傳播管理研究所

銘傳大學九十二學年度　　碩士班招生考試

資訊管理學系

第二節

資料結構

一、(20%)Consider the following C++ function:

```
void SomeFunction (NodeType*n)
{
  if (Head = = NULL)
      Head = n;
  else
       Tail->Next = n;
  n-> Next = NULL;
  Tail =n;
 }
```

1. What does the function do?
2. Is the list singly linked or doubly linked?
3. Is the list linear or circular?
4. Will this function work if there are already 3 nodes in the list?
5. Will this function work if there are no nodes already in the list?
6. Will the function work if called as “SomeFunction(NULL)”?
7. Is this a recursive function?
8. Does memory for “n” have to be assigned/allocated before the function is called?
9. Name one field/variable that is part of the “NodeType” struct.
10. Which of “Head”, “Tail” and “n” are pointers?

二、(14%)

(a) (6%) Suppose minimum number of entries in a node other than the root is 1000 for a B-tree. The tree has a root and one level of 1000 nodes below that.

What is the minimum number of entries that this tree might have? What is the maximum?

(b) (8%) Start with an empty B-tree with minimum number of entries set to 1.Enter the integers 1 through 10. Draw the resulting tree.

三、(9%) Suppose that we have a binary tree where the left subtree contains 3000 nodes and the right subtree contains 100 nodes. For each of the following traversals, how many nodes are processed before the root node?

(a) Inorder
(b) Preorder
(c) Postorder

四、 (12%) For each part of the problem, name and justify one data structure that addresses the problem. You may choose from the following list of data structures:
Stack Queue Binary search tree AVL tree Heap Hash table

(a) The data structure is initially empty. We then insert the values 2, 10, 12, 8, 6 and 4, in that order. Now, the only element we can remove is 12. (3 points)
(b) The data structure is initially is empty. We insert the values 2, 4, 6, 8, 10, 1 and 7, in that order. If we want to remove an element, our only choice is 2 (3 points)
(c) The data structure initially contains n elements. We then insert elements 7, 14, 27, 68, and 3. We may now find any element in average case O (1) time (3 points)
(c) The data structure initially contains n elements. We then insert elements 2, 7, 5, 13, 11, 3, and 1, in that order. We may insert any element in worst case O (long n) time (3 points)

五、(15%) Assume the hash function is: hash(x)=x modulo 11. Show the contents of the hash table (indexed by 0..10) after the following values are stored in order: 3, 14, 25, 4, 37.

(a) (5 points) Use linear probing to handle collisions.
(b) (5 points) Use double hashing hash’ (x) to handle collisions, where hash’ (x)=x modulo 5+1 is the step size hash function.
(c) (5 points) Use separate chaining to handle collisions.

六、(30%) Multiple choice

1. In a circular queue we can disambiguate empty from full queues by
   (a) using a gap in the array
   (b) incrementing queue positions by 2 instead of 1
   (c) keeping a count of the number of elements
   (d) a and c

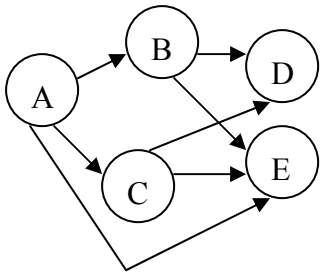
(e) a, b, and c

2. A six-digit key is hashed by using folding. The key is mapped into the sum of its digits. The hash table for this hash function must be store at least _____ items.
   (a) 45 (b) 54 (c) 55 (d) 81 (e) 120
3. Consider the following sequence of push operations in a stack:
   Push (S,' 1');
   Push (S,' 2');
   Push (S,' 3');
   Push (S,' 4');
   Push (S,' 5');
   Push (S,' 6');

   You can insert as many pop(S)' s as you like in the above sequence to get a desired output. Which of the following cannot be an output?
   (a) 123456 (b) 325416 (c)342561 (d)342615 (e)342165
4. An AVL tree requires
   (a) that every node' s subtree heights are equal
   (b) several rotations to complete each insertion
   (c) constant time to perform a rotation on it
   (d) that every node' s key is less than the keys in that node' s children
   (e) that the tree is a minimum-level binary tree
5. What is a tire?
   (a) A mis-spelling of tree
   (b) A tree with 3 children for each node; a mix of tri-and tree
   (c) A 26-ary tree
   (d) A 26-ary tree with a boolean at each node instead of a data pointer
   (e) A tree which represents data by paths rather than nodes
6. What is the worst case time for a Pop () operation on a stack of n items
   (a) O (n)
   (b) O (n0.5)
   (c) O (logn)
   (d) O (nlogn)
   (e) None of the above
7. How much time does inorder() take on a binary search tree with n nodes?
   (a) O (nlogn)
   (b) O (logn)
   (c) O (n)
   (d) O (n2)

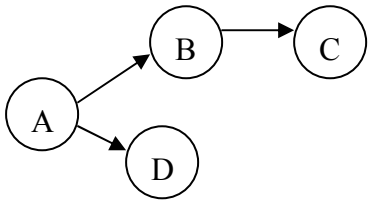
(e) None of the above

8. Which of these orders is not a possible order in which Depth First Search could visit the vertices of the directed graph shown below?



(a) ACDEB (b) ABDEC (c) ABDCE (d) AECDB (e) AEBDC

9. Which of these orders is not a topological order of the graph shown below?



(a) ABCD (b) ABDC (c) ADBC (d) ADCB (e) none of the above

10. Suppose that we are using a linked representation of lists which is circular, has double links, and has a sentinel node (also known as a list header). Assume that L points to the sentinel node for a list that has at least 5 elements. What effect would executing the following code have on the list being represented>

```
x=L.prev.prev;
x.next.prev=x.prev;
x.prev.next=x.next;
```

(a) It would delete the first element.
(b) It would delete the last element.
(c) It would delete the second-to-last element (i.e., the element just before the last element)
(d) It would delete all elements in the list.
(e) It would not change the list at all.