

分支 (selection , branch) 概  
念再複習

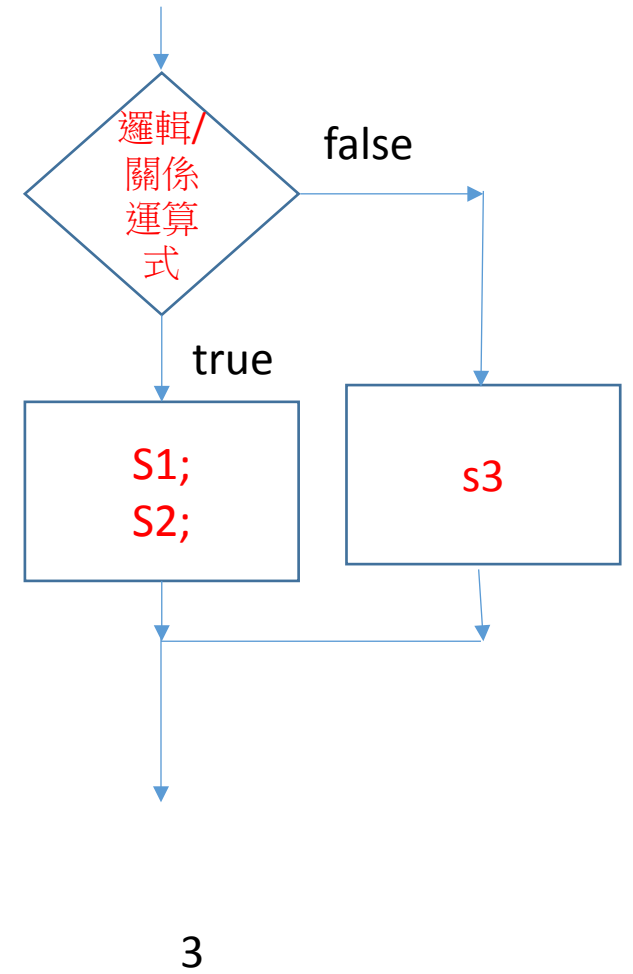
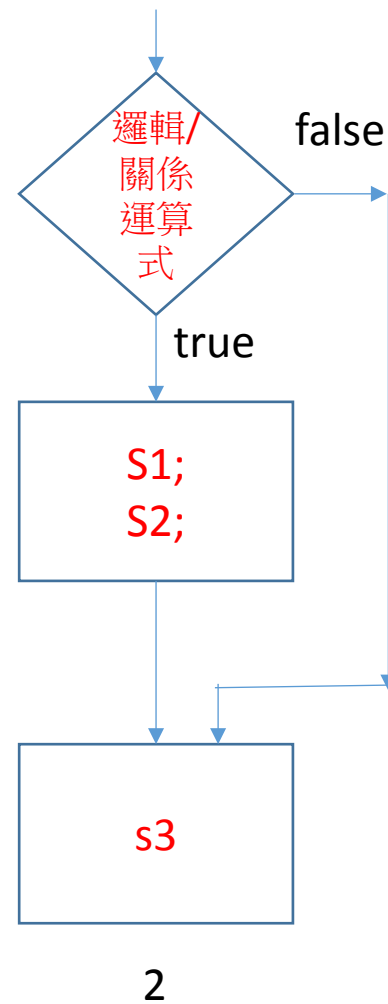
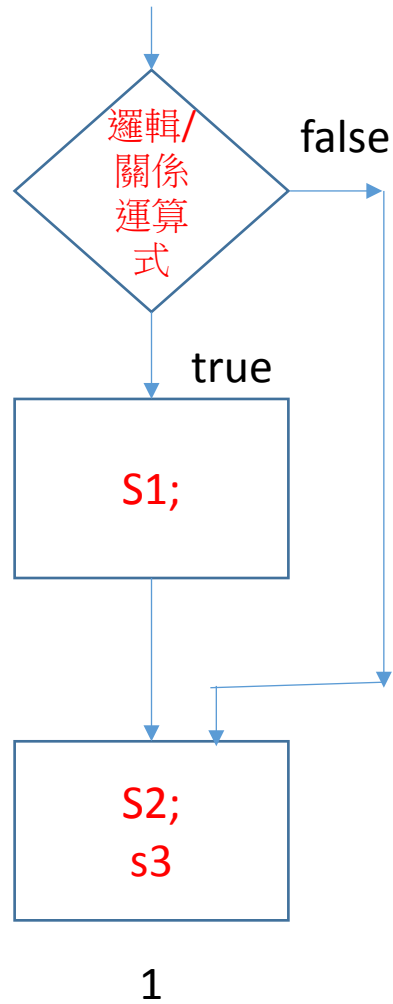
# 分支 (selection , branch)概念:搶答(1)

if (邏輯/關係運算式)

```
{  
  s1;  
  S2;  
}
```

s3;

A



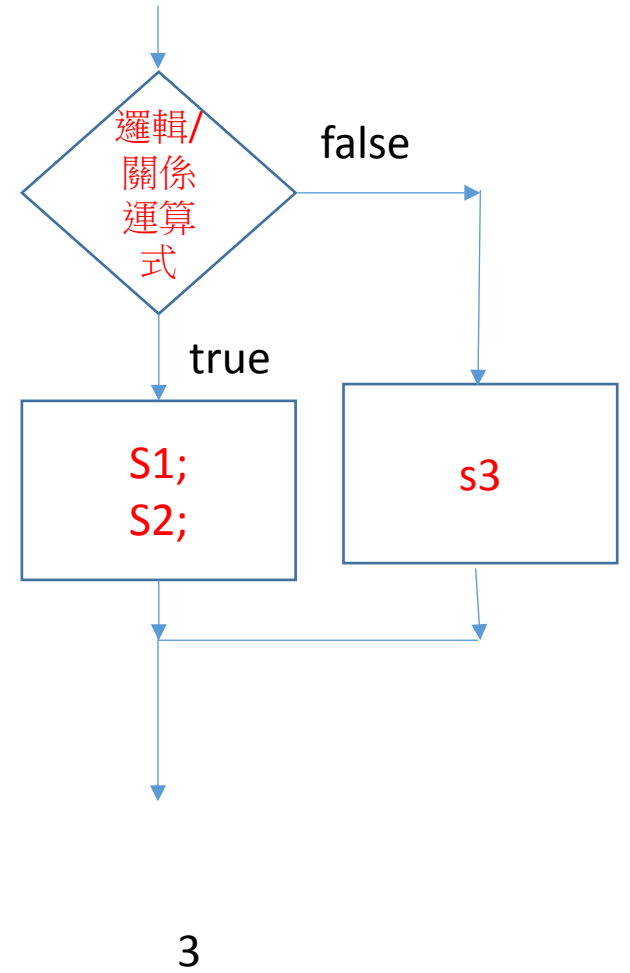
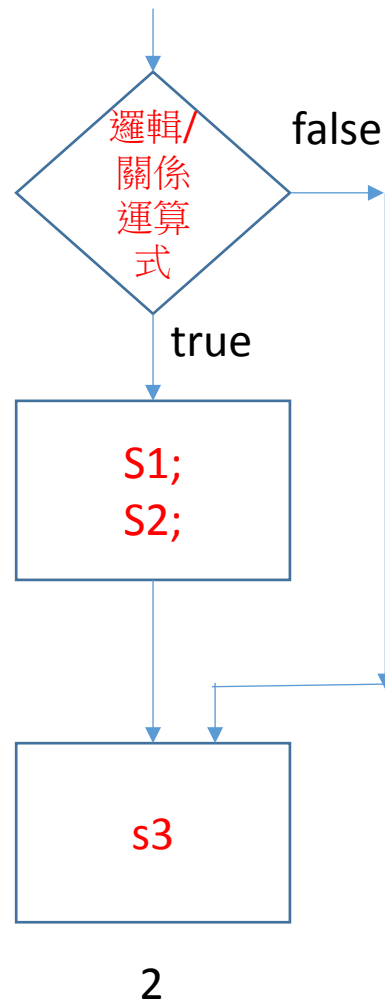
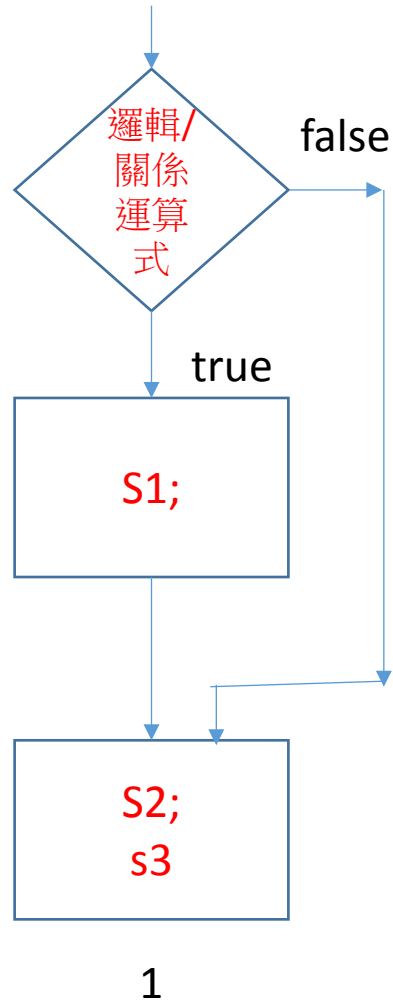
A的正確流程圖? 1、2、3

(邏輯/關係運算式)  
==(條件式)

# 分支 (selection , branch)概念:搶答(3)

```
if (邏輯/關係運算式)
{
  s1;
  S2;
}
else
  s3;
```

C



(邏輯/關係運算式)  
==(條件式)

