Examination Paper of Southeast University (A)

Course name	Data Structures and Algorithms	Semester	17-18-2	Score	
Specialty	Software Engineering	Way of examination	Open	Duration	120 min.
Textbook, dictionary, class notes and exercise books are allowed					

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I. Choice (Each 4 points and total 40 points)

1 Which one is not the advantage of data abstraction and encapsulation?( )

a) Simplification of software development b) Reusability
c) Easy to test and debug d) Good programming style

2 Given a push-to-stack sequence "A,B,C,D,E", which one is not the possible pop-from-stack sequence? ( )

a) E,D,C,B,A b) A,B,C,D,E
c) E,C,D,B,A d) D,E,C,B,A

3 Give four algorithms with the following different time complexities, which one is the least efficient?( )

a) O(n) b) O(log(n))
c) O(nlog(n)) d) $O(n^2)$

4 What is the average time complexity of deleting an element from a binary search tree of size n? ( )

a) O(n) b) O(log(n))
c) O(1) d) $O(n^2)$

5 Given an undirected graph with 17 vertices, how many edges does it have at least to be a connected graph? ( )

a) 15 b) 16
c) 17 d) 18

6 Among the following sort algorithms, which one is stable? ( )

a) Heap sort b) Shell sort
c) Merge sort d) Quick sort

7 Given a B-tree with order M, how many children does its root have at least? ( )

a) 1 b) 2
c) floor(M/2) d) ceil(M/2)

8 Given a binary tree with in-order traversal sequence "ABCDEFG" and post-order traversal sequence "ABGFEDC", how many levels does it have? ( )

a) 3 b) 4
c) 5 d) 6

9 In external sorting, to do 8-way merge, we totally need at least _____buffers.

a) 2 b) 8
c) 9 d) 17

10 Given a static hash table T of size 17 and each bin has only one slot, the hash function is H(key) = key MOD 17. A list of keys {19,14,23,1,36,20,84,27,55,11,10,71} are inserted into T successively. If the linear probing strategy is used to handle the collisions, _____ key comparisons are conducted to search 53.

a) 0 b) 2
c) 3 d) 6

II. Answer the following questions (Each 10 points and total 40 points)

1 Prove that the KMP algorithm is correct.

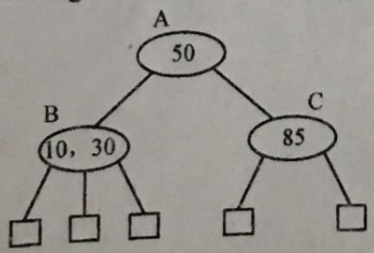
2 Given an array of 14, 12, 21, 7, 9, 5, 16, please construct a max-heap using the heap initialization algorithm.

3 Let T is an initially empty AVL tree, draw the process of inserting BJ, SH, CQ, TJ, ZJ, JS, and FJ into T in alphabet order. Write down the balance factors and the rotating types if any.

4 For the following B tree of order 3, please:

(1) draw the process of inserting 40, 45 and 42 into it.

(2) draw the process of deleting 85, 10 from it (the original tree)



III. Design algorithms (total 20 points)

1 Write an algorithm to delete an edge (u, v) from an undirected graph G. The graph is represented as adjacency multilist. (8)

2 Let the nodes of binary tree T have the following structure:

leftChild	data	rightChild

Write an algorithm to print out the data of the nodes only in the path from the root of T to the leaf node that is the farthest from the root (if there are many, any one will do). With no extra space overhead: 12; with space complexity of O(n): 8.