Part I. Single Choice Questions
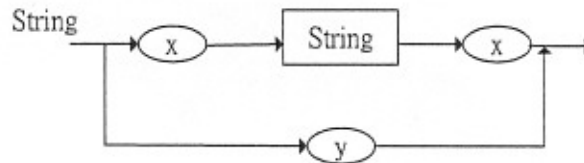
1. What is the sentence describing the structure of a string as defined by the syntax diagram below? (5 %)

(a) $x^n y x^n$
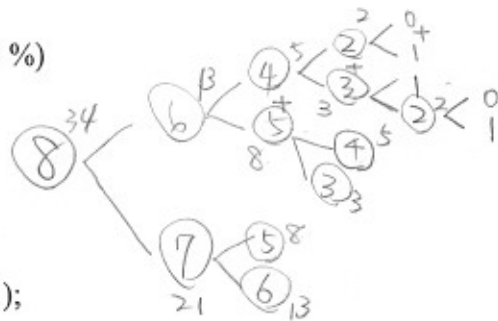(b) $x^n y x^{n-1}$
(c) $x^n y x^{n+1}$
(d) $x^n y^n x$

Ans: _____

2. Consider the following recursive function: (5 %)

```
int func(int n) {
    if (n=0 || n=1)
        return 1;
    else
        return func (n – 2) + func (n – 1);
}
```

What is the result of func(8)?
(a) 8
(b) 15
(c) 21
(d) 34

Ans: _____

3. The following program: (5 %)

```c
int inc1()
{
    int x=0;
    x++;
    return x;
}
int inc2()
{
    static int y=0;
    y++;
    return y;
}
int main()
{
    int x=3,y=8;
    for (int i=0; i<10; i++)
    {
        x= inc1();
        y= inc2();
    }
    printf("%d\n",x);
    printf("%d\n",y);
    return 0;
}
```

return y; | 2 3 ... 10

0 ~ 9 → 10 times

x = const = 1
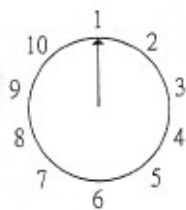y = 10

Which one is correct?

(a) x=3, y= 8

(b) x=1, y=18

(c) x=1, y=10

(d) x=1, y=1

Ans: C

Part II. Problem

4. Assume n people numbered *1* to n around a circle, and we eliminate every second
   remaining person until only one survives. We define a function J(n) to represent the
   marked number of the final survivor among n people. For example, here's the
   starting configuration for $n = 10$:

The elimination order is 2, 4, 6, 8, 10, 3, 7, 1, 9, so the person marked "number 5"
survives. Therefore, J(10) = 5 where n = 10. Note that J(1) = 1.
(1) Please find the recursive relation for J(n). (15 %)
(2) Please write an algorithm according to the recursive relation in (1) to solve this
    problem. (15 %)

Ans:

(1)

$$當\ n \geq J(n-1)+2$$
$$則\ J(n) = J(n-1)+2$$
$$否則\ J(n) = 1$$

$J(1) = 1 \quad J(13) = 11$

$J(2) = 1 \quad J(14) = 13$

$J(3) = 3 \quad J(15) = 15$

$J(4) = 1$

$J(5) = 3$

(2)

```
procedure recur(n)
  if (n=1) then (return 1)
  else if (n ≥ recur(n-1)+2) then (return recur(n-1)+2)
  else (return 1)
```

$J(6) = 5$

5. Why are software developments from the traditional waterfall model toward the incremental model? (5%)

Ans:

6. Would the number of lines in a program be a good measure of the complexity of the program? Why? (5%)

Ans:

否，∵複雜度並非和程式行敔有直接關聯，
應由其程式內容、使用的演算法等等去
佑算其複雜度。

7. Is the collection of statements $\neg R$, $(T \text{ OR } R)$, $(P \text{ OR } \neg Q)$, $(Q \text{ OR } \neg T)$, and $(R \text{ OR } \neg P)$ consistent? Explain your answer. (5 %)

Ans:

8. What problems could arise during the modification stage if a large program was designed in such a way that all of its data elements were global? (10 %)

Ans:

当變數全為廣域變數,則在眾模組中若改變了其值,並不容易發現,除非加上註解,而這樣的特點除了容易產生結果上的錯誤,也会大大降低其模組成為抽象工具的可用性。

9. What is the difference between coupling and cohesion? Which should be minimized and which should be maximized? Why? (10 %)

Ans:

Coupling:模組之間的連結,分成控制权的轉移和資料的流通轉移。

Cohesion:模組內的凝聚力,可分成邏輯凝聚力和功能凝聚力。

應增益的為 cohesion,可強化模組的使用,執行單一工作或同樣性質的工作,使模組便於分類管理。

10. Simultaneous execution of multiple activations is called parallel processing or concurrent processing. What is the difference between parallel processing and concurrent processing? (10 %)

Ans:

11. The following is a multiplication problem in traditional base ten notations. Each letter represents a different digit. What digit does each letter represent? Explain your answer. (10 %)

$$\begin{array}{r} XY \\ \times YX \\ \hline XY \\ YZ \\ \hline WVY \end{array}$$

驗： $\begin{array}{r} 13 \\ \times 31 \\ \hline 13 \\ 39 \\ \hline 403 \end{array}$

Ans:

有 W、X、Y、Z、V 与變取

$$\begin{cases} X \times (10X+Y) = 10X+Y - ① \\ Y \times (10X+Y) = 10Y+Z - ② \end{cases}$$

Ans: W = 4

X = 1

① ⇒ X = 1 代入 ②

Y = 3

$$10Y+Y^2 = 10Y+Z$$

Z = 9

V = 0