Examination Paper of Southeast University (A)

Course name	Data Structures and Algorithms	Semester	18-19-2	Score	
Specialty	Software Engineering	Way of examination	Open	Duration	120 min.
Textbook, dictionary, class notes and exercise books are allowed					

姓名_____ 线 封 密 学号_____

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

1 Given the following algorithm, its time complexity is (b)

```
x=2; while (x<n/2) x=2*x;
```

a) O(n)
b) $O(\log_2(n))$
c) $O(n\log_2(n))$
d) $O(n^2)$

2 Give four algorithms with the following different space complexities, which one is the most efficient?(b)

a) O(n)
b) $O(\log_2(n))$
c) $O(n\log_2(n))$
d) $O(n^2)$

3 Element A, B, C, D and E are pushed into a stack one by one, the order in which they are popped out could be different. How many solutions that make the stack empty start with popping D first? (b)

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

4 Given a binary tree, its preorder is "a,e,b,d,c" and its post order is "b,c,d,e,a". The children of the root include (C)

a) e, b
b) b
c) e
d) d

5 Transform a forest F into a binary tree T, the number of leaves of F equals to (C)

a) The number of leaves in T
b) The number of nodes with degree 1
c) The number of nodes with no left child
d) The number of nodes with no right child

6 Given an undirected graph with 16 vertices, how many edges does it have at least to be a connected graph? (a)

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

7 In external sorting, to do 6-way merge, we totally need at least (b) buffers.

a) 6
b) 7
c) 12
d) 13

8 Which of the following sequences is not an legal search path of a binary search tree? (a)

a) 95,22,91,24,94,71
b) 92,20,91,34,88,35
c) 21,89,77,29,36,38
d) 12,25,71,68,33,34

9 To improve the search efficiency of a Hash Table, the right choice is (b)

a) map equal keys to equal indices
b) minimize the probability of collisions
c) using double hashing
d) increase loading factor

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

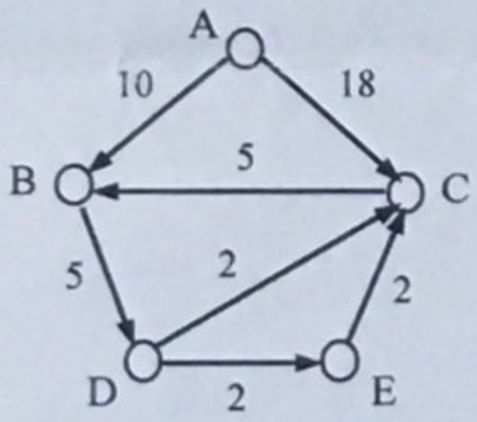
a) 1
b) 2
c) floor(M/2)
d) ceil(M/2)

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

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

2 Given an array of 14, 12, 21, 7, 9, 5, 16, please construct a loser tree.

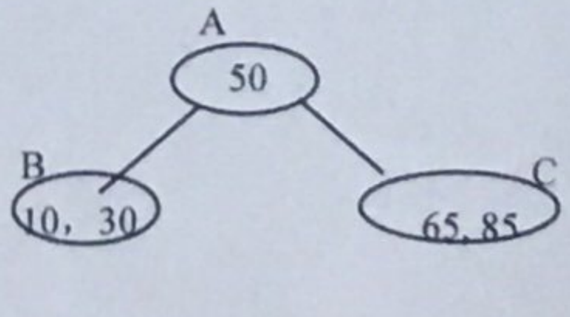
3 Given the following network, please compute the shortest paths using AllLengths algorithm (Floyd's algorithm), key steps are required (matrices).



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

(1) draw the process of inserting 20 and 80 into it.

(2) draw the process of deleting 85, 50, 65 from it (the original tree).



自觉遵守考场纪律 如考试作弊 此答卷无效

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III. Design algorithms (total 20 points)

1. The singular lists (chains) are used to store strings, the node structure is <data, next>. When two strings have the same suffices, they share the same nodes representing the suffix. As the following figure shows, str1("LOADING") and str2("BEING") share node I, N, and G. Please write an algorithm to find the first common node of two strings, e.g. node I of str1 and str2. The points you can get depend on the efficiency of the algorithm.
   a) Please give the basic idea of the algorithm in English or Chinese. (20%)
   b) Write the algorithm in C++. (70%)
   c) Analyze the time complexity. (10%)