

## FOS Exam Sample Questions: Software Engineering

### Question 1) Data Structures – 35 marks:

1.a) What is Binary Search Tree (BST)? Draw BSTs for these two sequences of numbers. (one BST for A and one for B – Assume you create the tree with the same order in the sequence. That is for example, for A first you add 7 to an empty BST, then add 4 to a BST with only one value (7) that you just created, etc.) (15 marks)

$$A=\{7,4,3,6,9,8\}$$

$$B=\{2,3,4,6,7,8,9\}$$

1.b) Write a recursive pseudo-code for searching in a BST. What is its run-time complexity, in Big O notation (20 marks)?

### Question 2) Software Engineering (OO modeling) – 35 marks:

Assume you are modeling the software system for an ATM (Automated Banking Machine).

2-a) Define 5 main use cases of this system and write their description. (15 marks)

2-b) Identify which classes are necessary for the system and draw the system's class diagram (10 marks)

2-c) For one of the classes of your choice, draw a state machine diagram that shows the behaviour of the object at run time (10 marks)

### Question 3) Software Engineering (software design) – 30 marks:

3.a) Explain what a design pattern is in the context of software engineering. Name two well-known design patterns? (10 marks)

3.b) Take one of the design patterns you named in part (3.a) and explain a software system that would benefit from that pattern. Draw a class diagram (with all class dependencies and important method names) that shows your design for the described system. (20 marks)