

Xi'an Jiaotong-Liverpool University

西交利物浦大學

PAPER CODE	EXAMINER	DEPARTMENT	TEL
CSE104		Computer Science and Software Engineering	

2nd SEMESTER 2015/16 RESIT EXAMINATIONS

BACHELOR DEGREE – Year 2

DATA STRUCTURES AND ALGORITHMS

TIME ALLOWED: 2 Hours

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INSTRUCTIONS TO CANDIDATES

- 1、 Answer all questions.
- 2、 Answers should be written in the answer booklet(s) provided.
- 3、 No calculator is allowed during the examination.
- 4、 Only answers in English are accepted.

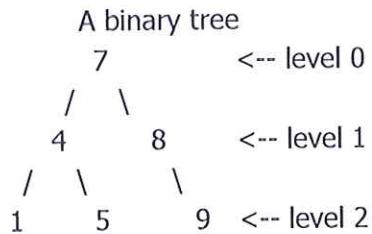
THIS PAPER MUST NOT BE REMOVED FROM THE EXAM HALL.

## Part II. Answer All Questions

15.

The following figure represents a binary tree to be traversed.

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- (a) What is the result of an inOrder traversal? 3
- (b) What is the result of a preOrder traversal? 3
- (c) What is the result of a postOrder traversal? 3
- (d) Given a traversal list L that is non-empty, develop the corresponding algorithm in pseudo code that constructs a binary tree producing in postOrder the same traversal list L. Identify what type of data structure(s) are being used. 9

Do not write your algorithm as a complete Java program.

Use the following template to fill in your solution:

---

Initialize ...

For each element x in ...

... ..

while (...) {

... ..

}

---

**Your solution should not exceed 9 lines of pseudo code.**

16.

18

Answer the following questions regarding binary search tree.

(a) Construct a balanced binary search tree using the following list of integers:

6

47, 21, 38, 55, 13, 1, 29.

What is the depth of the balanced binary search tree built from these integers?

(b) Given the specification of the following BinaryTree abstract data type and an array with  $n$  integers sorted in ascending order, design a recursive algorithm to build a binary search tree from the array given. The binary search tree built should be either balanced (i.e. the left and right sub-trees both have the same heights) or left-high (the left-sub tree is one level taller than the right-sub tree). You may use the functions supported by BinaryTree.

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```
public interface BinaryTree<T> {  
    BinaryTree<T> BinaryTree(T value);  
    boolean isEmpty();  
    boolean isLeaf();  
    int size();  
    BinaryTree<T> getLeft();  
    BinaryTree<T> getRight();  
    void setLeft(BinaryTree<T> subtree);  
    void setRight(BinaryTree<T> subtree);  
}
```

Use the following template to fill in your solutions:

Input: low, high ;referring to a[low]..a[high] in the sorted array a  
Output: reference to the constructed binary search tree

```
BinaryTree BST (low, high) {  
    if(high-low≥0) {  
        ... ..  
    } else return (NULL) ;no BST created with index-out-of-range  
}
```

Your solution should not exceed 6 lines of pseudo code.

17. Suppose you are asked to use two stacks as your only resources to implement the **Queue** abstract data type. Describe in pseudo-code how you would implement these methods: 14
- `enqueue()`, 6
  - `peek()` and 2
  - `deque()` 6
- where the running time for `enqueue()`, `peek()` or `deque()` in your implementation should be minimized. Discuss whether it is possible to achieve  $O(1)$  for `enqueue()`, `peek()` and `deque()`.

18. Using the information hiding & encapsulation concepts learnt, design a restaurant service package with the following roles inside. 15
- Customer
  - Waiter
  - Kitchen
  - Cashier
- (a) Briefly identify the services/functions of each role in no more than 8 sentences. 3
- (b) Clarify how encapsulation is achieved by specifying the service interfaces for these four roles using Java method signature. Do not write your solution as a complete Java program. **Your solution should not exceed 4 lines of Java code.** 8
- (c) Identify two types of data structures that are relevant in the design of such a service package. 4

END OF PAPER