

科目：資料結構與演算法

適用：資工系

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

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1. The sequence  $F(n)$  of Fibonacci numbers is defined by the recurrence relation
 
$$F(n) = F(n-1) + F(n-2),$$
 with seed values
 
$$F(0) = 1, \text{ and } F(1) = 1.$$
  - a. If using the recursion method to calculate the value of  $F(11)$ , how many times of additive operations will be performed?  
Explain your answer briefly. (15%)
  - b. If using the dynamic programming method to calculate the value of  $F(11)$ , how many times of additive operations will be performed?  
Explain your answer briefly. (15%)
2. Give a comparison between the Radix Exchange Sort and the Straight Radix Sort. (20%)
3. For the following key sequence, "ADIAMONDISFOREVER",
  - a. create a 2-3-4 tree. Explain your answer in detail. (10%)
  - b. draw a red-black tree to represent your 2-3-4 tree in the previous question. (10%)
  - c. explain the structural properties of the red-black trees. (10%)
4. Consider the following function F written in a C-like pseudo-code:
 

```
F ( triangle t, int depth )
{
    Subdivides t into four smaller congruent sub-triangles;
    Remove the central sub-triangle and fill it with a color;
    depth++;
    if ( depth <= 2 )
    {
        For each of the remaining sub-triangles, call:
        F ( sub-triangle, depth );
    }
}
```

 Given a triangle T, show the result of executing:  $F ( T, 0 )$ . (20%)