Assignment 3 – Part 1

Question 1 – Reflex Agent

1) In A*, the definition of a heuristic is the estimate of the minimum cost from any vertex n in the state space to the goal node. This allows us to select nodes from the open frontier, which lie on the path to the goal node. On the other hand, the heuristic value for a game state allows us to assign a value to nodes which are not terminal states, but the search must be stopped at that point (because of depth limited restrictions). Heuristics allow us to assign an estimate of the terminal value to that node i.e. If search were to continue along that path, would the agent win/lose/draw. The goal here is not to reach the end node, as in A*, but to estimate the outcome of the game from that state.
A heuristic is 'good' in either case if it closely estimates the correct value (cost to final node in A* and terminal value of node for game states). A good heuristic always underestimates the true cost.

Question 2 – Minimax

1) When death is imminent for the Pacman, it means that the values of the successor nodes that it must choose from are very close numerically and are equally bad. For example, the evaluation function can return -3 for "Left" action and -3.01 for "Right" action for the max node (Pacman). Even though, Pacman tries to maximize its return by selecting the "Left" action, it can't really do anything in this situation as it is too late to make alternative decisions, which will allow it to win. So, this may look like it is being suicidal. It is merely reacting to the game at that point.

2) **a)** Not same
b) Not same
c) Not same

Question 3 – Alpha-Beta Pruning

1) **a)** In best case scenario, alpha-beta would be able to search twice as deep i.e. 2*d in the same amount of time.
b) In the worst case, alpha-beta will search to same depth i.e. d in the same amount of time as minimax. This is equal to the minimax agent without alpha-beta pruning

2) **False.** At the root node, beta is infinity which will never be less than alpha. So no pruning will occur of any of root's children.