5 Algorithms I (FMS)

(*a*) Explain the quicksort algorithm. [*Note:* Pseudocode allowed but not required. Clarity of ideas, conciseness and legibility definitely required, but not absolute completeness.] [3 marks]

(*b*) Assume that, under certain hypothetical circumstances, quicksort always partitions into two regions of relative size α and $(1 - \alpha)$, with α a constant in the range $0 < \alpha < 0.5$. Under those circumstances, and ignoring rounding issues, derive an approximate expression for the minimum depth of a leaf in the recursion tree as a function of n and α. Clearly explain your derivation.

[5 marks]

(*c*) How long will quicksort take if all the elements are equal? Clearly explain your derivation. [6 marks]

(*d*) It has been suggested that the pivot should be selected at random. What are the advantages and disadvantages of this strategy? How will it affect the worst-case and average-case asymptotic complexity? Discuss. [6 marks]