Explorative Question 4:

1.

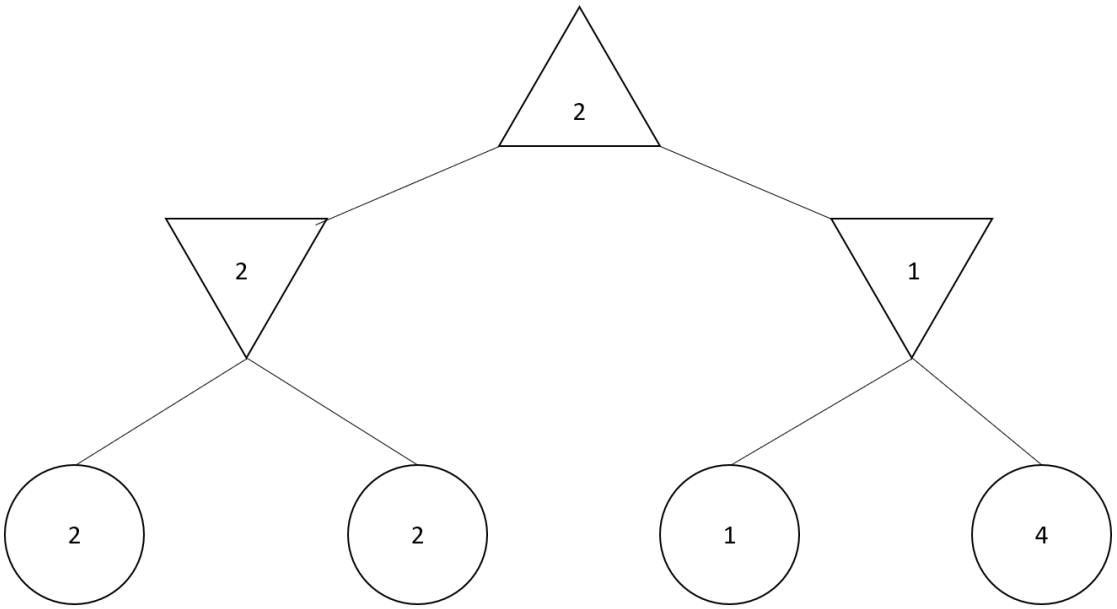
The expectimax agent can outperform the the alpha-beta agent mainly due to the fact that it accounts for the fact that the ghost might take suboptimal choices from time to time. For example, if the pacman realizes that he is trapped and will die eventually, it hopes that the ghost take a suboptimal move, allowing pacman to escape, and this behaviour is crucial, since it allows pacman to more food even if it's trapped, and it resolves the suicidal behavior.

2.

a) True.
The minimax tree with a value of v_m can be replaced with a expectimax tree, where there is a chance node which has a value of v_m and every other value of the other chance nodes are less than v_m. In that chance node with a value of v_m, there is a child with a minimum value of v_m with probability of 1 and all other children have a probability of 0. Since the expected value is linear, meaning that we can add them, if we replace the minimax tree with a expectimax, in the worst case, the children of the node with value of v_E has probability of zero except for one, which can be equal to v_m. In all other cases, since the expected values add, the value for that node increases, and makes $v_E > v_m$.

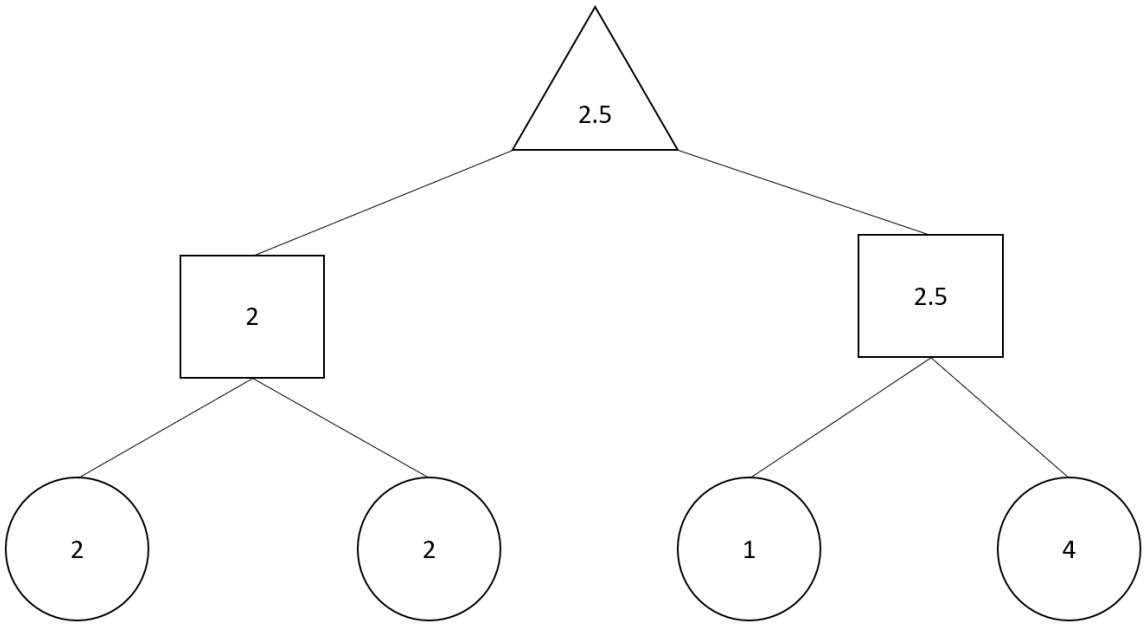
b) True.
Since from part a, we proved that $v_m \leq v_E$. As a result, we are guaranteed to get at least v_m for our expectimax tree.

c) False by counter example.



In this example, the max node value is 2 and the path is left and then left.

If we replace the min nodes with chance nodes:



The max node is in this case 2.5.

As a result, $V_E = 2.5$ and $V_M = 2$. If we apply the path of left, left to the graph with chance nodes, we get the value of 2 which is less than the value of V_E. So, we are not guaranteed a payoff of at least V_E.