

## Part 1 Written Responses

### Question 1

1. The goal of a heuristic when evaluating game states is to provide an estimate of how beneficial the evaluated state is to the maximizing player so that future states need not be evaluated. Meanwhile, heuristics for A\* search are used to identify which nodes should be expanded first. While a game state heuristics goal is to most accurately capture the “value” of a state, an A\* heuristic wants to approach the true value of the distance to the goal *without exceeding that value*. As a direct consequence of these differences, while a game state heuristic that cannot ensure that the relative value of two states is correct will likely perform quite poorly, a A\* heuristic that does not do this will still generate an optimal solution assuming it is still valid, albeit slower.

### Question 2

1. At each time moment, Pacman’s score ticks down. When death is unavoidable, Pacman will thus try to kill himself as quickly as possible in order to maximize his score.
2.
  - a. Not Same
  - b. Not Same
  - c. Not Same

### Question 3

1.
  - a. We know that a minimax search takes  $O(b^d)$  time while, in the best case, alpha-beta has time complexity of  $O(b^{d/2})$ . Hence, in the same amount of time as minimax search would be able to explore to a depth  $d$ , alpha-beta would, in the best case, be able to explore to depth  $2d$ .
  - b. In the worst-case, alpha-beta pruning results in no prunes, thus it will only be able to explore to depth  $d$ , the same as that for minimax search without alpha-beta pruning. In other words, in the worst case there is no difference in asymptotic time complexity between alpha-beta and minimax search.
2. False