

## 2006 Paper 1 Question 12

### 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]