C的正確流程圖? 1、2、3

# 分支 (selection , branch)概念:搶答(2)

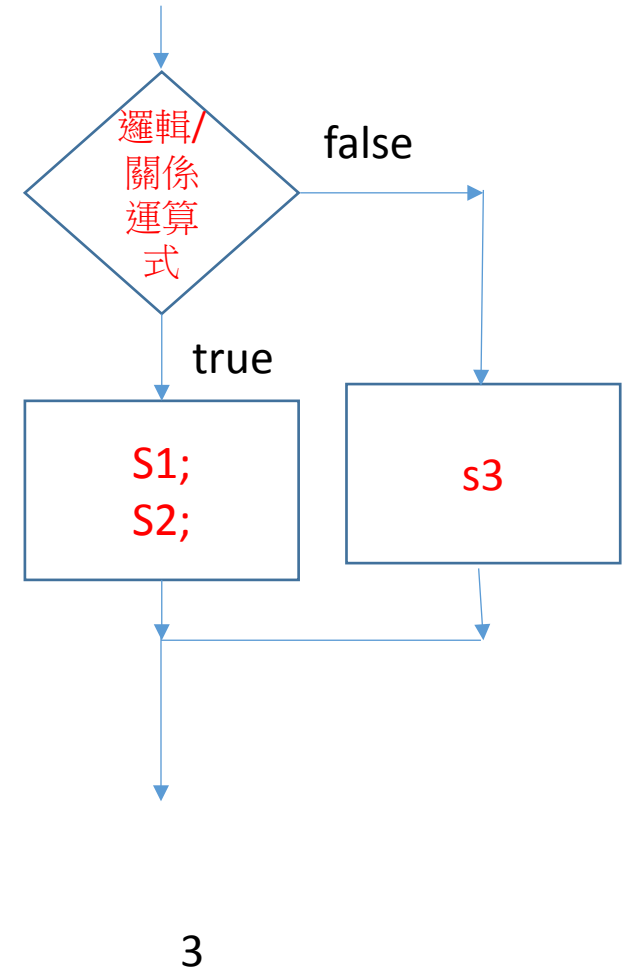
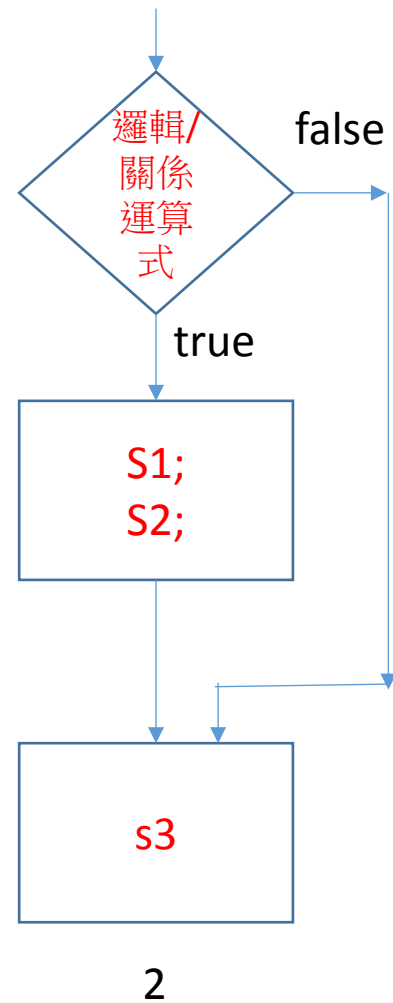
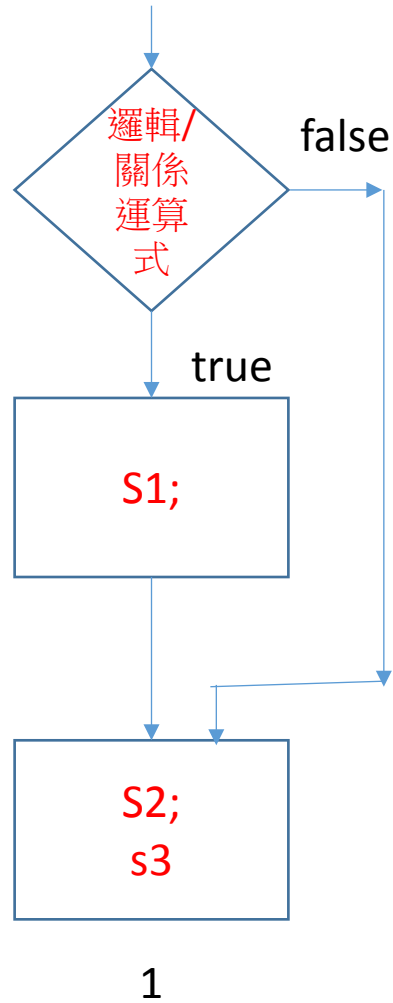
if (邏輯/關係運算式)

s1;

s2;

s3;

B



(邏輯/關係運算式)  
==(條件式)

B的正確流程圖? 1、2、3

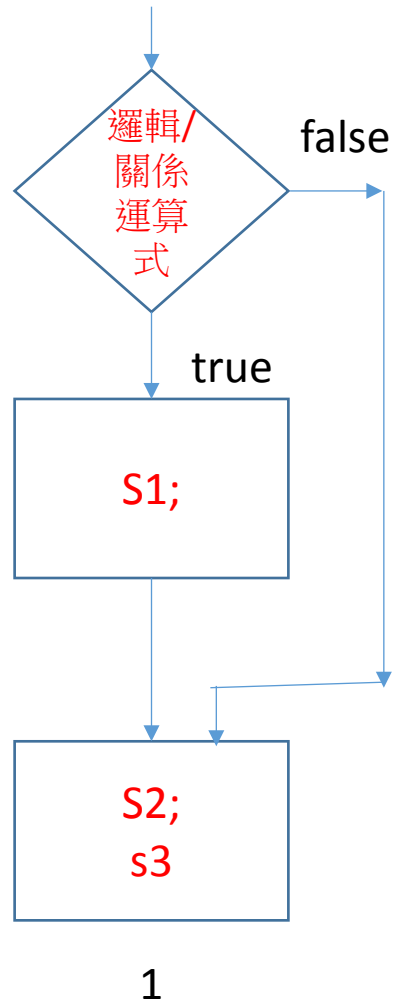
# 分支 (selection, branch) 概念複習(1)

if (邏輯/關係運算式)

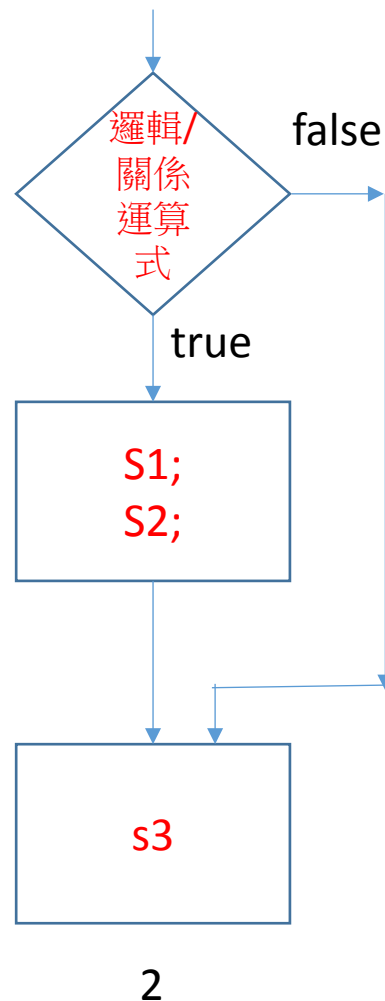
```
{  
  s1;  
  S2;  
}
```

```
s3;
```

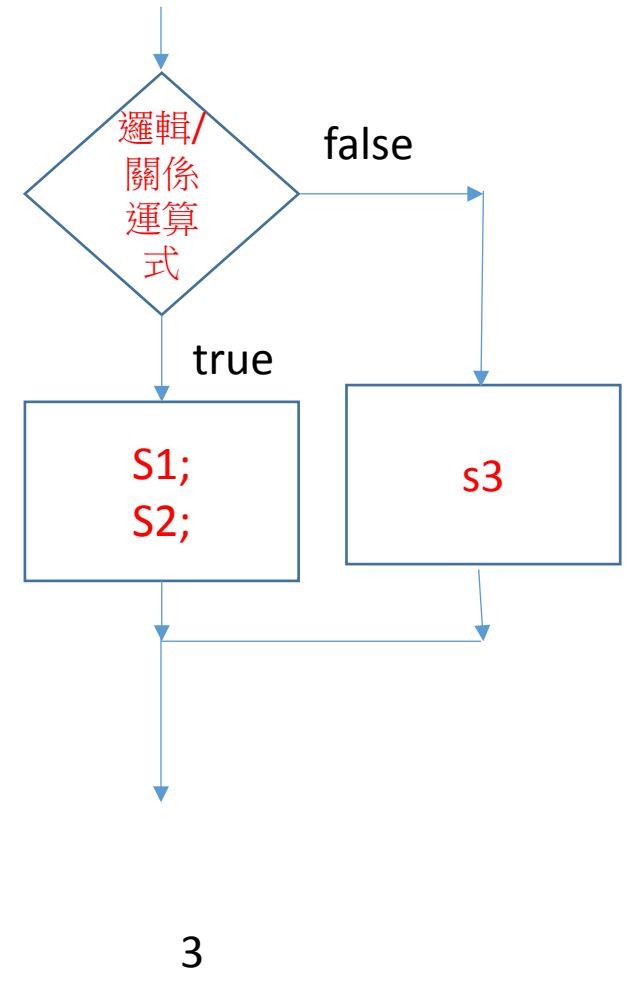
A



1



2



3

if (邏輯/關係運算式)

```
s1;  
s2;  
s3;
```

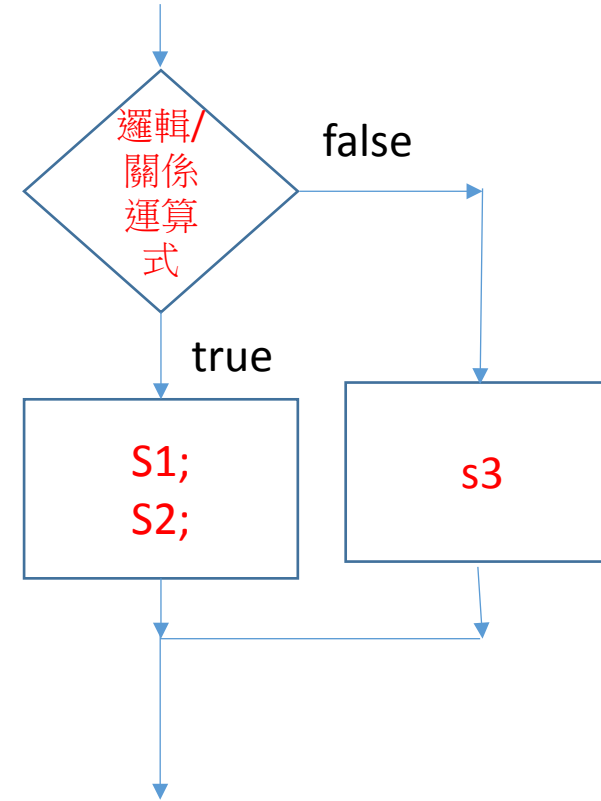
B

A的正確流程圖? 1~3  
B的正確流程圖? 1~3

(邏輯/關係運算式)  
==(條件式)

