Problem 1 – State True or False

1. An admissible heuristic function does not underestimate the cost to reach the goal. False

2. Turing test can be used to test whether a computer system acts rationally. False

3. The acronyms PEAS (in agent design) stands for Percepts Environment Actions System. False
   Performance
   Environment
   Actuators
   Sensors

4. Agent performance measure should be defined based on how the agent should behave but not on what is wanted in the environment. True

5. To a problem solving agent, a solution is a state that satisfies the goal test. True

Problem 2 – Short answers

1. What are the four major approaches to building AI systems? Select one and briefly discuss this approach.

Think like humans
Act like humans
Think rationally
Act rationally

Act like humans:
It aims to create the machines that perform functions that require intelligence. These are not mechanical functions, but something enough sophisticated to act like humans. The applied methodology is to take an intellectual human task and make a computer do it.

Examples of tasks: process the language, recognize faces, play chess, navigate in a building, etc.

Measure: How do we know that the system is enough intelligent? Alan Turing test poses a question: Is it a human or machine? If we are unable to distinguish between the two, the AI system is as intelligent as a human.

Drawback: It does not make us more productive, but rather tries to beat the test. For instance, if we give a complex mathematical task, the machine can solve it in a few milliseconds, but human may take a couple of minutes. If the machine wants to pass this test, it will have to create a delay to imitate human thinking process

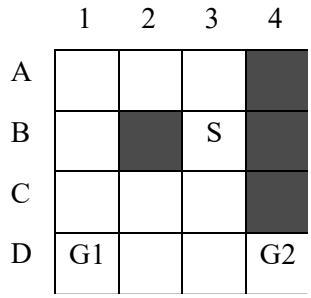
2. What are the major agent types?

Four basic kind of agent programs will be discussed:
Simple reflex agents
Model-based reflex agents: respond immediately to percepts.
Goal-based agents: act in order to achieve their goal(s)
Utility-based agents: maximize their own utility function

All these can be turned into learning agents.
And that gives you four additional advanced agent types

Problem 3 – Search

Consider the maze below for the robot navigation problem, where S is the robot's current location and being at either G1 or G2 satisfies the goal test. Shaded cells represent the wall. The robot can only travel up, left, down or right.



1. Formulate the problem by providing a suitable representation which includes **state representation, initial state, goal state, operators, and path cost.**

2. What would be a useful admissible heuristic for this problem?

3. For each of the following search strategies, indicate which goal state is reached (if any) and list, ***in order***, all the states associated with the nodes which are expanded. **When all else is equal**, nodes should be expanded according to the following order: the robot would try to go up before attempting left, before attempting down, before attempting right, in that order. When you list the states associated to expanded nodes, if the list is infinite, you can just show the first occurrences of the nodes in a loop.

   3.1. Breadth First (**without** repeated state check)

   Goal state reached:
   States associated with expanded nodes:

   3.2. Depth First (**with** repeated state check)

   Goal state reached:
   States associated with expanded nodes:

   3.3. Greedy Best First (**without** repeated state check and using the heuristic defined in question 2)

   Goal state reached:
   States associated with expanded nodes:

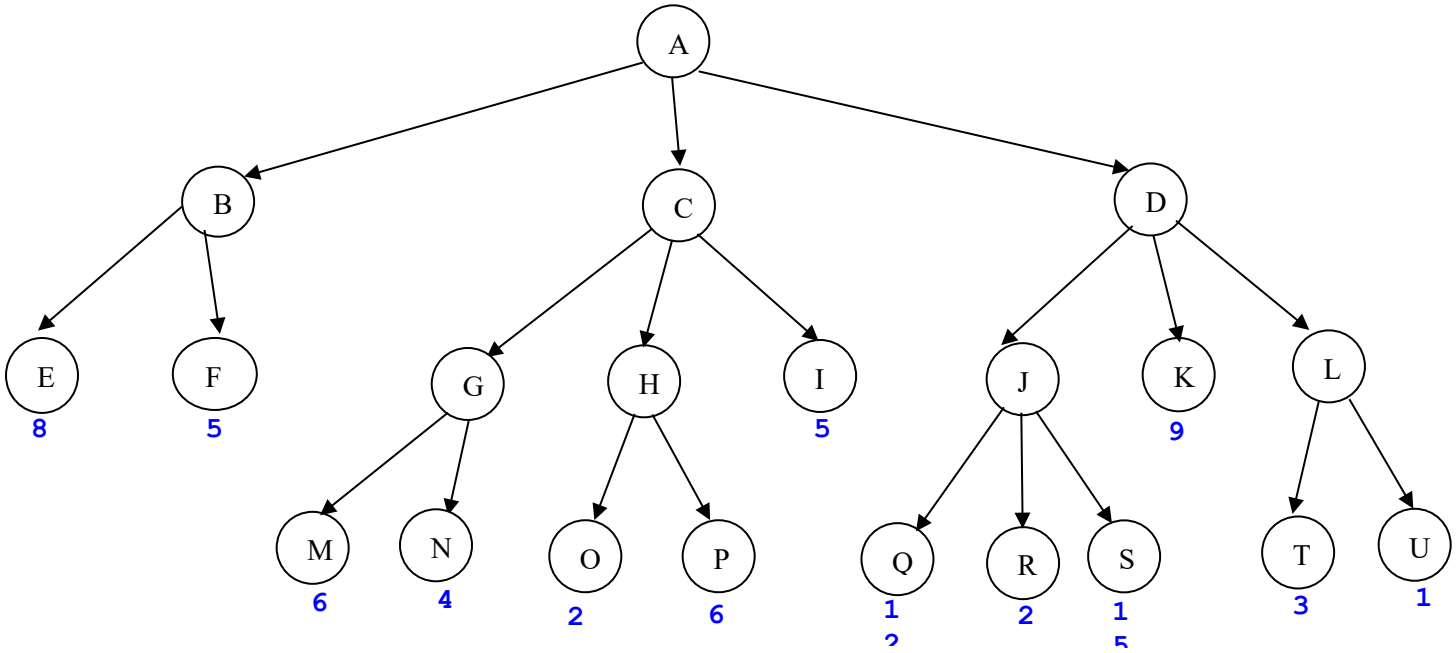
   3.4. A* (**with** repeated state check and using the heuristic defined in question 2)

   Goal state reached:
   States associated with expanded nodes:

Problem 4 – Game Playing and Expected Values

Consider the following game tree in which the evaluation function values are shown below eachleaf node. Assume that the root node corresponds to the minimising player. That is, the first player(MIN) is trying to minimise the final score. Assume that the search always visits children left-to- right.

1. Clearly indicate the max and min layers of the tree AND use minimax to determine the bestfirst move for MIN.



2. In which order will the nodes be examined by the alpha-beta procedure? Which nodes willbe pruned by the alpha-beta procedure?