

**Duration 3 Hours**

**Total Marks: 80**

**Note** (1) Question No.1 is compulsory and solve any three questions from remaining questions.

(2) Assume suitable data if necessary.

(3) Draw neat and clean figures.

**Q.1. Answer any four:**

(a) Define Heuristic Function. Give an example Heuristic function for 8 Puzzle problem. 5

(b) Explain PEAS description of task environment for Vacuum Cleaner. 5

(c) List and explain performance measuring ways for problem solving Search. 5

(d) Convert following statement in FOPL. 5

An enemy's enemy is a friend.

Mary Loves everyone.

(e) Explain Partial order planning with example. 5

(f) What are the problems/frustrations occurring in Hill climbing algorithm? Illustrate with examples. 5

**Q 2. (a) Consider the following statements:** 10

All people who are graduating are happy.

All Happy people smile.

Someone is graduating.

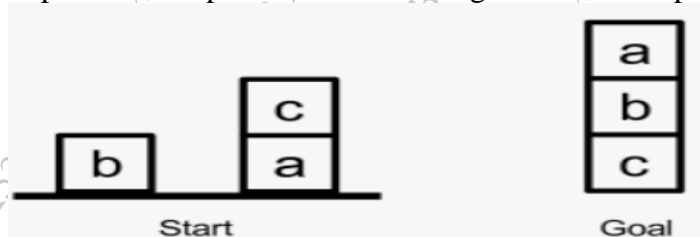
(i) Represent these statements in first order predicate logic (FOPL).

(ii) Convert each FOPL to CNF form.

(iii) Prove that "Someone is smiling" using resolution technique. Draw the resolution tree.

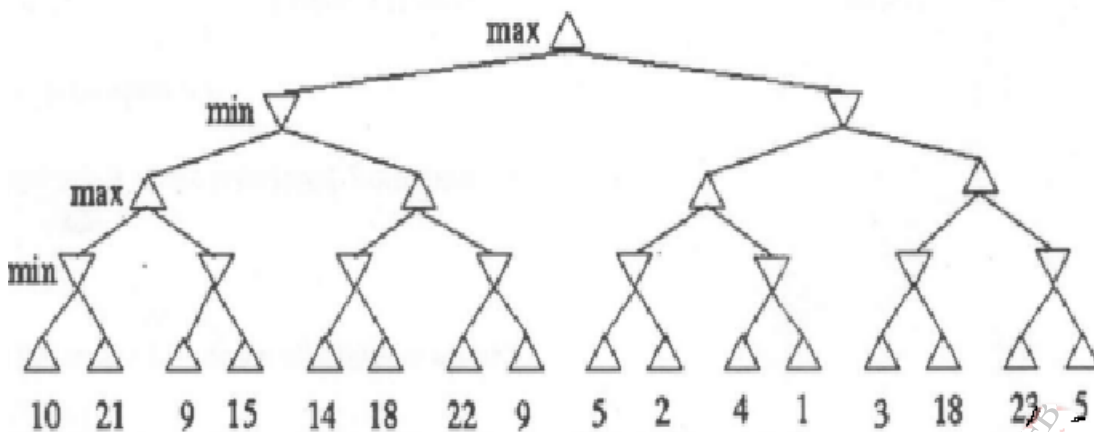
(b) Explain Breadth First Search (BFS), Depth First Search (DFS), Depth limited Search (DLS), Iterative Deepening Search (IDS). Compare all 4 algorithms-based on performance measures: Complete, Optimal, Time Complexity, Space Complexity. 10

**Q 3. (a) Give the partial order plan for the following blocks-world-problem.** 10



(b) Explain the architecture of Expert system. What are the advantages and limitations of expert System. 10

Q 4 (a) Apply Alpha Beta pruning on the following figure. Consider the First node as Max. **10**

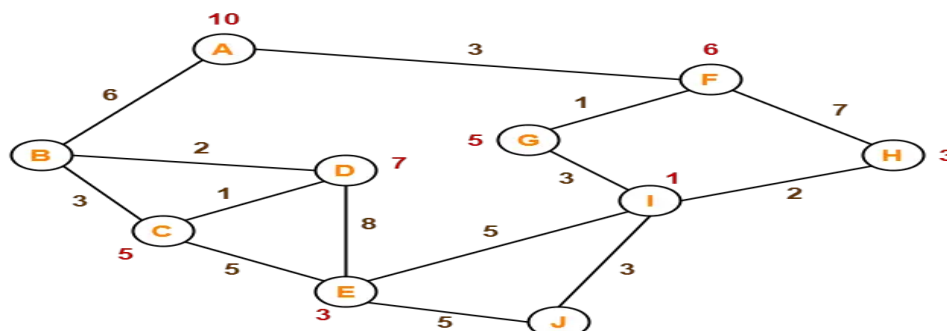


(b) Convert the following propositional logic statement in to CNF. **6**

$$(A \rightarrow B) \rightarrow C$$

(c) Draw and describe the architecture of Model Based reflex agent. **4**

Q 5 (a) Consider the graph given in the figure Below. Assume that the initial state is A and final state is J. The numbers written on nodes represent the straight-line distance heuristic estimates. Find the most cost-effective path and path cost to reach from start state A to final state J using A\* Algorithm. **10**



(a) Define Belief Network. Describe the steps of constructing belief network with an example. What type of inference can be drawn from that. **[2+6+2]**

Q 6 Answer any two of the following. **20**

(a) Explain how genetic Algorithm Works. Define the Terms chromosomes, fitness function, crossover and mutation as used on Genetic Algorithm. Algorithm

(b) Explain the steps for FOPL (First order predicate logic) to CNF (Conjunction Normal Form) conversion. Explain each step with example.

(c) Explain the Supervised, Unsupervised and Reinforcement Learning with proper block diagram.