# 分支 (selection , branch)概念複習(1)

```
if (邏輯/關係運算式)  
{  
    s1;  
    s2;  
}  
else  
    s3;
```



# (selection, branch)概念複習(2)

if (邏輯/關係運算式)

```
{  
  s1;  
  S2;  
}  
s3;
```

if (邏輯/關係運算式)

```
{  
  s1;  
  S2;  
}  
else {  
  s3;  
  S4;  
}  
S5;
```

2分支

if (邏輯/關係運算式)

```
{  
  s1;  
  S2;  
}  
else if (邏輯/關係運算式)  
{  
  s3;  
  s4;  
}  
else {  
  s5;  
  S6;  
}  
S7;
```

Multiple-way if: 3分支

if (邏輯/關係運算式)

```
{  
  if (邏輯/關係運算式) {  
    s1;  
    s2;  
  }  
  else  
    s3;  
}  
else if (邏輯/關係運算式)  
{  
  s4;  
  s5;  
}  
S6;
```

nested if: 2層巢狀

# 分支 (selection, branch) 概念複習(3)

```
if (邏輯/關係運算式)
{
    s1;
    s2;
}
s3;
```

```
if (邏輯/關係運算式)
    s1;
    s2;
    s3;
```

```
if (邏輯/關係運算式)
{
    s1;
    s2;
}
else {
    s3;
    s4;
}
s5;
```

```
if (邏輯/關係運算式)
    s1;
else
    s3;
s4;
s5;
```

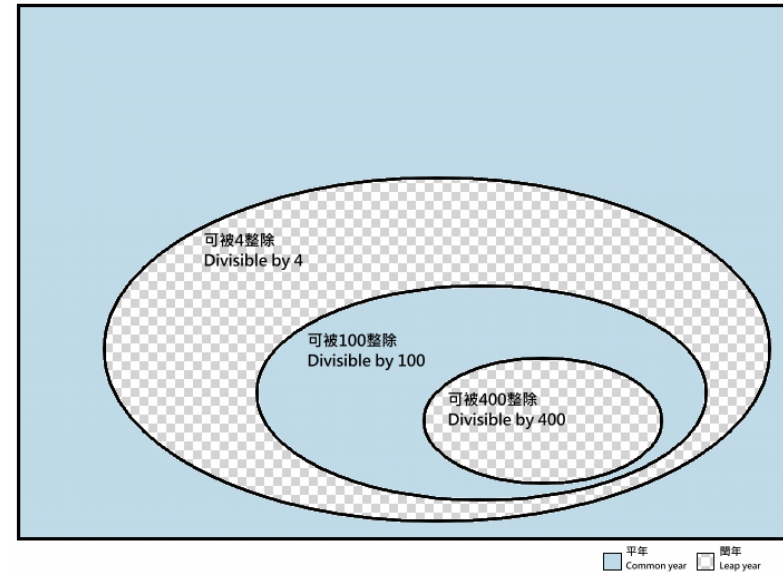
複合敘述 Compound statement  
單一敘述 Single statement 不用 { }



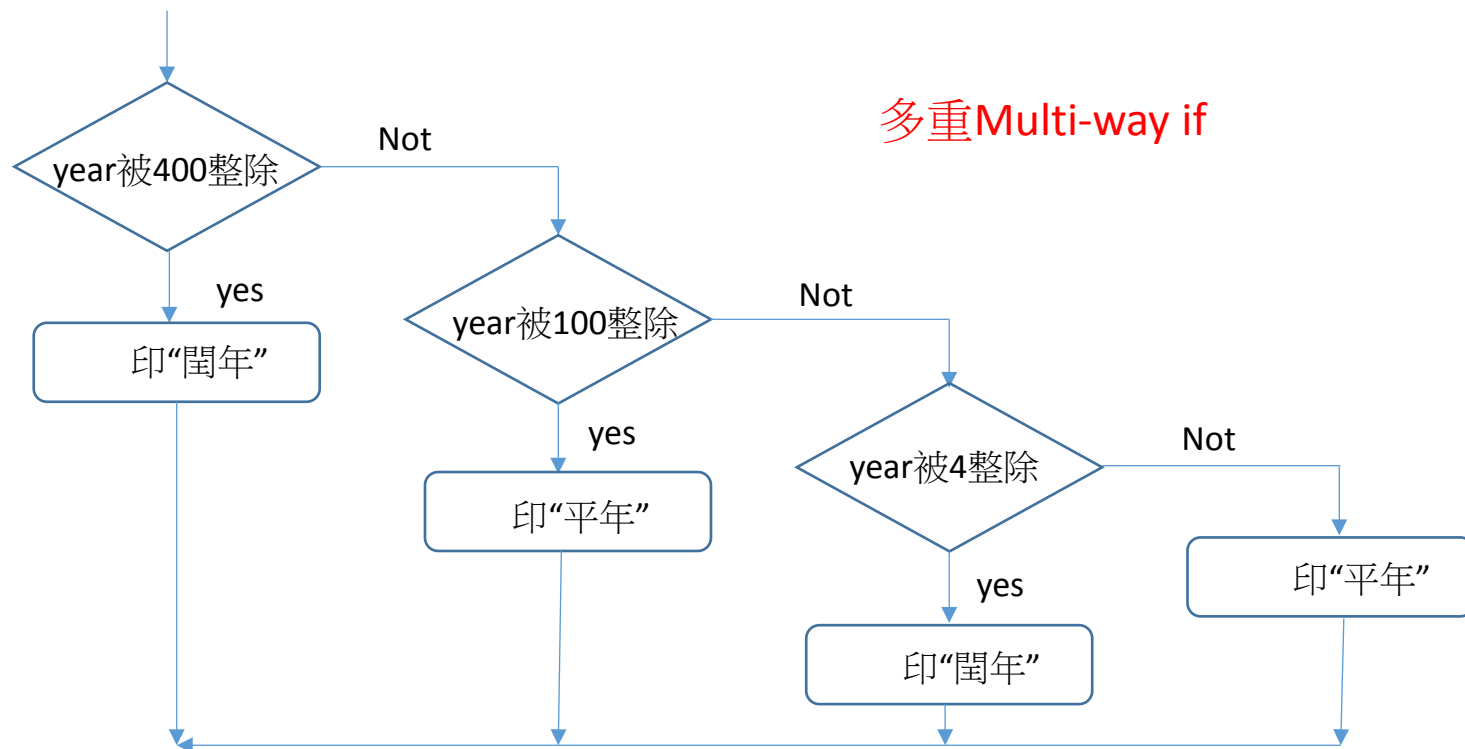
判斷閏年(leap year)、平年(common year)

# 閏年、平年

- 閏年:閏年是比普通年分多出一段時間的年分，目的是為了彌補人為規定的紀年與地球公轉產生的差異
- 格里高利曆(Calendarium Gregorianum)閏年規則如下：
  - 4的倍數是可能的。
  - 100的倍數是不可能的。
  - 400的倍數是可能的。
- 每逢閏年，2月分有29日，平年的2月分為28日
- 公元前之閏年出現在1, 5, 9, 13, ... BC，須將年份值減1再以「除以4」計算。（因為沒有公元0年這一年，所以公元前1, 2, 3, 4, ... 年應該是公元0, -1, -2, -3, ... 年，而公元前1, 5, 9, 13, ... 年為公元0, -4, -8, -12, ... 年，為4的倍數）
- <https://zh.wikipedia.org/wiki/%E9%97%B0%E5%B9%B4>



