BLG435E, Artificial Intelligence, Fall 2021-2022
Assignment #1

Q1 (15 pts) Select one of the following agents (show which one you have selected) and develop a PEAS description of the task environment:

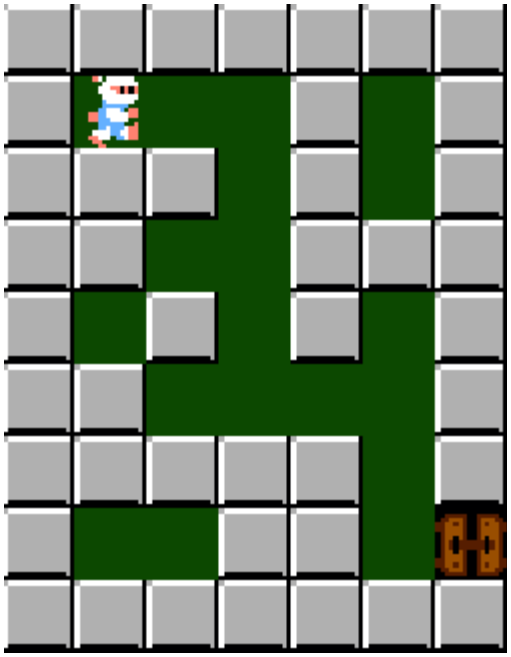
1. Cargo delivery robot
2. Product recommendation application based on preferences
3. Industrial robotic arm in a car factory
4. A robot that plays table tennis

For the agent you have selected, 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.

Q2 (25 pts) Prove that if a heuristic is consistent, it must be admissible. Construct an admissible heuristic that is not consistent.

Q3 (60 pts) In this section, you are required to implement BFS, DFS and A* agents on an existing python3 environment written in *pygame* library (you can use `pip install pygame` to install it). You can get the files from Ninova. The environment can be run in a format like:

- python main.py <ALGORITHM> <LEVEL>
- ALGORITHM → a string that can be one of the following: BFS, DFS, ASTAR, HUMAN
- LEVEL → an integer that defines the level to run the agent



In the game, your agent will control a character in a maze level and you are required to find a path to the exit door and execute it step-by-step. The agent can move in four directions and can go one tile in a single time step. The game is complete when the agent reaches the door. The agent relies on its *solve* method to find the path.

For each algorithm, you are given a respective python file along with a base class for them. You need to edit *the solve method* in each of them by implementing the mentioned algorithms in their respective files. Any other file modification is not needed (see submission section). You can create new classes or methods in those files if you see it necessary.

Reporting:

You need to formulate the problem in a well-defined form. Explain the state and action representations you chose.

a. Run and analyze both tree search and graph search versions of BFS and DFS.
b. Run A* with two different heuristics (admissible and consistent heuristics).

Test your methods on level1 and level2, given to you with the project files. (Please note that your code may be tested with different levels so please make sure your code will run on different levels as well.)

Analyze and report your results on the basis of

- number of nodes generated
- number of nodes expanded
- number of nodes kept in memory
- running time

If any of the algorithms do not last, please specify the reason.

Submission:

Submit your code and report through Ninova. Please zip and upload all your files using the file name BLG435E_HW1_<STUDENT_ID>.zip You are required to submit 5 files (even if you had not modified them):

- *agent.py*
- *bfs_agent.py*
- *dfs_agent.py*
- *astar_agent.py*
- *report.pdf*

The report should contain the answers for the Q1 and Q2 and the detailed analysis of the Q3. Also, if you use any other language, include their code files as well.

Important Notes:

- In Q3, your solution can rely on existing BFS, DFS or A* algorithms. However, you need to explain how the algorithms work in this problem and perform the requested analyses above with sufficient explanations in your report. **Code usage without relevant references will be considered as plagiarism.**
- If you would like to use any other programming language, you may invoke your code from the python file and use its result, or write the result to a file and read that file.
- Feel free to ask any questions to me: ugursoy@itu.edu.tr