University of Antwerp
Faculty of Science

Artificial Intelligence

Assignment 7: Pacman Ghostbusters

Deadline: December 17, 2023

General Remarks

- You are free to consult with other students. The assignment is, however, individual, meaning that each submitted assignment has to be sufficiently unique.
- Always motivate your answers. Detail the steps needed to come to your conclusions.
- You are free to provide answers in either English or Dutch.
- If anything is unclear or if you experience technical problems with the assignment, contact me at joey.depauw@uantwerpen.be.

Assignment (17 points)

For this assignment, you will implement inference algorithms in the context of Pacman: https://inst.eecs.berkeley.edu/~cs188/fa22/projects/proj4/. The first part of this project (questions 1 – 4) is about the basics of Bayes nets which we already practised in the previous, written assignment. Only the listed questions in this assignment need to be solved in addition to writing a short report explaining the insight questions indicated by bullet points.

Solutions should work with Python version 3.10.

Exact Inference (5 points)

Question 5a (0 points): DiscreteDistribution Class

Question 5b (1 point): Observation Probability

Question 6 (1.5 points): Exact Inference Observation

- Write down the equation of the inference problem you are trying to solve.

Question 7 (1.5 points): Exact Inference with Time Elapse

- Write down the equation of the inference problem you are trying to solve.

Question 8 (1 point): Exact Inference Full Test

- Can you think of a better strategy than the greedy strategy? Describe how Pacman can use the probability values to their advantage and more effectively hunt ghosts. You can test your alternative by implementing it in the `GreedyBustersAgent` and running the following command:

`python autograder.py -t test_cases/q8/3-gameScoreTest --no-graphics`
Mark the average score of the greedy strategy and of your alternative in your report. Note that scores may differ when running the autograder compared to the single test. This is because the random seed is not fixed.
Important: do not forget to switch back to the correct implementation of `GreedyBustersAgent` in the version you submit!

Approximate Inference (5 points)

Question 9 (1 point): Approximate Inference Initialization and Beliefs

Question 10 (2 points): Approximate Inference Observation

Question 11 (2 points): Approximate Inference with Time Elapse

Dynamic Bayes Net (5 points)

Question 12 (1 point): Joint Particle Filter Initialization

Question 13 (2 points): Joint Particle Filter Observation

Question 14 (2 points): Joint Particle Filter Time Elapse and Full Test

- As you run the autograder note that q14/1-JointParticlePredict and q14/2-JointParticlePredict test your elapseTime implementations only, and q14/3-JointParticleFull tests both your observeUpdate and elapseTime implementations. Notice the difference between test 1 and test 3. In both tests, pacman knows that the ghosts will move to the sides of the gameboard. What is different between the tests, and why?

Report (2 points)

Write a report to discuss the questions in this assignment (the bullet points between the assignment questions of the PDF, not the website). Don't forget to include the equations from questions 2 and 3 as well.

Submit

Upload a **zip** file containing **only** the files `report.pdf`, `inference.py` and `bustersAgents.py` via Blackboard. These files should contain your solution to all the questions. Do not change the names of these files. Best wishes and good luck!