# 判斷閏年(leap year)、平年(common year)流程圖 條件式調整順序，是否正確？



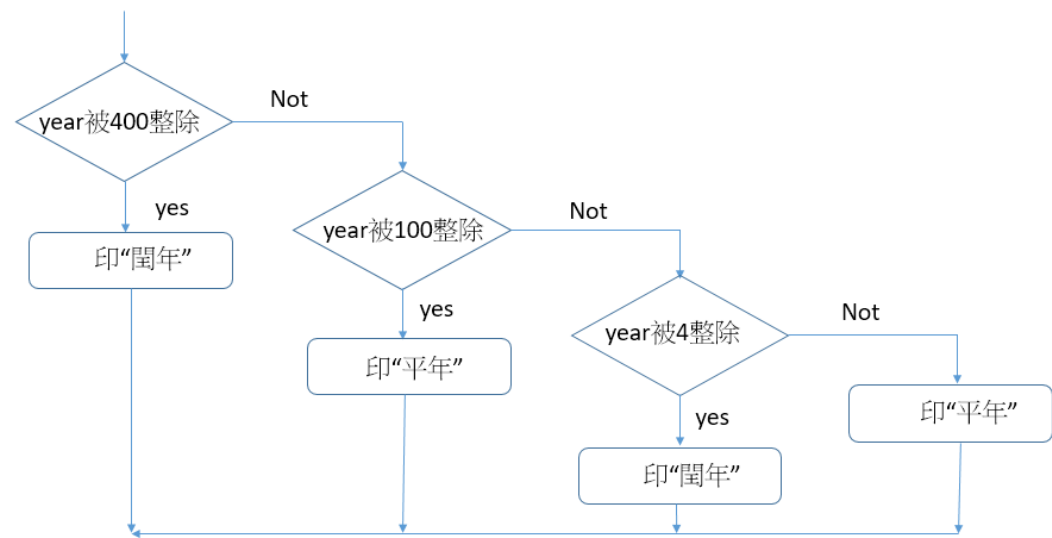
```

import java.util.Scanner;
//閏年:閏年是比普通年分多出一段時間的年分
public class leap_year_0a {

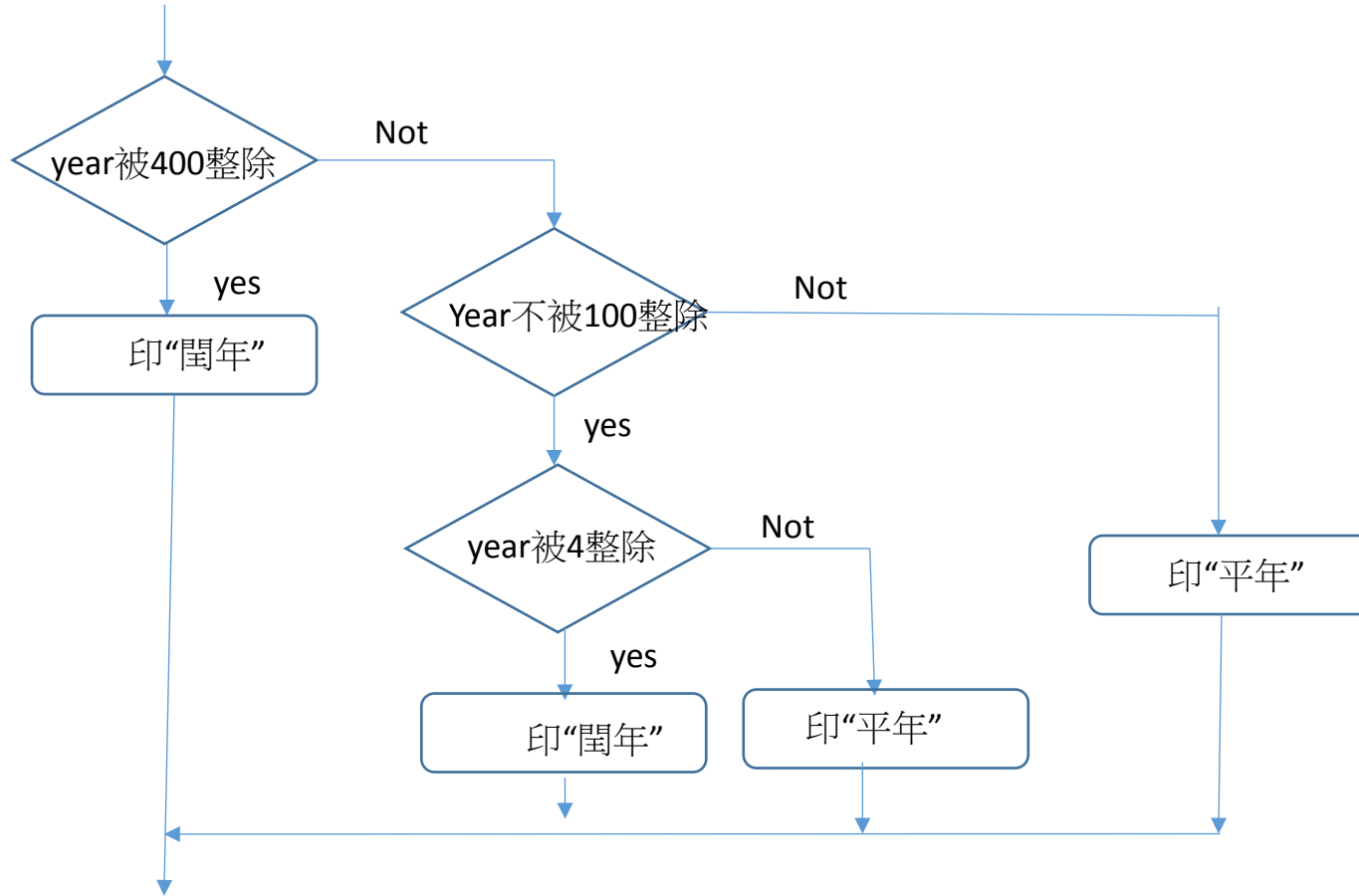
public static void main(String[] args) {
    String status;
    System.out.println("=====歡迎=====");
    Scanner input = new Scanner(System.in);
    int year=2000;
    System.out.print("輸入公元年：");
    year = input.nextInt();

    if (year%400==0)
        status = "閏年(leap year)!";
    else if (year%100==0)
        status = "平年(common year)!";
    else if (year%4==0)
        status = "閏年(leap year)!";
    else
        status = "平年(common year)!";
    if (year>=0)
        System.out.println("你輸入：公元"+year+"年，是 "+status);
    System.out.println("=====bye=====");
    }//main
} //class

```



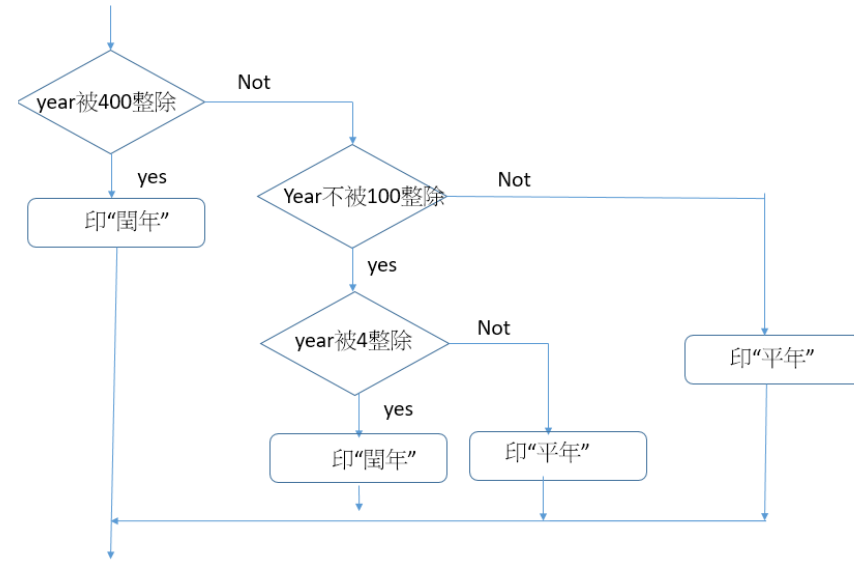
## 巢狀分支Nested if

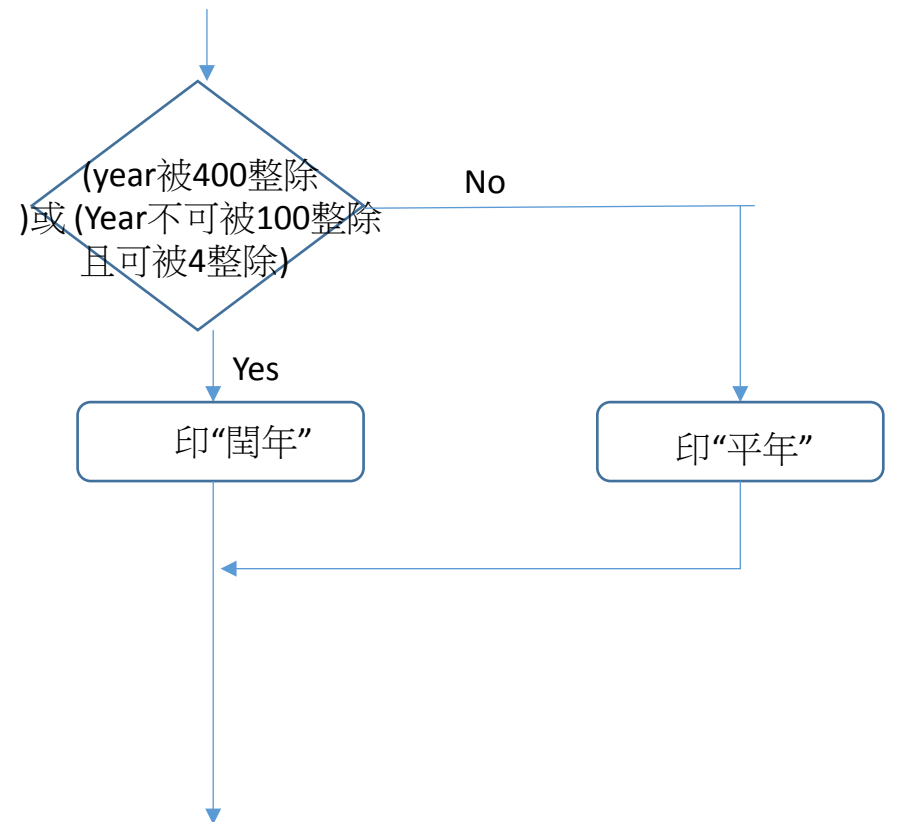
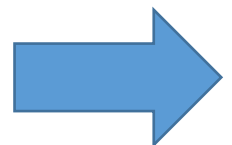
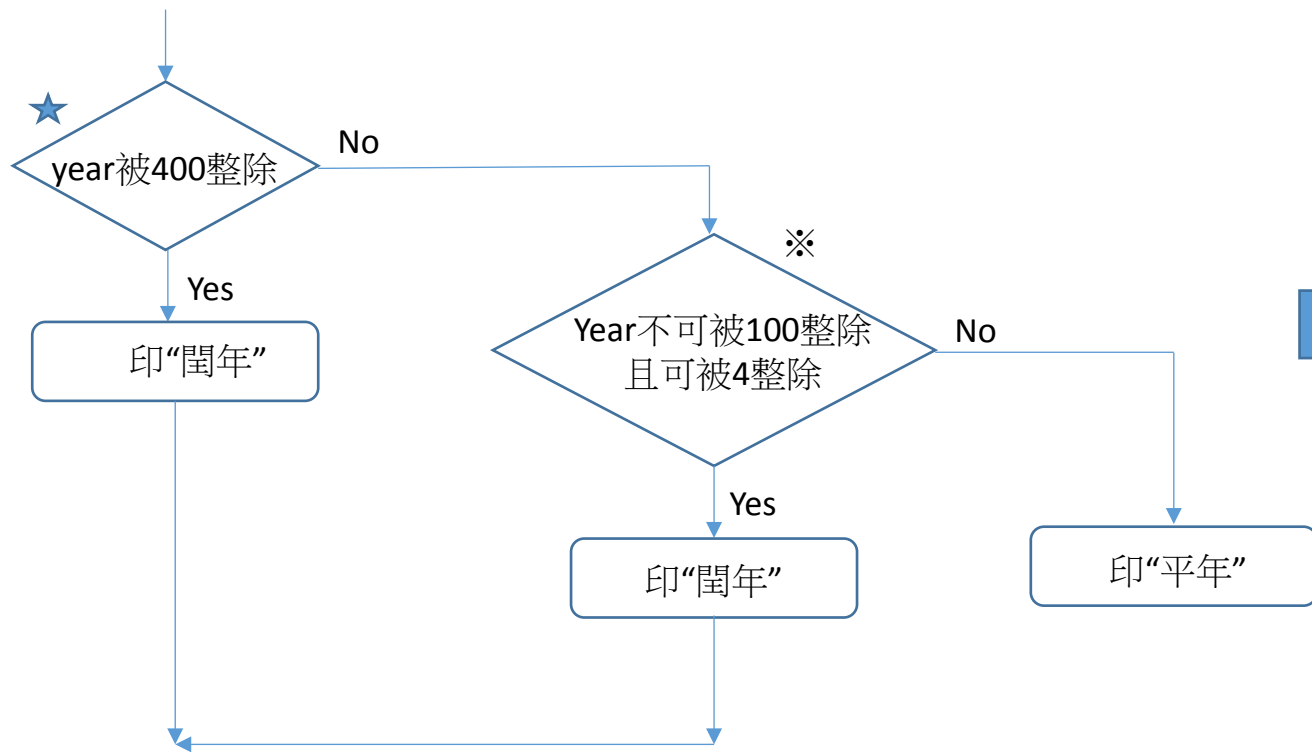


```

Scanner input = new Scanner(System.in);
int year=2000;
System.out.print("輸入公元年：");
year = input.nextInt();
if (year%400==0)
    status = "閏年(leap year)!";
else if (year%100!=0)
{
    if (year%4==0)
        status = "閏年(leap year)!";
    else //can be omitted
        status = "平年(common year)!"; //can be omitted
}
else
    status = "平年(common year)!";
if (year>=0)
    System.out.println("你輸入：公元"+year+"年，是 "+status);
else
    System.out.println("你輸入錯誤!");

