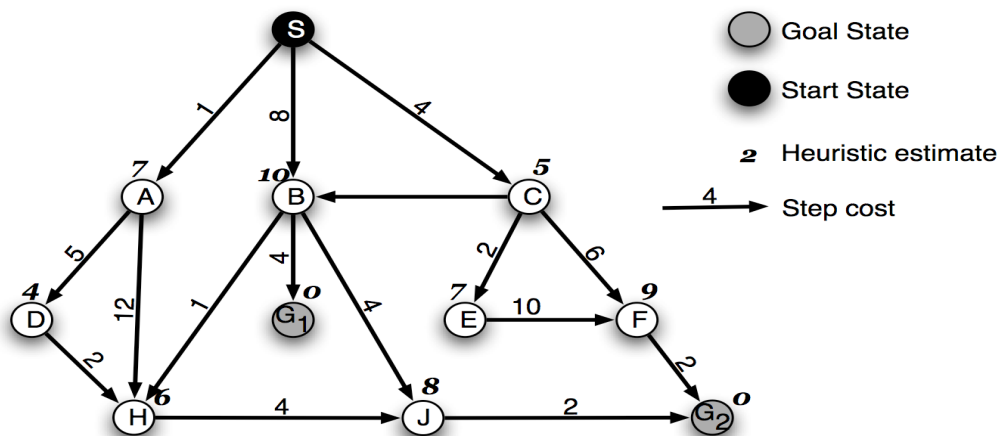
$$E1: I1=1, I2=3, o = 0;$$

All weights are set to value 1 initially; learning rate is set to 0.2. Show the updated weight value after the training. [in<sup>2</sup> means the square of the sum of the inputs.]



(18)

6. a) Show by a resolution refutation that the following formula is a tautology:  
 $(P \Rightarrow Q) \Rightarrow [(R \vee P) \Rightarrow (R \vee Q)]$
- b) Consider the search space below, where S is the start node and G1 and G2 are goal nodes. Arcs are labeled with the value of a *cost function*; the number gives the cost of traversing the arc. Above each node is the value of a *heuristic function*; the number gives the estimate of the distance to the goal. Assume that uninformed search algorithms always choose the left branch first when there is a choice. Assume that the algorithms do *not* keep track of and recognize repeated states.
- For each of the following search strategies,
- Indicate which goal state is reached first (if any) and
  - List *in order*, all the states that are popped off the OPEN list.



(8+10)

7.

a) Explain about the general parsing techniques with a block diagram and explain the function of it with an example.

b) Consider the following two fuzzy sets:

$$\tilde{A} = \left\{ \frac{1}{2} + \frac{0.5}{3} + \frac{0.3}{4} + \frac{0.2}{5} \right\} \quad \text{and} \quad \tilde{B} = \left\{ \frac{0.5}{2} + \frac{0.7}{3} + \frac{0.2}{4} + \frac{0.4}{5} \right\}$$

Now obtain the following fuzzy operations:

i)  $\overline{\tilde{A}}$  and  $\overline{\tilde{B}}$

ii)  $\tilde{A} \cup \tilde{B}$  and  $\tilde{A} \cap \tilde{B}$

ii)  $\tilde{A} \mid \tilde{B}$  and  $\tilde{B} \mid \tilde{A}$

c) What is Hopfield neural network? Discuss the algorithm for pattern storage and its recalling in Hopfield neural network?

**(6+6+6)**