Algorithms

(a) A splay tree is a binary search tree with amortised complexity $O(\log(n))$ per operation.

(i) What is meant by *amortised complexity*? [1 mark]

(ii) Draw the three different splay rotations that may be applied when the target node is the *left* child of its parent. Take care to include the location of subtrees before and after each rotation. [9 marks]

(iii) Why is a red–black tree a better general-purpose search structure than a splay tree? Under what circumstances would you choose to implement a splay tree in preference to a red–black tree, and why? [4 marks]

(b) Heapsort is an $O(n \log(n))$ sorting algorithm based on the heap data structure.

(i) What is the *heap property*? [1 mark]

(ii) Briefly describe how heapsort is related to the classic quadratic-time selection sort algorithm, explaining how heapsort manages to sort more efficiently. [5 marks]