```





二分支都可得閏年:或(or)

# 閏年規則轉成條件

- 閏年規則如下：

- 是4的倍數
- 不是100的倍數
- 是400的倍數

```
if ((year%4==0 && year%100!=0) || year%400==0) {  
    status = "閏年(leap year)!";  
}  
else  
    status = "平年(common year)!";
```



```
System.out.print("輸入公元年(-1:結束)：");
year = input.nextInt();

if ((year%4==0 && year%100!=0)|| year%400==0) {
    status = "閏年(leap year)!";
}
else
    status = "平年(common year)!";
if (year>=0)
    System.out.println("你輸入：公元"+year+"年，是 "+status);
```

# 迴圈加入判斷leap year(閏年)

```
import java.util.Scanner;
//閏年:閏年是比普通年分多出一段時間的年分
public class leap_year_1 {

public static void main(String[] args) {
    String status;
    System.out.println("=====歡迎=====");
    Scanner input = new Scanner(System.in);
    int year=2000;
    while (year>=0) {
        System.out.print("輸入公元年(-1:結束):");
        year = input.nextInt();

        if ((year%4==0 && year%100!=0)|| year%400==0) {
            status = "閏年(leap year)!";
        }
        else
            status = "平年(common year)!";
        if (year>=0)
            System.out.println("你輸入:公元"+year+"年,是 "+status);
    }//while
    System.out.println("=====bye=====");
} //main
} //class
```

# 讓程式繞圈圈：談迴圈(loop)

臺北市立大學 [資訊科學系\(含碩士班\)](#)

賴阿福

# 迴圈(loop)

- 讓猜數字重複執行
  - 猜到對為止
  - 繼續猜
  - 但何時結束? 結束條件
- 重複計算BMI
- 重複判斷leap year(閏年)

# 迴圈(loop)概念

- 重複不斷執行，直到條件不符合為止。

常見型態：for、while、do...while

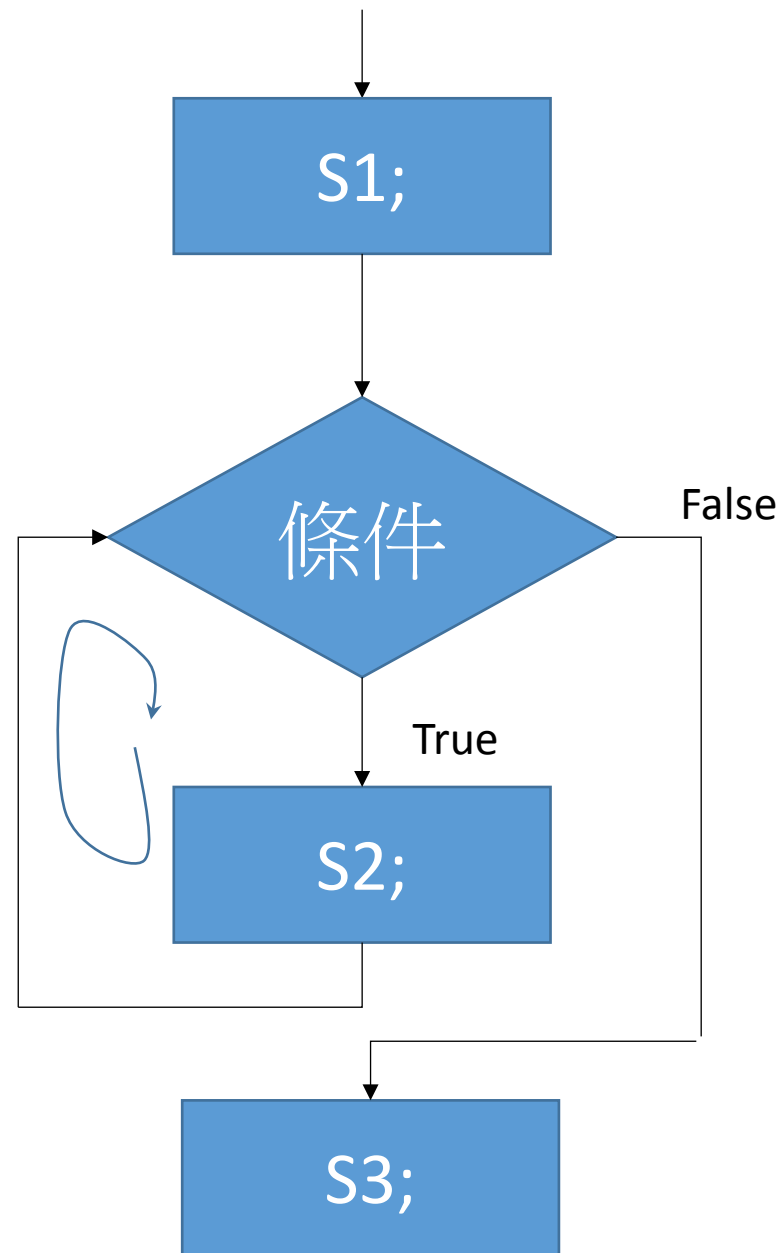
- 一開始條件須符合，才能進入迴圈內部執行

- 無窮迴圈：條件永遠符合

- 有些環境必須是無窮迴圈：

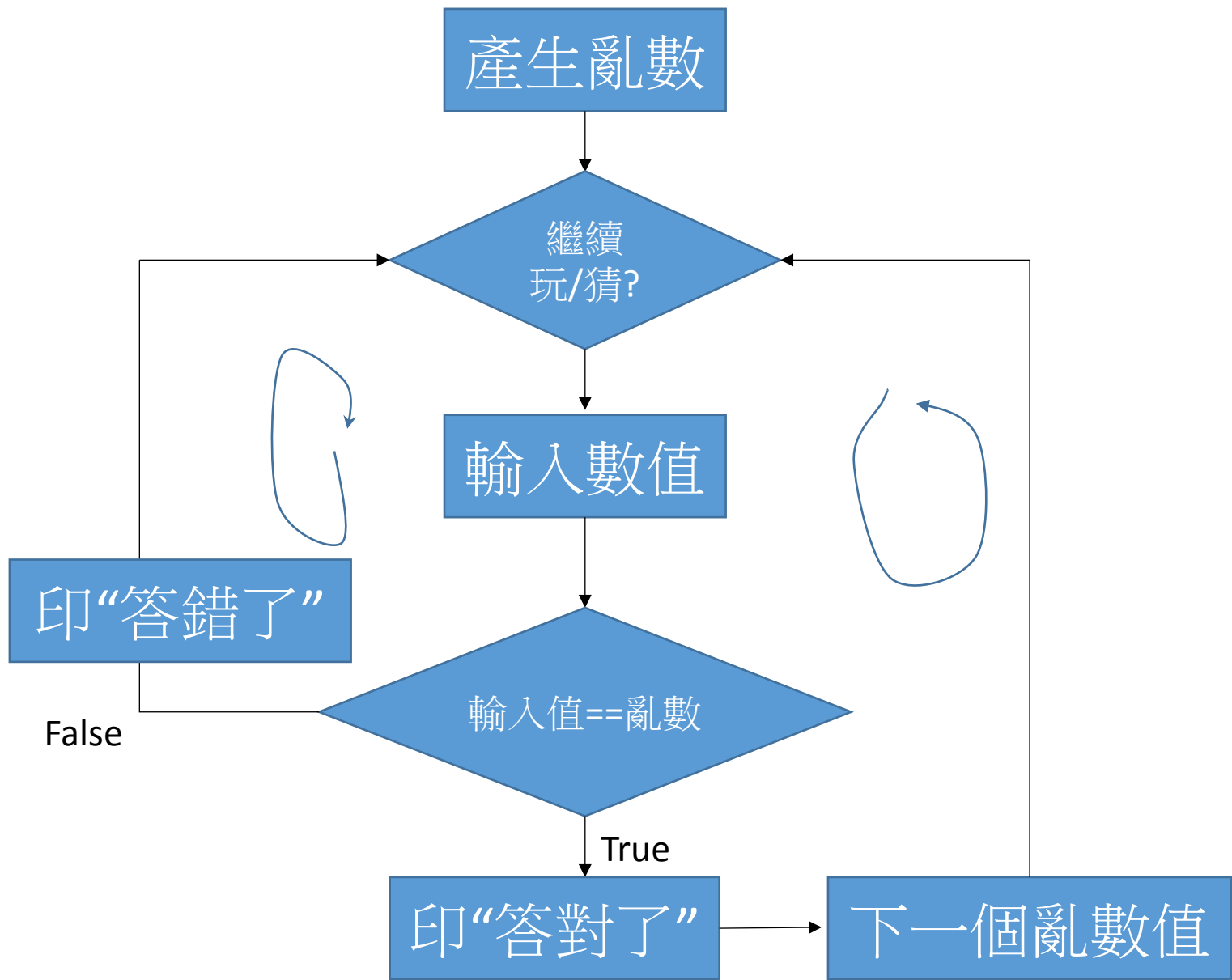
O.S(作業系統)

\* CPU特性：重複執行(耐性)



# 猜數字遊戲

- 讓猜數字重複執行
- 猜到對為止
- 繼續猜
- 但何時結束? 結束條件



```
C:\Windows\System32\cmd.exe - ja...
亂數為8
E:\java-2017\9-22\code>javac GuessN_3.java
E:\java-2017\9-22\code>java GuessN_3
猜數字(1~100) : 33
猜的太大囉
猜數字(1~100) : 22
猜的太大囉
猜數字(1~100) : 12
猜的太大囉
猜數字(1~100) : 10
猜的太大囉
猜數字(1~100) : 8
猜的太大囉
猜數字(1~100) : 5
猜的太小囉
猜數字(1~100) : 7
恭喜猜對!
猜數字(1~100) :
```

