

COMPUTER SCIENCE TRIPOS Part II – 2012 – Paper 3

1 Algorithms II (FMS)

- (a) Draw a proto-vEB node, labelling each of its fields and briefly explaining what each field does. [2 marks]
- (b) Draw a vEB node, labelling each of its fields and briefly explaining what each field does. [2 marks]
- (c) On its own page, draw in pencil a complete and legible vEB tree holding the values $\{0, 2, 4, 8, 9, 10, 13, 14\}$. The correctness of the structure and the accuracy of all fields of all nodes is important. Once done, write each of the values in ink under the leaf record in which it is logically stored. [6 marks]
- (d) Consider the task of inserting a value v into a proto-vEB or vEB tree whose root node is r . Assume the value is in range and not already in the tree. Write two legible pieces of high-level pseudocode for `insertInProtoVEB(r, v)` and `insertInVEB(r, v)` respectively. Clarity (insert comments where appropriate) will count more than perfect low-level accuracy. Derive the computational complexity of your two procedures using the appropriate recurrence formulae (but solving the recurrences is not required). Explain what specific features of the vEB tree make it faster than the proto-vEB tree for this particular task. [10 marks]