Xi'an Jiaotong-Liverpool University

西交利物浦大学

PAPER CODE	EXAMINER	DEPARTMENT	TEL
CSE104		Computer Science and Software Engineering	

2nd SEMESTER 2015/16 FINAL EXAMINATIONS

BACHELOR DEGREE – Year 2

DATA STRUCTURES AND ALGORITHMS

TIME ALLOWED: 2 Hours

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. Answer each of the following questions regarding prefix expression. **(19 marks)**

(a) Convert the following infix expression into its 'prefix' form. **(3 marks)**
9-b+7*y

(b) Convert the following postfix expression into its 'prefix' form. **(3 marks)**
d6/k4*+

(c) Mention two error conditions arising from prefix evaluation. **(4 marks)**

(d) Develop the corresponding algorithm in pseudo code that carries out the procedure to convert a prefix expression into postfix. No error checking or processing is required. **(9 marks)**

Do not write your algorithm as a complete Java program.

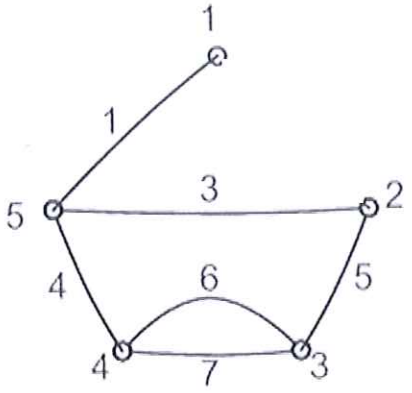
Use the following template to fill in your solutions:

// Assume *preptr* is a reference to the input prefix string
//The following code should return a reference *postptr* pointing to the converted postfix string

Initialize an empty stack
While (not end of string) scan the input string *preptr* from right to left, one character at a time {
Switch(character being scanned)
{
... ...
}
}
...
Return(*postptr*)

Your solutions should not exceed 9 lines of pseudo code.

16. Given the following graph. **(15 marks)**



(a) Write down the adjacency matrix for the graph shown. **(5 marks)**

(b) Assume the label specified upon each edge represents the cost of construction. Derive a **minimum spanning tree** step-by-step for this graph using the algorithm demonstrated in our class, by choosing node 2 as the starting vertex. You must show intermediate results and the total cost.
(5 marks)

(c) State the condition when a given graph has a unique minimum spanning tree. **(5 marks)**

17. Given the following binary search trees: **(17 marks)**

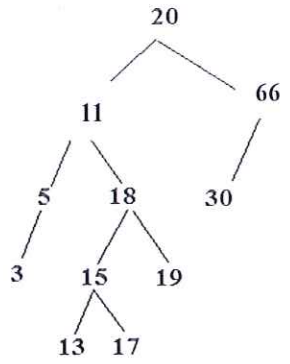


Figure 1

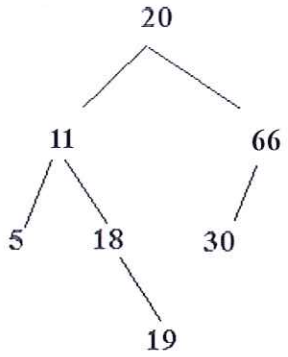


Figure 2

(a) Convert the tree in **Figure 1** into AVL tree. **(4 marks)**

(b) Draw the AVL tree after inserting the element 26 into the tree in **Figure 2**. **(4 marks)**

(c) Design an O(n) algorithm that constructs an AVL tree based on a sorted list given. Justify your solution. **(9 marks)**

18. What is the order of each of the following tasks? (You may choose from O(1), $O(\log_2 n)$, O(n), $O(n \log_2 n)$, $O(n^2)$, $O(n^2 \log_2 n)$, $O(n^3)$, $O(2^n)$) **(14 marks)**

(a) Performing a bubble sort on an array of n integers, in the worst case. **(2 marks)**

(b) Inserting two items into a binary search tree containing n items, in the average case. **(2 marks)**

(c) Using mergesort to sort an array of n integers, in the average case. **(2 marks)**

(d) Pushing an item onto a stack containing n items. **(2 marks)**

(e) Displaying all n elements in a nonsorted linked list. **(2 marks)**

(f) Inserting one item into a nonsorted ArraySet. **(2 marks)**

(g) Retrieving a specific item from data stored using a HashMap. Assume there exist no collisions during hashing. **(2 marks)**

END OF PAPER