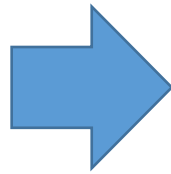
# 讓猜數字重複執行

```
public class GuessN_2 {
    public static void main(String[] args) {

        SecureRandom sr = new SecureRandom();
        Scanner input = new Scanner(System.in);

        int a = 0;
        int b = 0;
        a = sr.nextInt(100)+1;

        System.out.print("猜數字(1~100)：");
        b = input.nextInt();
        if (a!= b) { //nested if
            if (a > b)
                System.out.println("猜的太小囉\n");
            else
                System.out.println("猜的太大囉\n");
            System.out.println("亂數為"+a);
        } //if
    } else
        System.out.println("恭喜猜對!");
} //main
} //class
```



```
public class GuessN_3 {
    public static void main(String[] args) {

        SecureRandom sr = new SecureRandom();
        Scanner input = new Scanner(System.in);

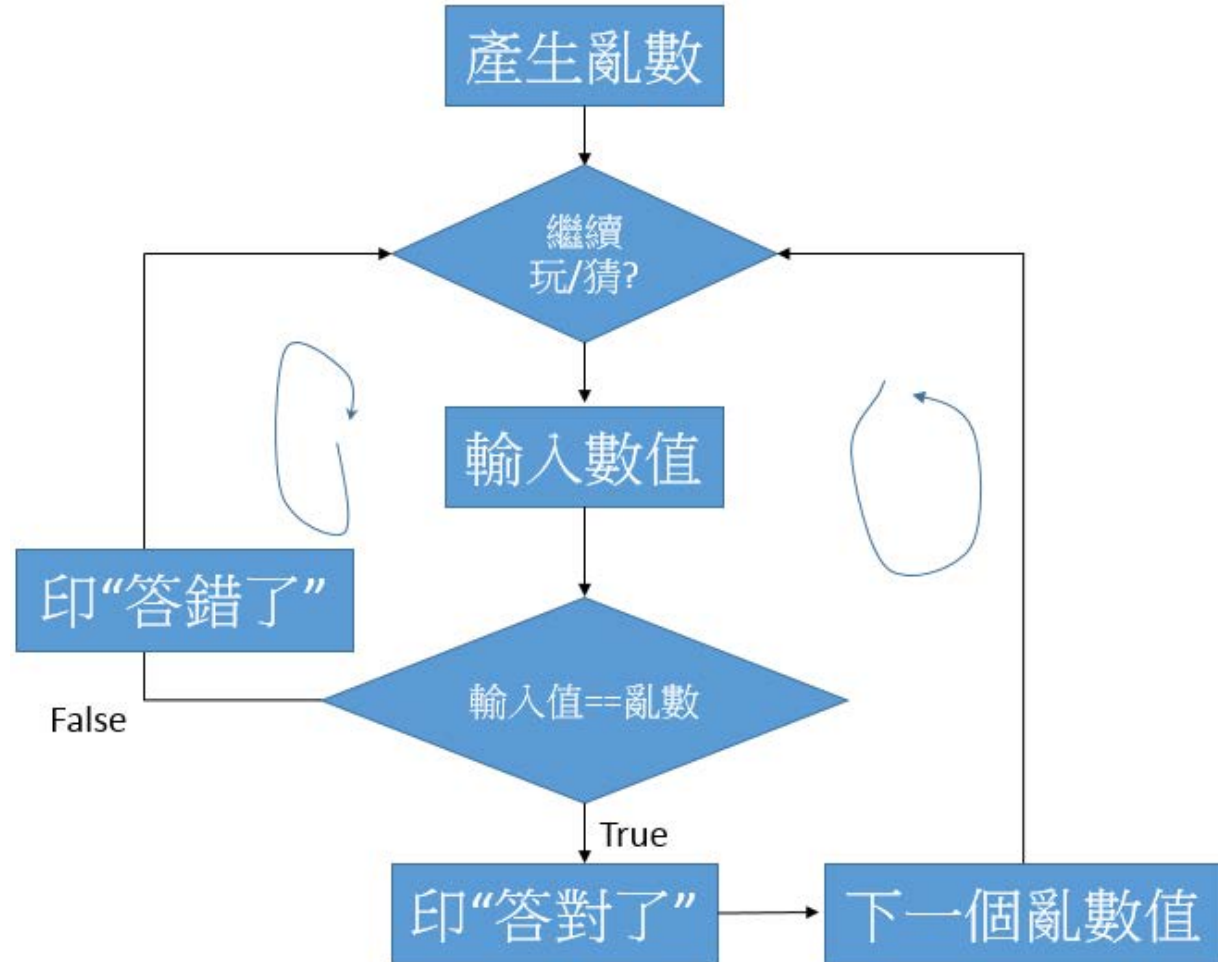
        int a = 0;
        int b = 100;
        a = sr.nextInt(100)+1;
        while (b>0) {
            System.out.print("猜數字(1~100)：");
            b = input.nextInt();
            if (a!= b) { //nested if
                if (a > b)
                    System.out.println("猜的太小囉");
                else
                    System.out.println("猜的太大囉");
                //System.out.println("亂數為"+a);
            } //if
        } else {
            System.out.println("恭喜猜對!\n");
            a = sr.nextInt(100)+1;
        }
    } //while
} //main
} //class
```

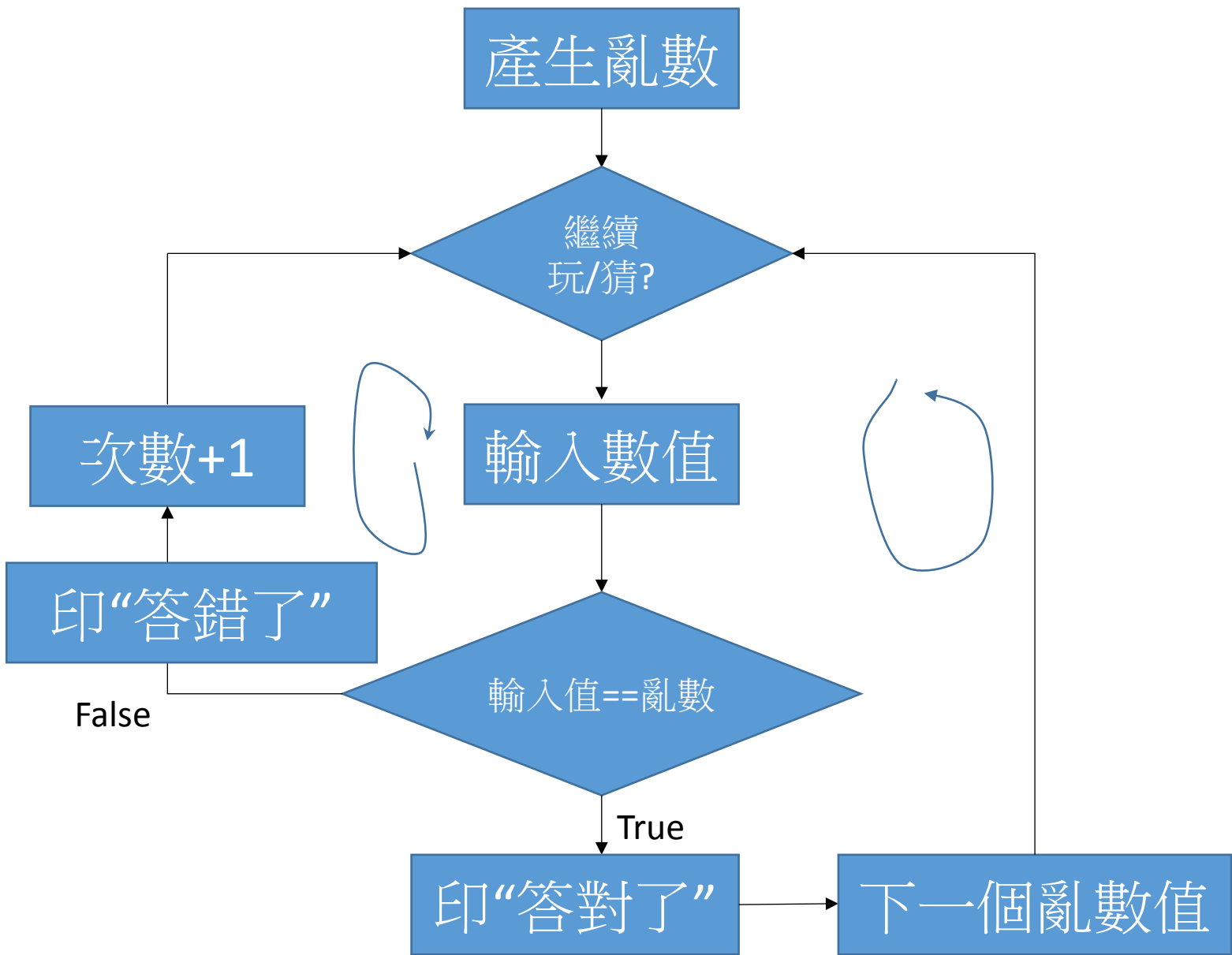


```
public class GuessN_3 {
    public static void main(String[] args) {

        SecureRandom sr = new SecureRandom();
        Scanner input = new Scanner(System.in);

        int a = 0;
        int b = 100;
        a = sr.nextInt(100)+1;
        while (b>0) {
            System.out.print("猜數字(1~100) : ");
            b = input.nextInt();
            if (a!= b) { //nested if
                if (a > b)
                    System.out.println("猜的太小囉");
                else
                    System.out.println("猜的太大囉");
                //System.out.println("亂數為"+a);
            } //if
        } else {
            System.out.println("恭喜猜對!\n");
            a = sr.nextInt(100)+1;
        }
    } //while
} //main
} //class
```





```
C:\Windows\System32\cmd.exe
猜數字(1~100) : 0
猜的太小囉

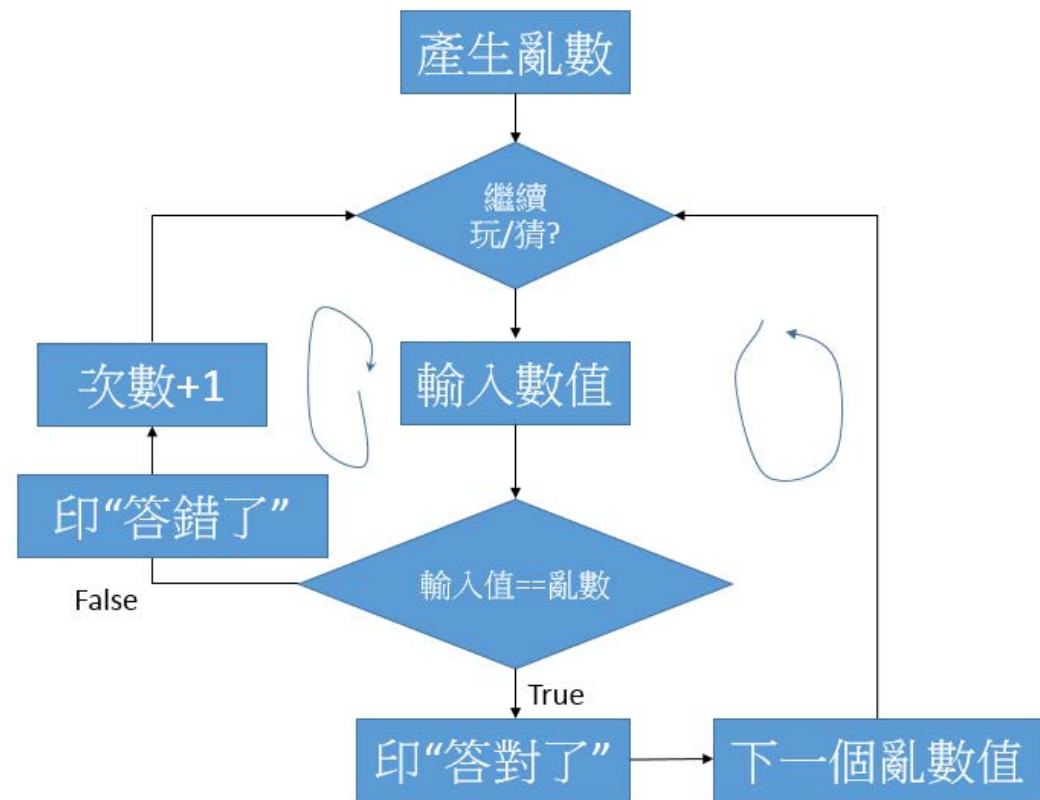
E:\java-2017\9-22\code>javac GuessN_4.java

E:\java-2017\9-22\code>java GuessN_4
猜數字(1~100) : 33
猜的太小囉
猜數字(1~100) : 55
猜的太大囉
猜數字(1~100) : 44
猜的太小囉
猜數字(1~100) : 50
恭喜猜對! 共猜3次

猜數字(1~100) : 33
猜的太小囉
猜數字(1~100) : 66
猜的太小囉
猜數字(1~100) : 77
猜的太小囉
猜數字(1~100) : 90
猜的太小囉
猜數字(1~100) : 98
猜的太大囉
```

