Artificial Intelligence – Exercise 1

Task 1: Environment

Agents in the PEAS agent environment are classified based on a performance measure, their environment, actuators and sensors. The environment plays a major role in the complexity and operation of an agent.

1. For each of the following environmental characteristics, name the opposite and give an example of both the given and opposite expression. Here is an example:

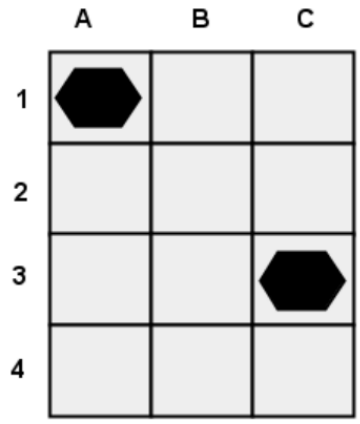
   Given: Fully observable **Opposite** Partially observable
   Example: Tic-tac-toe vs. taxi drive

Given:	One agent	**Opposite:**	
Example:			
Given:	Deterministic	**Opposite:**	
Example:			
Given:	Sequential	**Opposite:**	
Example:			
Given:	Discreet	**Opposite:**	
Example:			
Given:	Unknown	**Opposite:**	
Example:			

2. Describe feasible environments for the following scenarios and classify them based on the properties described above:
   1) Chess, 2) Converyor belt sorter, 3) Poker

Task 2: Engineering of a robotic vacuum cleaner

Define a vacuum cleaner agent in a discrete environment, as shown in the map. The squares are either clean or dirty or they contain an obstacle.



1. State the necessary actuators.
2. State at least two useful performance measure.
3. Which types of sensors are required or useful?
4. Which are the required conditions in order to correctly assume the environment to be static?
5. Which are the required conditions in order to correctly assume the environment to be deterministic?
6. Is the environment sequential or episodic?
7. How should the agent approach the cleaning of an unknown room? Draft the agent's procedure for the the case with as well as without memory using pseudo code.
8. How would the agent solve the task if a map of the room was available? For this, we assume the environment to be deterministic and static. In this case, would it require a memory or sensors?

Task 3: Problem formulation using search

Given this well known problem, which we snitched from Wikipedia:

> Once upon a time a farmer went to a market and purchased a wolf, a goat, and a cabbage. On his way home, the farmer came to the bank of a river and rented a boat. But crossing the river by boat, the farmer could carry only himself and a single one of his purchases: the wolf, the goat, or the cabbage.
>
> If left unattended together, the wolf would eat the goat, or the goat would eat the cabbage.
>
> The farmer's challenge was to carry himself and his purchases to the far bank of the river, leaving each purchase intact. The task is to devise a plan to solve this problem with as few river crossings as possible.

Specify the problem as a search task. Define the necessary states, the initial state, the available actions, the transition model, the target test and the edge weights.

Task 4: Search algorithms

The search tree is shown below (Solutions are marked with an asterisk). For each algorithm, specify the order of the vertices that will be visited to find the solution.

1. Breadth-first search
2. Uniform-Cost search, whereby the costs to get to a successor of a node, starting with 1, increasing by 1 from left to right, (e.g. costs (AC) = 2, Cost (EL) = 3, Cost (HQ) = 4 and Cost (CG) = 1). Note: It happens that different paths have the same cost, so the cheapest previous path is not clear. Then choose from these the alphabet.
3. Depth-first search
4. Iterative depth-first search – first 2 iterations until depth 2 (i.e. level with E,F,..)
5. Bidirectional search (only for vertex S)

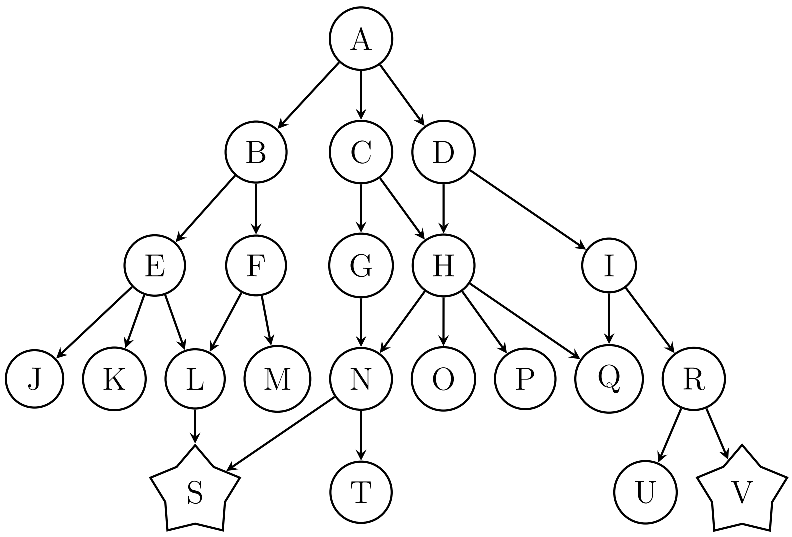


Figure 1: Searchtree