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

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

False

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

False

Problem 2 – Short answers

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

AI as a system that thinks like humans.
AI as a system that thinks rationally.
AI as a system that acts like humans.
AI as a system that acts rationally.

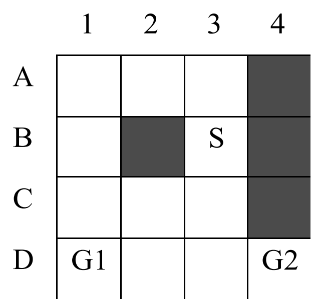
Student then chooses one to elaborate with no more than 3-4 sentences.

2. What are the major agent types?

Simple reflex agents
Model-based reflex agents
Goal-based agents
Utility-based reflex agents
+ 4 advanced agent types by adding learning capability to each of the above 4 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.**

State: Coordinates [x, y] (x = 1 .. 4; y = A .. D)
Initial State: [3, B]
Goal states: [1, D] and [4, D]
Operators: Up, Down, Left, Right
Path cost = Number of steps (i.e., each action costs 1)

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

MD(s1, s2) = Manhattan distance between cell s1 and cell s2.

An admissible heuristic function h(s) = min{MD(s, G1), MD(s, G2)}

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: 4D
States associated with expanded nodes: 3B, 3A, 3C, 2A, 3B, 3B, 2C, 3D, 1A, 3A, 3A, 3C, 3A, 3C, 1C, 2D, 3C, 3C, 2D, 4D

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

Goal state reached: 1D
States associated with expanded nodes: 3B, 3A, 2A, 1A, 1B, 1C, 1D

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

Goal state reached: 4D
States associated with expanded nodes: 3B, 3C, 3D, 4D

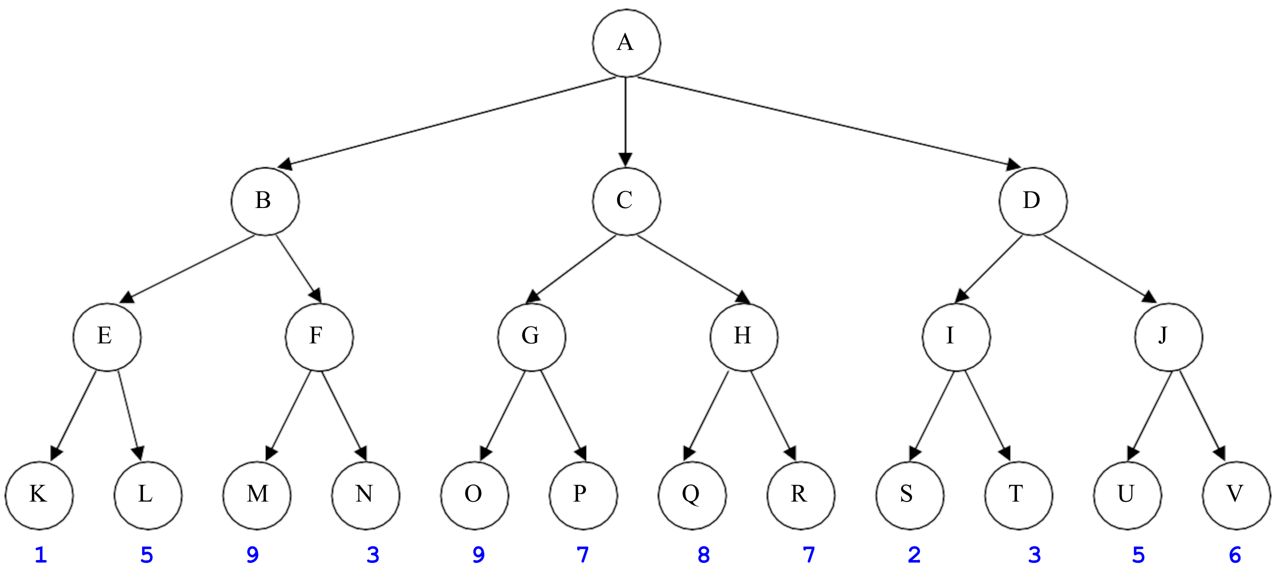
3.4. A* (**with** repeated state check and using the heuristic defined in question 2)

Goal state reached: 4D
States associated with expanded nodes: 3B, 3C, 3D, 4D

Problem 4 – Game Playing and Expected Values

Consider the following game tree in which the evaluation function values are shown below each leaf 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 best first move for MIN.



See Week 5 tutorial.

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

See Week 5 tutorial.