CS255: Artificial Intelligence
Seminar Sheet 4 — Local Search and Adversarial Search

1. Suppose that a hill climbing search is in state s, which has successors x, y and z, such that $value(x) = 56$, $value(y) = 45$ and $value(z) = 61$. Which state would the search move to next?

2. Explain why a standard hill climbing algorithm is not guaranteed to reach the globally optimal solution.

3. Suppose that a simulated annealing search for a CSP has the current assignment n, and selects variable v_7 and value 42. Suppose that $h(n) = 87$, $h(n \cup \langle v_7 = 42 \rangle) = 66$, and the current temperature is 6. What is the probability that $n \cup \langle v_7 = 42 \rangle$ will be adopted?

4. Consider a genetic algorithm with the following population of individuals

   $$s_1 = acdbadcb, s_2 = cbadcabd, s_3 = bbbdcadc, s_4 = aaaadddd, s_5 = ddaaddaa$$

   which have fitness values of $s_1 = 86, s_2 = 82, s_3 = 3, s_4 = 23, s_5 = 26$.

   (a) Given a fitness threshold of 10, which of these individuals would be culled?

   (b) If s_1 and s_5 are selected for reproduction, what offspring would be produced if a random crossover location of 3 is chosen (assuming no mutation occurs)?

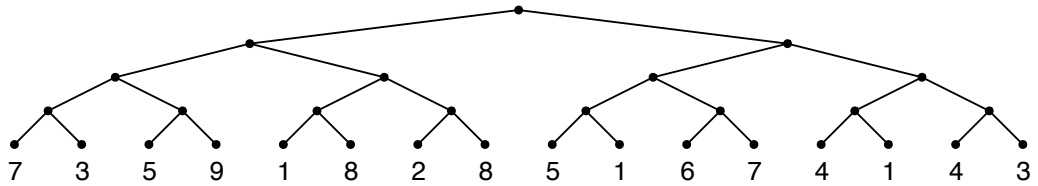
5. Suppose that an agent is using minimax in a game of checkers to play against an opponent who uses the following valuation function for nodes in the game tree.

   $EstimatedValue(n) =$

   $$\begin{cases} Utility(n) & \text{if } n \text{ is a terminal} \\ random_{s \in Successors(n)} EstimatedValue(s) & \text{otherwise} \end{cases}$$

   In this case, is minimax guaranteed to be optimal and complete?

6. Consider the following game tree, where the first player aims to maximise their utility. Use the minimax algorithm to determine which move the first player should choose, and what utility they should expect. You should show the resulting search tree.



7. Show how minimax with alpha-beta pruning operates on the following tree, where the first player is the maximising player. State which move the first player should choose, and what utility they should expect. You should show the resulting search tree.