# 增加:猜次數

```
public class GuessN_4 {
    public static void main(String[] args) {
        SecureRandom sr = new SecureRandom();
        Scanner input = new Scanner(System.in);
        int a = 0, count=0;
        int b = 100;
        a = sr.nextInt(100)+1;
        while (b>0) {
            System.out.print("猜數字(1~100) : ");
            b = input.nextInt();
            if (a!= b) { //nested if
                count++;
                if (a > b)
                    System.out.println("猜的太小囉");
                else
                    System.out.println("猜的太大囉");
                //System.out.println("亂數為"+a);
            } //if
        } else {
            System.out.println("恭喜猜對! 共猜"+count+"次\n");
            a = sr.nextInt(100)+1;
            count=0;
        }
    } //while
} //main
} //class
```



```
import java.security.SecureRandom;
import java.util.Scanner;

public class GuessN_3 {
    public static void main(String[] args) {
        SecureRandom sr = new SecureRandom();
        Scanner input = new Scanner(System.in);
        int a = 0;
        int b = 100;
        a = sr.nextInt(100)+1;
        while (b>0) {
            System.out.print("猜數字(1~100) : ");
            b = input.nextInt();
            if (b<=0) {
                System.out.println("bye!!!");
                System.exit(-1);
            }
            if (a!= b) { //nested if
                if (a > b) System.out.println("猜的太小囉");
                else System.out.println("猜的太大囉");
            } //if
        }
        else {
            System.out.println("恭喜猜對!\n");
            a = sr.nextInt(100)+1;
        }
    } //while
    System.out.println("不會被顯示!!!");
} //main
} //class
```

# 結束(離開)程式: System.exit(-1);

迴圈加入計算BMI：  
debug until it can work.

# Errors: 宣告問題

```
public class BMI_3a {
public static void main(String[] args) {
    Scanner input = new Scanner(System.in);
    while (height>0 && weight>0) {
        System.out.print("輸入身高(公尺):");
        double height = input.nextDouble();
        System.out.print("輸入體重(公斤):");
        double weight = input.nextDouble();
        double bmi = Math.round((weight/ (height*height) )* 100) / 100.000;
        String status;

        if (bmi < 18.5)
            status = "體重過輕Underweight";
        else if (bmi>=18.5 && bmi < 24)
            status = "正常Normal (18.5<=BMI<24)";
        else
            status = "過重Overweight";

        System.out.println("BMI : "+bmi+" , 狀態: "+status);
    } //while
} //main
} //class
```

```
C:\Users\user\Desktop\code-demo>javac BMI_3a.java
BMI_3a.java:6: error: cannot find symbol
    while (height>0 && weight>0) {
            ^
    symbol:   variable height
    location: class BMI_3a
BMI_3a.java:6: error: cannot find symbol
    while (height>0 && weight>0) {
            ^
    symbol:   variable weight
    location: class BMI_3a
2 errors
```

## Errors: 重複宣告

```
public class BMI_3a {
public static void main(String[] args) {
    Scanner input = new Scanner(System.in);
    double height=1, weight=1;
    while (height>0 && weight>0) {
        System.out.print("輸入身高(公尺)：");
        double height = input.nextDouble();
        System.out.print("輸入體重(公斤)：");
        double weight = input.nextDouble();
        double bmi = Math.round((weight/ (height*height) ) * 100) / 100.000;
        String status;

        if (bmi < 18.5)
            status = "體重過輕Underweight";
        else if (bmi>=18.5 && bmi < 24)
            status = "正常Normal (18.5<=BMI<24)";
        else
            status = "過重Overweight";

        System.out.println("BMI : "+bmi+" , 狀態: "+status);
    } //while
} //main
} //class
```

```
C:\Users\user\Desktop\code-demo>javac BMI_3a.java
BMI_3a.java:9: error: variable height is already defined in method main(String[])
    double height = input.nextDouble();
      ^
BMI_3a.java:11: error: variable weight is already defined in method main(String[])
    double weight = input.nextDouble();
      ^
2 errors
```

# 迴圈加入計 算BMI

```
import java.util.Scanner;

public class BMI_3a {
public static void main(String[] args) {
    Scanner input = new Scanner(System.in);
    double height=1, weight=1, bmi;
    String status;
    while (height>0 && weight>0) {
        System.out.print("輸入身高(公尺)：");
        height = input.nextDouble();
        System.out.print("輸入體重(公斤)：");
        weight = input.nextDouble();
        bmi = Math.round((weight/ (height*height) )* 100) / 100.000;
        if (bmi < 18.5)
            status = "體重過輕Underweight";
        else if (bmi>=18.5 && bmi < 24)
            status = "正常Normal (18.5<=BMI<24)";
        else
            status = "過重Overweight";

        System.out.println("BMI："+bmi+"，狀態："+status);
    } //while
} //main
} //class
```



# 迴圈加入判斷leap year(閏年)

```
import java.util.Scanner;

public class leap_year_1 {
public static void main(String[] args) {
    String status;
    System.out.println("=====歡迎=====");
    Scanner input = new Scanner(System.in);
    int year=2000;
    while (year>=0) {
        System.out.print("輸入公元年(-1:結束):");
        year = input.nextInt();

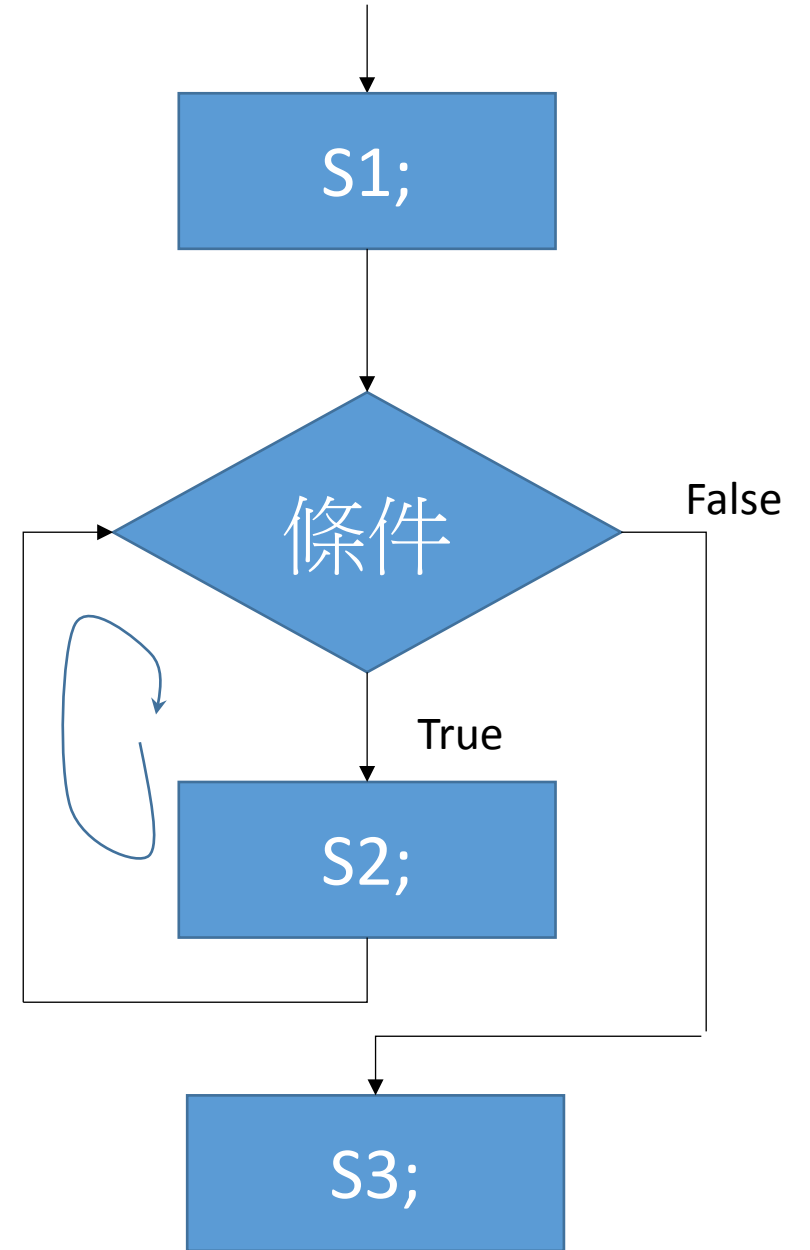
        if ((year%4==0 && year%100!=0)|| year%400==0) {
            status = "閏年(leap year)!";
        }
        else
            status = "平年(common year)!";
        if (year>=0)
            System.out.println("你輸入：公元"+year+"年，是 "+status);
    } //while
    System.out.println("=====bye=====");
} //main
} //class
```

