CS221 Fall 2018 Homework [pacman]

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By turning in this assignment, I agree by the Stanford honor code and declare that all of this is my own work.

Problem 1

1.a:

$$V_{minmax}(s,d) = \begin{cases} Utility(s) & IsEnd(s) \\ Eval(s) & d = 0 \\ max_{a \in Actions(s)} V_{minmax}(Succ(s,a),d) & Player(s) = a_0 \\ min_{a \in Actions(s)} V_{minmax}(Succ(s,a),d)) & Player(s) \notin \{a_0, a_n\} \\ min_{a \in Actions(s)} V_{minmax}(Succ(s,a),d-1)) & Player(s) = a_n \end{cases}$$

Problem 3

3.a:

$$V_{exptmax}(s,d) = \begin{cases} Utility(s) & IsEnd(s) \\ Eval(s) & d = 0 \\ max_{a \in Actions(s)} V_{exptmax}(Succ(s,a),d) & Player(s) \neq a_0 \\ \sum_{a \in Actions(s)} \frac{1}{len(actions)} V_{exptmax}(Succ(s,a),d)) & Player(s) \notin \{a_0, a_1\} \\ \sum_{a \in Actions(s)} \frac{1}{len(actions)} V_{exptmax}(Succ(s,a),d-1)) & Player(s) = a_n \end{cases}$$

Problem 4

4.b:

Answer: For the evaluation function used in problem 4, its return value (game score) is calculated based on below features:

1. Closest ghost agent distance from pacman.
2. Closest capsule distance from pacman.
3. Closest food distance from pacman.
4. Total (sum) food distance from pacman.

Strategy: The thinking here is to find a balance between pacman's surroundings and overall game status (food and ghost distribution). The high-level motivation is to let pacman eats nearby food first and then move to other areas of the map where the majority of the remain food are and at the meanwhile keep pacman away from nearby active ghosts. Below are the steps used in score calculation:

1. Get the base score from game score.
2. Update score by things surround pacman to gain local optimal. (closest food, ghost, capsule)
3. Increase score to encourage pacman to eat nearby scared ghost.
4. Decrease score to urge pacman keep away from active ghost.
5. Decrease score to urge pacman to move towards food by considering overall food distribution.

Lots features were tried and been discarded, like number of ghosts near by pacman within distance of 2; number of food near by pacman within distance of 2; Max average between ghost and pacman. But I got poor performance that pacman would thrash around a lot and even turn another direction right next to a dot without eating it.

What makes it works:

1. Reduce features make it easier to tune.
2. Decrease score according to sum of distance of all food to make pacman move to places has lots of food.
3. Encourage pacman to eat near by scared host.