**CS205 - Artificial Intelligence - Pacman Final Report**

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**Introduction**

We use the Pac-Man project from UC Berkeley’s AI course. Pac-Man implements key AI concepts like search algorithms. We utilize search algorithms like DFS, BFS, UCS, and A\* and compare their performance against each other for different types of tests like finding the closest food pellet or finding the most optimal path to the goal. Pac-Man is a pretty straightforward game with a clear goal but the implementation process helped us understand the different types of constraints that were involved and how to overcome problems related to speed and efficiency when playing the game.

**Accomplishments**

We learned how to write different types of search algorithms. DFS and BFS are well known but UCS and A\* were algorithms we had never implemented before. The use of a heuristic to calculate the estimated path to the goal was a cool concept to consider. Taking into consideration the constraint of the algorithm was a fun challenge because in most games we always consider diagonal movement but that wasn't possible here. Typical distance-measuring formulas didn’t always give us the results we expected. Figuring out whether the best solution was the shortest path or the least expensive path or a combination of both was an interesting experimental process. The different search algorithms had a lot of different data structures and complementary functions to work with. Watching the game actually become playable at the end of all our work was something we felt proud about.

**Challenges**

Implementing the search algorithms was a challenge mainly because we were not familiar with some of them. When in doubt, Google and YouTube. We even referred to a textbook to learn about these algorithms. A part we found particularly tricky was in Week 7. The number of nodes being expanded was always higher than what would be considered optimal and it took us some time to finally optimize it. The challenge was with the foodHeuristic implementation because initially we were not getting the expected results and we had to improvise it again and again and it took a lot of time. One thing we hated was that for some commands, the output format was inconsistent. For example, for -p AstarFoodSearchAgent, the output gave the number of nodes expanded, the total time taken to execute, etc. But for -p ClosedDotSearchAgent it did not include these things but just the score. It would have been nice to have all the info, even if it is NULL so that it is easier to compare.

**Team**

Our team worked well together because this project was interesting and we were determined to complete it. We set up regular meetings and deadlines to make sure we didn’t have to crunch at the last minute and were flexible to make changes according to everyone's midterm schedule. Our group chat was 40% project-related and 60% shenanigans. We learned from each other that doing projects beforehand and synchronizing whenever possible yields positive results for the team. The overall experience was rewarding for all of us.

**Final Thoughts**

It's safe to say that going forward, whenever we play Pac-Man, we’ll do it with a newfound appreciation for the game in the context of AI. We also saw a documentary [Pac-Man](https://www3.nhk.or.jp/nhkworld/en/tv/topinventions/20200326/2072016/) produced by NHK World. We highly recommend watching it!