# 習題

- 習題1:輸入矩形長、寬(整數)資料，求面積及邊長、判斷為正方形或長方形，但須能重複執行，直到長或寬輸入為 $\leq 0$ 
  - 正方形或長方形條件?
  - 如何解決? 請規畫其過程(解法)且畫流程圖(參考:程式設計歷程表.docx、程式設計歷程參考範本.docx)
- 習題2:輸入民國幾年，判斷該年是閏年或平年
  - 須能重複執行，直到輸入年份為 $\leq -100$ ，結束(離開)程式:  
`System.exit(-1);`
  - 判斷閏年或平年之邏輯式為何? 請規畫其過程(解法)且畫流程圖(參考:程式設計歷程表.docx、程式設計歷程參考範本.docx)

# 追蹤迴圈

- 無窮迴圈
- 空迴圈
- 如何跳出迴圈



# 追蹤迴圈1

```
public class loop_1a {
    public static void main(String[] args) {
        int a = 10;
        int b = 20;
        int i=0, j=0;
        System.out.println("i="+i);
        while (a>b) {
            i=i+1;
            System.out.println("i="+i);
        }//while
        System.out.println("i="+i);

        System.out.println("j="+j);
        while (a>=30) {
            j=j+1;
            System.out.println("j="+j);
        }//while
        System.out.println("j="+j);

        // while (false) { //cause compile error
        //     System.out.println("loop-4");
        // }//while
        }//main
    }//class
```

## 追蹤迴圈2

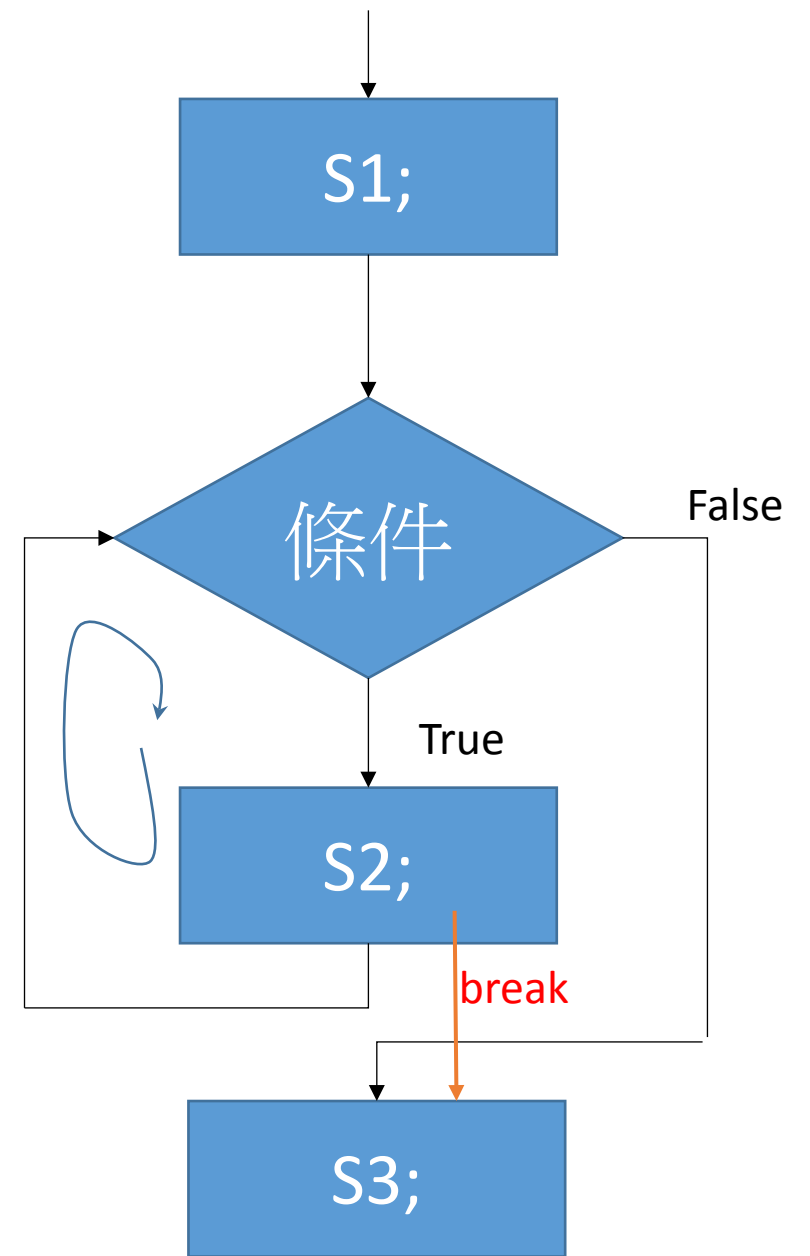
```
public class loop_1b {
    public static void main(String[] args) {
        int a = 10;
        int b = 20;
        int i=0;
        System.out.println("i="+i);
        while (true) {
            i=i+1;
            System.out.println("i="+i);
        }//while
        //System.out.println("i="+i);//cause compile error
    }//main
}//class
```

## 追蹤迴圈3

```
public class loop_1c {  
    public static void main(String[] args) {  
        int a = 10;  
        int b = 20;  
        int i=0;  
        System.out.println("i="+i);  
        while (b>a) {  
            i=i+1;  
            System.out.println("i="+i);  
            if (i>=500) break;  
        }//while  
        System.out.println("i="+i);  
    }//main  
}//class
```

# 追蹤迴圈4

```
public class loop_1d {  
    public static void main(String[] args) {  
        int i=0;  
        System.out.println("i="+i);  
        while (true) {  
            i=i+1;  
            System.out.println("i="+i);  
            if (i>=500) break;  
        }//while  
        System.out.println("i="+i);  
    }//class
```



# 亂數加法練習 (個位數)

- (1)出10題個位數加法測驗(一次一題)，不管對錯都出下一題，直到答對為止；
- (2)出10題，答錯不出下一題，直到答對為止；
- (3)出N題，由user決定題數，每題10分，答錯之題目須於結束時顯示；



```
import java.security.SecureRandom;
import java.util.Scanner;

public class add_drill_1 {
    public static void main(String[] args) {
        SecureRandom sr = new SecureRandom();
        Scanner input = new Scanner(System.in);
        int n1=0,n2= 0;
        int ans= 0;

        n1 = sr.nextInt(10);
        n2 = sr.nextInt(10);
        System.out.print(""+n1+"+"+n2+"="); //present question
        ans = input.nextInt();
        if (ans== n1+n2) +
            System.out.println("答對， GREAT!!\n");
        else
            System.out.println("答錯， 加油!");
        } //main
    } //class
```

```
public class add_drill_2 {
    public static void main(String[] args) {
        SecureRandom sr = new SecureRandom();
        Scanner input = new Scanner(System.in);
        int n1=0,n2= 0;
        int ans= 0, score=0, i=1;
        while (i<=10) {
            n1 = sr.nextInt(10);
            n2 = sr.nextInt(10);
            System.out.print(""+n1+" "+n2+"="); //present question
            ans = input.nextInt();
            if (ans== n1+n2) {
                score=score+10;
                System.out.println("答對， GREAT!!");
            }
            else
                System.out.println("答錯， 加油!");
        } //while
    } //main
} //class
```

What's wrong?

```
public class add_drill_2 {
    public static void main(String[] args) {
        SecureRandom sr = new SecureRandom();
        Scanner input = new Scanner(System.in);
        int n1=0,n2= 0;
        int ans= 0, score=0, i=1;
        while (i<=10) {
            //i=i+1;
            n1 = sr.nextInt(10);
            n2 = sr.nextInt(10);
            System.out.print(""+n1+" "+n2+"="); //present question
            ans = input.nextInt();
            if (ans== n1+n2) {
                score=score+10;
                System.out.println("答對， GREAT!! 分數:"+score+"分.");}
            else
                System.out.println("答錯， 加油! 分數:"+score+"分.");
            i=i+1;
        } //while
    } //main
} //class
```

輸入三變數內容，分別放入a, b, c，且將最大  
值放入a，最小值放入c

# 迴圈加入計算BMI

```
import java.util.Scanner;

public class BMI_3 {
public static void main(String[] args) {
    String ok="Y";
    System.out.println("=====歡迎量測體位=====");
    Scanner input = new Scanner(System.in);
    double height, weight;
    while (ok.toUpperCase().equals("Y")) {
        System.out.print("輸入身高：");
        height = input.nextDouble();
        System.out.print("輸入體重：");
        weight = input.nextDouble();
        double bmi = Math.round((weight/ (height*height) )* 100) / 100.0;
        String status;

        if (bmi < 18.5) {
            status = "體重過輕Underweight";
        }
        else if (bmi < 24) { //(bmi>=18.5 && bmi < 24)
            status = "正常Normal";
        }
        else
            status = "過重Overweight";

        System.out.println("BMI："+bmi+"，狀態："+status);
        System.out.print("(繼續(Y/N)：");
        ok= input.next().toUpperCase();
    } //while
    System.out.println("=====bye bye=====");
} //main
} //class
```

# 亂數加法練習 (個位數)

- \* 亂數加法練習 (個位數) : (1)出10題，答錯不出下一題，直到答對為止； (2)出N題，由user決定題數，每題10分，答錯之題目須於結束時顯示；
- \* 減法：不可小減大
- \* 除法：(1)只能整除；(2)需輸入商和餘數