

Koç University

COMP341

Introduction to Artificial Intelligence

Assignment 5

Instructor: Barış Akgün

Due Date: June 9 2024, 13:00

Submission Through: Blackboard

Make sure you read and understand every part of this document

This programming assignment will test your knowledge and your implementation abilities of what you have learned in the reinforcement learning part of the class. You are asked to complete a coding part and answer a few questions about how it runs. The coding part of the homework will follow the Berkeley CS188 Summer 2021 pacman project P3: Reinforcement Learning at <https://inst.eecs.berkeley.edu/~cs188/fa23/projects/proj3/>.

This homework must be completed individually. Discussion about algorithms, algorithm properties, code structure, and Python is allowed but group work is not. Coming up with the same approach and talking about the ways of implementation leads to very similar code which is treated as plagiarism! Furthermore, do not discuss the answers directly as it will lead to similar sentences which is treated as plagiarism. If you are unsure, you should not discuss. Any academic dishonesty, will not be tolerated. **By submitting your assignment, you agree to abide by the Koç University codes of conduct.**

Important: Make sure you go over all the submission instructions at the end of this document before submission. Once you upload your submission, download it to make sure it is not corrupted and it has your latest documents. You are only going to be graded by your blackboard submission.

Warning: The solution code for the homeworks can be found online. We are going to compare your submission with these sources. We are also going to compare your code to latest and previous submissions of Koç students. If your code's similarity level is above a certain threshold, your code will be scrutinized. If there is strong suspicion of plagiarism, we will take action based on university policies.

Programming

You are going to do the 8 (+ Q4 which is optional) programming questions about reinforcement learning given in the website. You are only required to change *valueIterationAgents.py*, *qlearningAgents.py* and *analysis.py*. If you have any issues with other parts of the code let your instructor or TA know ASAP, even if you manage to solve your problem. Use the data structures in *util.py* for the autograder to work properly. Some of these are really useful as well! If the you think you have the right answer but the autograder is not giving you any points, try to run it on individual questions (examples on how to do this is given in the website).

The website of the homework and the comments in the code have very useful tips and explanations. Do not skip them!

Hints

The questions are fairly straightforward. We have not covered Q4 and Q5 in class, but the website has enough information to implement them. Feel free to complete the other questions and get back to these later.

util.Counter()

The `util.Counter()` data structure is very useful. It is a modified dictionary, returning 0 for keys that are not in the dictionary. Use this to your advantage.

Calculating the max and the argmax for Q-Values

I recommend that you write a separate function, which returns both the maximum Q-value given a state

and corresponding action (argmax). This will be useful in many parts of your code. Note that you can return two values from a function in Python. You should do this both for value iteration and q-learning agents.

Terminal States

You do not need to calculate anything for the terminal states, do not forget to handle them accordingly! There is a function to test whether a state is terminal or not.

This is not a hint but a suggestion; For personal satisfaction, I recommend you add your features from homework 2 and watch pacman learn!

Submission

You are going to submit a compressed archive through the blackboard site. This file should only contain *valueIterationAgents.py*, *qlearningAgents.py* and *analysis.py*. Other files will be deleted and/or overwritten.

Submission Instructions

- You are going to submit a **single** compressed archive through the blackboard site. The file can have *zip*, *rar*, *tar*, *tar.gz* or *7z* format. If you submit files individually they may get lost.
- You are fine as long as the compressed archive has the required files within 4 folder levels.
- Code that does not run (e.g. due to syntax errors), that does not terminate (e.g. due to infinite loops) or that blows up memory will not get any points.
- **Important:** Download your submission to make sure it is not corrupted and it has your latest code. You are only going to be graded by your blackboard submission.