Time: 3 Hours   **Total Marks: 80**

Note:
 (i) Each question carries 20 marks
 (ii) Question 1 is compulsory
 (iii) Attempt any three (3) from the remaining questions
 (iv) Assume suitable data wherever required

Q1.   Attempt **any four (4)** questions from the following   [20]
 (a) Give PEAS description for a **Personal Assistant in Smartphone**.
       Characterize its environment.
 (b) Give the initial state, goal test, successor function, and cost function for an "**N Queens problem**".
 (c) Draw and explain architecture of Utility Based Agent.
 (d) Define Turing test and explain its significance in AI.
 (e) What are universal and existential quantifiers? Illustrate its usage in predicate logic with a suitable example

Q2 (a) Explain termination conditions in a decision tree learning algorithm with an   [6+2+2]
       example for each condition. What are decision rules? How to use it for
       classifying new samples?
 (b) Consider the following sentences: [10]
       Anyone passing his history exams and winning a lottery is happy. But anyone
       who studies or is lucky can pass all his exams. John did not study but he is
       lucky. Anyone who is lucky wins the lottery.
       Answer "**Is John happy**?" using proof by resolution

Q3 (a) Design a suitable planning agent for cleaning the kitchen. Give **any 2** STRIPS   [10]
       style operators that might be used. When designing the operators take into
       account considerations such as --- Cleaning the stove or refrigerator will get
       the floor dirty.
 (b) Explain the Bayesian Belief Networks (BBN) with a suitable example. What   [10]
       types of inferences can be drawn from such networks?

Q4 (a) Define heuristics. Give a suitable heuristic function to solve a **tic-tac-toe**   [6]
       problem in AI. Illustrate its application to any state of a tic-tac-toe problem
Q4 (b) Write a pseudo code for alpha-beta algorithm. Consider a section of min-max
       tree shown in Figure 1. Is there any Beta Cut Off possible? If possible, Where   [4+2+4]
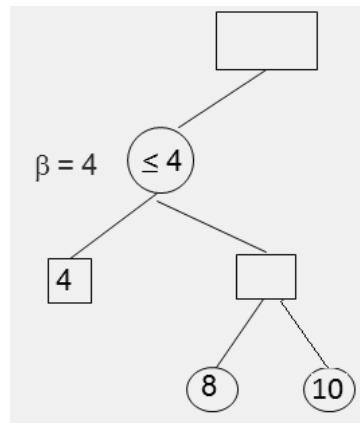   and Why?

Figure 1

(c) What are the frustrations that occur in hill climbing algorithm? [4]

Q5 (a) Explain how Genetic algorithms work with a suitable example? Define the terms chromosome, fitness function, crossover and mutation for the same example. [10]

(b) Consider the graph given in Figure 2 below. Assume that the initial state is S and the goal state is G. Show how **A* Search** would create a search tree to find a path from the initial state to the goal state [10]
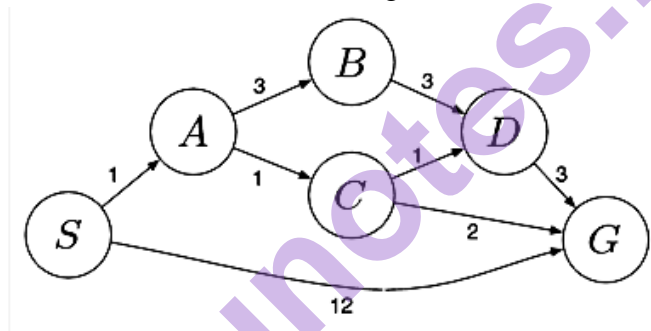

Figure 2

Assuming the straight-line distance as the heuristics function: h(S)=4, h(A)=2, h(B)=6, h(C)=2, h(D)=3 and h(G)=0.

Q6 Answer any two (2) of the following [20]

(a) How would you differentiate between Expert System and just an AI program? Draw and illustrate expert systems architecture. Use an example to support your claims.

(b) What are steps involved in natural language processing (NLP) of an English sentence? Explain with an example sentence. Briefly explain any one application of NLP

(c) Write a short note on simulated annealing.

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