

國立臺灣科技大學  
九十一學年度碩士班招生考試試題

系所組別：資訊工程系在職專班  
科目：資訊工程實務

1. Write the insert() procedure for implementing a sorted singly linked list of integers. Insert() returns TRUE if the insertion is successful, and FALSE otherwise. You don't have to check for duplicated items in the list. (15%)

```
typedef struct _node
{
    int iValue;
    struct _node * pNodeNext;
} NODE;
typedef struct _linkedlist
{
    NODE * pNodeHead;
    int    cElements;
} LinkedList;

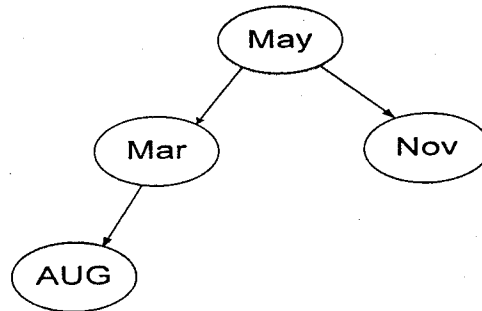
BOOL Insert(LinkedList * pList, int iValue)
{ .... }
```

2. Which of the following operations are of order  $O(\log n)$ : (10%)
- An assignment operation  $A[2000]=10$ ;
  - Insert a new node into a binary search tree.
  - Insert a new node into a balanced AVL tree.
  - Delete an element from a min heap.
  - Search for an element in a sorted array.
  - Search for an element in an unsorted array.
  - Search for an element in a sorted singly linked list.
  - Search for an element in an unordered singly linked list.
3. We want to use an array to represent a complete binary tree of  $n$  nodes. The nodes of the tree are numbered using the sequential numbering scheme -- root node is numbered 1, its left child as node 2, right child as node 3, etc. Derive expressions for the node  $i$ : (15%)
- Parent of node  $i$
  - Left child  $i$
  - Right child of  $i$
4. With respect to a tree, let root be at level 1. Let a node be at level  $l$ , then its children are at level  $l+1$ . Define height  $h(T)$  to be the maximum level of any node in the tree. Define the balance factor  $BF(T)$  of a tree to be  $h_l - h_r$ , where  $h_l$  denotes the height of its left subtree, etc. A tree  $T$  is balanced if (1)  $T_l$  and  $T_r$  are balanced, and (2) the  $BF(S) \leq 1$  for any subtree  $S$  in  $T$ . (15%)
- Label the following tree with their balance factor values.



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- b. Show the resulting tree by inserting "APR" into the tree before balancing.  
c. How would you balance the resulting tree? Show your result.
5. Of the following items, which of those are stored in the process control block? (10%)
- CPU registers
  - page table pointer
  - stack pointer
  - ready list
  - process priority
  - program counter
  - segment table
  - file table pointer
6. Which of the following statements are appropriate? (10%)
- In a virtual memory system, the size of the page table of a user program is determined by the size of its logical address space.
  - A virtual memory system allows some of the pages of a user program to reside in the secondary storage while the program is running.
  - When writing programs to run on a computer with virtual memory, programmers need to make sure that the size of the logical address space of the program does not exceed that of the physical memory of the computer.
  - The average memory access time of a virtual memory system is always more than that of a memory system without virtual memory.
7. Use pseudo code to implement the interrupt service routine for handling the timer interrupt. (10%)
8. Please implement mutex locks in terms of semaphores. (15%)

