大同大學 九十一 學年度 轉學考試 試題

考試科目：資料結構　　所別：資訊工程學系　　級別：三年級　　共 1 頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

1. Consider the function f(n) defined as follows, where n is a nonnegative integer: (4%+6%)

$$f(n)=\begin{cases} n & \text{if } n<=1; \\ n+f(n/2) & \text{if n is even, n>1;} \\ f((n+1)/2)+f((n-1)/2) & \text{if n is odd, n>1.} \end{cases}$$

(a) For n=7, draw the recursion tree and calculate the value of f(7).
(b) Write a recursive C function to calculate f(n).

```
int f(n)
{ if n <= 1
    return n ;
  else if (n mod 2 = 1)
    return n+f(n/2)
  else return f((n+1)/2)+f((n-1)/2)
```

2. (a) Define the term "stack". What operations can be done on a stack. (3%+3%+4%)
(b) Define the term "queue". What operations can be done on a queue.
(c) Define the term "divide and conquer". Is quick sort an example of divide and conquer algorithm ?

3. (a)Illustrate how to use the stack structure to evaluate the postfix expression 9 6 2 3 + * 5 / - (4%+6%)
(b)Convert the above postfix expression to both infix and prefix expression.

4. Which of the following sorting algorithms are in the worst case complexity $O(n^2)$? (10%)
(a)insertion sort (b)bubble sort (c)merge sort (d)quick soot (e)heap sort (f)selection sort.

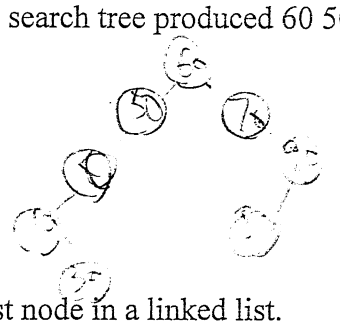
5. The sequential search is used with a list of n items. (2%+2%+2%)
(a) What is the least number of comparisons the search will take?
(b) What is the maximum number of comparisons the search will take? (n-1)
(c) What is the expected number of comparisons?

6. The binary search is used with a list of n items (2%+2%)
(a) What is the least number of comparisons the search will take?
(b) What is the maximum number of comparisons reqeired

7. Sort the sequence 50, 40, 70, 80, 20, 30, 60, 90 using (a) selection sort (b) insertion sort. You should show the partial intermediate result at each key step. (5%+5%)

8. (a)Define the term "max heap". (4%+6%)
(b) 8 integers are inserted into an initially empty max heap in the following order : 50 40 70 80 20 30 60 90 .Draw the final max heap. The properties of the max heap must be kept after each integer is inserted.

9. A preorder traversal (just print out the value stored in each node) of a binary search tree produced 60 50 40 10 30 70 90 80 Draw the binary search tree. (8%)



10. Assuming the pointer implementation of singly linked list : (2%*8)

```
typedef struct node { int info ; struct node *next ; } Node ;
typedef  Node *list, *ndptr ;
```

(a) Complete the following recursive C function to return a pointer to the last node in a linked list.

```
ndptr last(list l)
{ if ( l == NULL )____(1)_____ ; /* given list is empty */
      else if ( l->next == NULL ) ___(2)____ ;  /* list has only one node */  else ___(3)____ ;
}
```

(b) Complete the following recursive C function to copy/duplicate a given linked list.

```
list copy( list l )
{ ndptr p ;
  if ( l == NULL ) return ___(1)___ ;
  p = (ndptr) malloc(___(2)___) ;  p->info = ___(3)___ ;  p ->next = ___(4)____ ;  ___(5)____ ;
}
```

11. Let p be a pointer pointing to a node of a doubly linked circular list with more than two nodes. Write a sequence of statements to delete the node pointed to by p from the list. (6%)