

BLG435E, Artificial Intelligence, Fall 2017-2018
Assignment #1

Submission Type: An archive file including a softcopy report and the source codes for Q3 to be submitted using Ninova. Solutions for Q1 and Q2 must be **handwritten and scanned/photographed** in your report. Note that each student must work individually for this assignment. Team work is not accepted!

Q1 (20 pts) Select one of the following agents (show which one you have selected) and develop a PEAS description of the task environment:

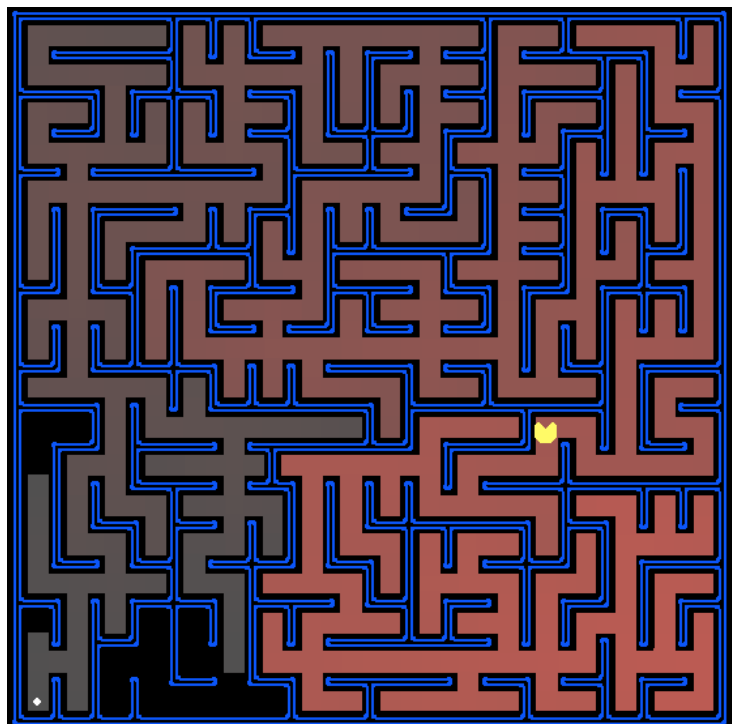
- (a) Domestic service robot
- (b) E-mail sorting application based on preferences
- (c) Public transportation recommendation system
- (d) Activity recognition and anomaly detection software agent in an airport

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

Q3 (60 pts) For this question, you are required to analyse how BFS, DFS and A* algorithms work for the domain provided in the [Pacman AI projects developed at UC Berkeley](#). You can obtain the base codes to be used and information on how to use these codes from [here](#).

In this assignment, we are only interested in finding a path to a fixed location in the Pacman's maze. We are not interested in the other aspects of the domain such as the ghosts etc. The picture on the right shows an example layout in which the food (i.e., the goal location) is at the lower left corner.



(a) (30 pts) Depth-First Search (DFS) and Breadth-First Search (BFS)

Implement tree search versions of BFS and DFS in `search.py` in a compatible format to be used in `searchAgents.py`. Test your functions in the `bigMaze` layout and analyze tree search versions of BFS and DFS in terms of:

- the number of nodes generated
- the number of nodes expanded
- the maximum number of nodes kept in the memory
- the running time.

If the corresponding algorithm does not last, please specify the reason.

(b) (30 pts) A* Search

Implement the A* algorithm in `search.py` in a compatible format to be used in `searchAgents.py`. You will need to implement two different heuristics to be used in A*. One of the heuristics will be $h(n) = 1$. You are also asked to devise an admissible heuristic as your second function. First, you need to show that the heuristic function you found is admissible for this problem. Then, you are asked to test these two functions in the `bigMaze` layout and compare them in terms of:

- the number of nodes generated
- the number of nodes expanded
- the maximum number of nodes kept in the memory
- the running time.

If the corresponding algorithm does not last, please specify the reason.

Important: In Q3, your solution can rely on existing algorithm implementations such as [AIMA Online Code Repository](#) or [Simple AI library](#). 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.

Hint: Check this [link](#) for a tutorial on how to create a search problem using [Simple AI library](#) and how to run search algorithms (BFS, DFS, A* etc.) on the problem you create.