108-2 Data Structures Quiz 1

系級: 　　　　　　　　學號: 　　　　　　　　姓名:

1. Which of the following about "Asymptotic Notation (O, Ω, Θ)" is (are) correct?
   (Note: "iff" means "if and only if") (multi-choice) (全選對才給分) (6%)
   (A) Let p(n) be a polynomial function with degree d, then p(n) = $\Theta(n^d)$ = O(n^d) = $\Omega(n^d)$
   (B) $6n^3 2^n + 6n^2 3^n = O(n^3 2^n)$
   (C) log^kn = O(n) for any power k
   (D) f(n) = Θ(g(n)) iff f(n) = O(g(n)) and f(n) = Ω(g(n))
   (E) f(n) = O(g(n)) implies g(n) =O(f(n))
   (F) f(n) =n^3+n!, g(n) = 2^n+ logn , f(n) = O(g(n))
   (G) $66n^3 + 4n^2 + 499$n = $\Omega(n^2)$
   Ans: (A) (C) (D)

2. X is two-dimensional array. The address of X(5, 3) and X(8, 5) are 5314 and 5422.
   Assume that each element occupies four bytes, then what is the address of X(1, 7)? (要有計算過程否則不計分) (10%)
   Ans: 先算Row-major:
   　　A(8, 5) = A(5, 3) + [(8 − 5) * n + (5 − 3)]* 4
   　　5422 = 5314 +12n + 8
   　　100 = 12n, 非整數, 所以不合

   　　算Column-major
   　　A(8, 5) = A(5, 3) + [(5 − 3) * m + (8 − 5)]* 4
   　　5422 = 5314 + 8m +12
   　　96 = 8m
   　　m = 12
   　　所以 A(1, 7) = A(5, 3) + [(7 − 3) *12 + (1 − 5)] * 4 = 5490

3. Write the postfix and prefix expression for the following infix expression.
   a/b − c + d × e − a × c (要有過程否則不計分) (8%)
   Ans: prefix: − + −/abc × de × ac
   　　postfix: ab/c − de × +ac × −

4. The following function f is a non-recursive function. Please write a recursive function with the same result for function f. (10%)

```
int f (int n)
{
    int i;
    int j = 0;
    for (i = 0; i < n; i++)
        j = j + (i + 1);
    return j
}
```
Ans:
```
int f (int n)
{
    if (n ==1);
        return 1;
    else
        return f(n-1) + n;
}
```

5. What is the value of count? (8%)
```
float sum(float list[ ], int n)
{
    float temp = 0;
    count ++;
    int i;
    count ++;
    for (i = 0; i < n; i++) {
        count += 3;
        temp += list[i];
        count ++
    }
    count ++;
    return temps;
}
```
   Ans: 4n + 3

6. The following programming segment is a delete function from a stack, please fill in the programming statement at the empty space (8%)
```
element pop()
{
```

```
if (        )
        return stackEmpty ();
return stack [        ];
}
```

Ans: top == -1
       top--

7. Let *first* be a pointer to a linked list as following program. Assume that we want to insert a node with a data field of 100 after some arbitrary node *x*.
   Finish the following program. (12%)

```
void insert (listPointer *first, listPointer x)
{
        listPointer temp;
        MALLOC (temp, sizeof(*temp));
        temp → data = 100;
        if (*first) {
                                        ;
                x → link = temp;
        }
        else {
                temp → link =        ;
                                        ;
        }
}
```

Ans: temp → link = x → link;
       NULL
       *first = temp

8. The following programming segment is a delete function from a circular queue, please fill in the programming statement at the empty space (8%)

```
element delete ()
{
        element item;
            if (        )
                    return queueEmpty();
            front = (        ) % MAX_QUEUE_SIZE;
            return queue [front];
}
```

Ans: front == rear

front + 1

9. What is Ack (2,2)? Ack (1,2)? (要有計算過程否則不計分)(10%)

   int Ack (int m, int n)
   {
       if (m == 0)   return n+1;
       else if (n == 0)   return Ack (m-1, 1);
       else   return Ack (m-1, Ack(m,n-1));
   }

   Ans: Ack (2,2) = 7 , Ack (1,2) = 4

10. Order the following functions by growth rate.

    a = n, b = $n^{1.7}$, c = nlogn, d = nloglogn, e = 2/n, f = 2^n, g = n^3, h = $2^{n/2}$ (8%)

    Ans: e a d c b g h f

11. Consider a = $2x^5 + 99x^4 + 3x^{12} + 9527$

    Use (1)Array Representation   (3%)   (2)link list Representation (3%)

    Ans:

    (1)

coef	2	99	3	9527
exp	5	4	12	0

    (2)

    a ⟶ [2 | 5 |] ⟶ [99 | 4 |] ⟶ [3 | 12 |] ⟶ [9527 | 0 |] ⟶ null

12. Choose all the correct statements. (multi-choice) (全選對才給分) (6%)

    (A) A stack is an ordered list in which insertions and deletions are made at one end called the *top*.

    (B) The C library function void *malloc(size_t size) allocates the requested memory and returns a pointer to it.

    (C) A queue is a last-in, first-out list.

    (D) The memory of the dynamic array is dynamically allocated.

    (E) The data in the dynamic array is dynamically sorted.

    (F) To prevent stack overflow, we should limit the number of local variables in recursive function

    (G) For the implementation of a recursive program, a stack mechanism is maintained by a programming system that supports the recursive function.

    Ans: (A) (B) (G)