Xi'an Jiaotong-Liverpool University

西交利物浦大学

PAPER CODE	EXAMINER	DEPARTMENT	TEL
CPT102	S. Guan	Computing	1501

2nd SEMESTER 2021/22 FINAL EXAMINATIONS

BACHELOR DEGREE – Year 2

DATA STRUCTURES AND ALGORITHMS

TIME ALLOWED: 2 Hours

INSTRUCTIONS TO CANDIDATES

1、 **This is an open-book exam. Please tick the integrity disclaimer *immediately after you initiate the online/onsite exam* and complete the assessment independently and honestly.**

2、 **Total marks available are 100.**

3、 **Answer all questions. There is NO penalty for providing a wrong answer.**

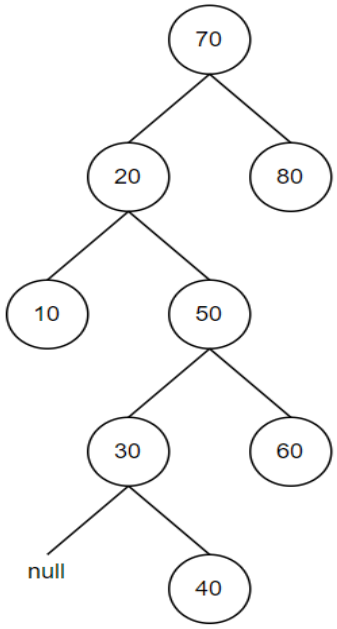
4、 **Only answers in English are accepted.**

5、 **The duration is *2 hours*. Where there are any major problems preventing you from continuing the exam or submitting your answers in time, please do not hesitate to email the Module Examiner (steven.guan@xjtlu.edu.cn) or Assessment Team of Registry (assessment@xjtlu.edu.cn).**

THIS PAPER MUST NOT BE REMOVED FROM THE EXAM HALL.

Part II. 25 marks - Answer All Questions

31. A Binary Search Tree (BST) was created by inserting these integers in the following sequence: 70, 20, 50, 80, 30, 10, 40, 60 (i.e. "70" gets inserted first and "60" inserted last).



Drag-and-drop (for online test) or write the correct sequence of integers (for on-site test) when traversing the tree using **Post-order Depth First Traversal**. Note that your sequence must absolutely match the index numbers to the left-most column of the table otherwise 2 marks will be deducted for each incorrect match. The answers for the first 3 indices have been provided. Complete the rest.

(Total 10 marks, i.e. each correct integer sequence worth 2 marks.)

	Correct Integer Sequence	**Pick Integers From Here**
Index 0	10	10
Index 1	40	20
Index 2	30	30
Index 3		40
Index 4		50
Index 5		60
Index 6		70
Index 7		80

32. **Drag-and-drop (for online test) or write the correct sequence number (for on-site test)** in implementing the *delete* operation of a *binary min-heap* abstract data type, assuming the element to be deleted is never in the last level. Note that your sequence must absolutely match the step numbers to the left-most column of the table otherwise 3 marks will be deducted for each incorrect match.

(Total 15 marks, i.e. each correct number sequence worth 3 marks.)

	Correct Number Sequence	**Pick Numbers From Here**	
Step 1		1	Repeat steps 3 to 4 until the node reaches its correct position.
Step 2		2	Find the index for the element to be deleted.
Step 3		3	If the replaced element is smaller than any of its child node, swap the element with its greatest child.
Step 4		4	Take out the last element from the last level of the heap and replace the index with this element.
Step 5		5	Replaced the root element in the heap with the found indexed element.
		6	Output updated binary heap.
		7	If the replaced element is greater than any of its child node, swap the element with its smallest child.
		8	Add the indexed element to the bottom leaf of the heap.

END OF PAPER