

1. Pacman should display more relaxed behavior when ghosts are nearby. In particular, if Pacman perceives that he could be trapped but might escape to grab a few more pieces of food, he'll at least try.

Investigate the results of these two scenarios:

```
python pacman.py -p AlphaBetaAgent -l trappedClassic -a depth=3 -q -n 10
```

```
python pacman.py -p ExpectimaxAgent -l trappedClassic -a depth=3 -q -n 10
```

Explain in one or two sentences why the ExpectimaxAgent might outperform the AlphaBetaAgent in this scenario. (2 points total)

In the case of the AlphaBetaAgent, Pacman has suicidal tendencies and moves towards the ghost closest to it until it dies. In the case of the Expectimax agent, it tries to optimize its average score by trying to gain as many food capsules as it can before dying. The Expectimax agent is considering the probability of dying vs. the probability of getting food to improve the score, while the AlphaBetaAgent is only looking at the terminal state of losing.

2. Consider a game tree where the root node is a max node, and the minimax value of the tree is v_M . Consider a similar tree where the root node is a max node, but each min node is replaced with a chance node, where the expectimax value of the game tree is v_E .

For each of the following, decide whether the statement is True or False and briefly explain in one or two sentences your answer.

(a) True or False: v_M is always less than or equal to v_E . Explain your answer. (2 points)

True. In the minimax tree, the algorithm finds the minimum value of its terminal states and then the max root node chooses the highest from these values. In the expectimax tree, the terminal nodes v_E finds the average/weighted average values of all the values below it. This value would be greater than or equal to the minimum value (if all values are the same) which means the max value at the root would be higher or equal to the minimax tree as well.

(b) True or False: If we apply the optimal minimax policy to the game tree with chance nodes, we are guaranteed to result in a payoff of at least v_M . Explain your answer. (2 points)

True. Based on the answer for part a, we have established that $v_E > v_M$ and so the payoff would be at least v_M .

(c) True or False: If we apply the optimal minimax policy to the game tree with chance nodes, we are guaranteed a payoff of at least v_E . Explain your answer. (2 points)

False. Based on the answers in part a and b, you would not get at least v_E .