Agents and Search

In this homework, you are required to answer questions Q1 and Q2, and implement a solution to a described search problem (Q3), and write a report. To do so, you are going to implement some of the search algorithms that have been covered in the class. Example mazes for problem in Q3 will be provided to you, and you are required to get visual outputs and numbers indicating the performance of the algorithm. Details about the problems are given in the next sections.

Problem 1 - PEAS Description of Agents (20 points)

For each of the following agents, develop a PEAS description of the task environment:

(a) A package sorting system that distributes packages on the belt conveyor depending on their route

(b) A tool assessing the similarity of BLG435E assignment submissions both with each other and with web

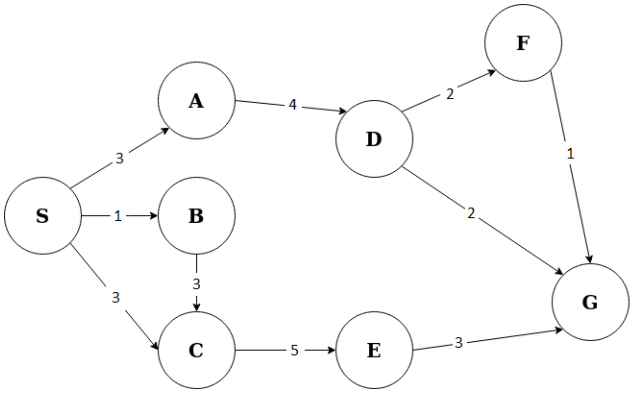
(c) An autonomous rocket traveling intercontinental

(d) A product recommendation system using user preferences

For each of these agent types characterize the environment according to the properties of the environment (observability, dynamism, etc.), and determine the appropriate type of the agent architecture with reasonable arguments.

Problem 2 - Admissible but Inconsistent Heuristics (30 points)

In the graph below, S is the start node and G is the goal node. There is also a heuristic function h whose values for each state is shown in the table, except h(B). Values along edges are costs of moving from one node to another.



n	h(n)
S	8
A	5
B	?
C	7
D	2
E	1
F	1
G	0

Figure 1

(**a**) What values of h(B) make h an admissible heuristic function?

(**b**) What values of h(B) make h a consistent heuristic function?

(**c**) What values of h(B) make it so that when you perform graph version of A* on this graph, you first expand node S, then node A, then node B in order.

Problem 3 - Problem Solving with Search Algorithms (50 points)

3.1 Comparing Search Algorithms (30)

In this section, you are required to implement search algorithms for path planning problems using various search algorithms. Implement the following algorithms.

- BFS
- DFS
- IDS
- A^*

Compare each algorithm with graph and tree search on mazes 1-4 and write a detailed report. Criticize each algorithm. Note that you should be aware of which properties to compare.

Download "ItuAIMaze-2023Fall.zip" to access to the environment. For the instruction on how to use the environment, use the readme file that is given with the environment. The environment is tested with python 3.10.4 and it requires pygame library. You are not expected to change the environment and you are going to submit only the files you are going to write and your submissions will be tested with the version of the environment that is given to you.

3.2 Robot Path Planning (20)

Let's consider a path planning problem for a robot. In the previous part, the planning problem was uniform cost. By considering the time that the robot would spend turning the problem becomes nonuniform. In the robot application, if the robot wants to go North while facing East, it would turn left for 90 degrees and then would go straight. Therefore turning changes the cost of the action. Design a heuristic for A^* and design the costs of actions. Use A^* to find the optimal path with minimum required turns. Use maze5 to test your approach. Discuss and show proof of the admissibility of your heuristic.

Submission

Submit your homework files through Ninova. Please zip and upload all your files using filename BLG435E_HW_1_STUDENTID.zip. You are going to submit:

1. All your code files for implementation of Q3.
2. A pdf file containing answers of the first two questions of the homework, required report that includes explanations/analyses about the third question of the homework.

Pay attention to the deadline of the homework.

This is an individual assignment. Your codes will be checked with automated tools for plagiarism with both other students and through the web.

Note that submitted homeworks may also be tested with different mazes other than those that are given to you.

Note that the environment provides great visuals for your search. Use these visuals in your report to enhance your explanations.

In case of any questions, feel free to send an e-mail to akab@itu.edu.tr.