# 複習算術運算式、條件運算式

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# 搶答Q1: debug

```
int x=9, y=8, z;
if (y=x+1)   z=3;
if (x-1=y+8) z=4;
```

# 搶答Q1: debug (answer)

```
int x=9, y=8, z;
if (y==x+1)   z=3;
if (x-1==y+8) z=4;
```

```
int x=9, y=8, z;
if (y==x+1)
    z=3;
if (x-1==y+8)
    z=4;
```

```
int x=9, y=8, z;
if (y==x+1)
    {  z=3; }
if (x-1==y+8)
    { z=4;  }
```

# 條件Q2:邏輯運算式 (立即搶答)

if (nn>=100 && nn<=999)

- 符合條件數值範圍?

If (nn>=100 || nn<=999)

-
- 符合條件數值範圍?

# 條件Q3:邏輯運算式 (立即搶答)

If (nn<100 || nn>999)

- 符合條件數值範圍?

If (nn<100 && nn>999)

- 符合條件數值範圍?

If ( !(nn>=100 && nn<=999))

- 符合條件數值範圍?

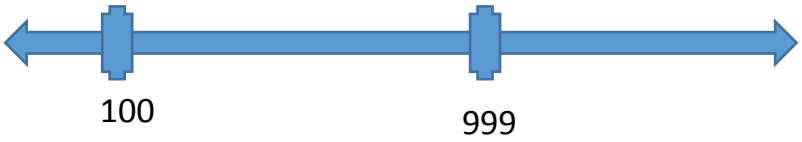
# 條件Q2/3:邏輯運算式 (answer)

if (nn>=100 && nn<=999)

- && : and (及)　交集
- 符合條件數值範圍?  100<=　nn　<=999

If (nn>=100 || nn<=999)

- || : or (或)　聯集
- 符合條件數值範圍?　unlimited




If (nn<100 || nn>999)

- 符合條件數值範圍?  100~999之外

If (nn<100 && nn>999)

- 符合條件數值範圍? 無此

if (!(nn>=100 && nn<=999))

- ! : not (反)
- 符合條件數值範圍? Same as (nn<100 || nn>999)

# 搶答Q4

```
int x , y , z = 5;
x = y = z + 5;
z = x + y + z;
System.out.println("z = " + z);
```

# 搶答Q5

```
int x1 = 9, y1 = 8, z1 = 7;
x1 = x1 % z1;
if (x1 < 5)
    y1 = y1 + 1;
else
                y1 = x1 + 1;
System.out.println("y1 = " + y1);
```

# 搶答Q6

```
 x1 = 9; y1=8; z1=7;
x1 = x1 % z1;
if (!(x1<=5))
    y1 = y1 + 1;
else
    y1 = x1 + 1;
System.out.println("y1 = " + y1);
```

# 搶答Q7

```
int w=7, p = 4;
x = 3;
p = w / x * 2;
if (p<18 && p>8)
    x = (x*x)%2;
else
    x = x % 3;
System.out.println("x = " + x);
```

# 搶答Q8

```
w = 7;  p = 4;  x = 3;
p = w / x * 2;
if (p<18 || p>8)
    x = (x*x)%2;
else
    x = x % 3;
System.out.println("x = " + x);
```

# 搶答Q9

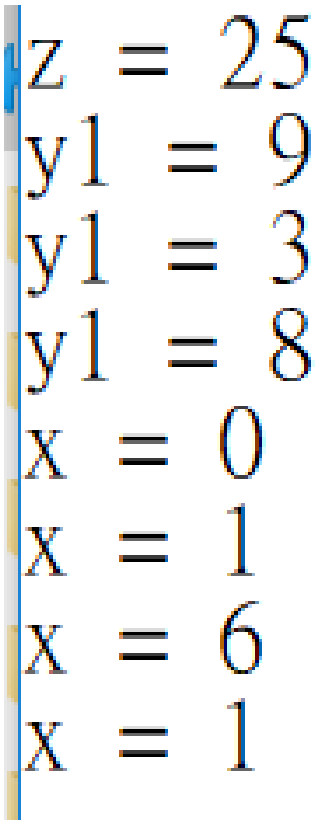
```
w = 8; p = 6; x = 4;
x++;  //x = x + 1;
if( w+1 == p+3) x=x+1;
System.out.println("x = " + x);
```

# 搶答Q10

```
w = 8; p = 4; x = 2;
x--;  //x = x-1;
if (w+1!=p+3)
    x = x--;
else
    x = x++;
System.out.println("x = " + x);
```

# Q4~Q10 Answer

- Please download test_if.java, compile & run
- Then try to revise and test



# Assignment statement

| x=x+1; | x=x-1; |
| --- | --- |
| x++; | x--; |
| ++x; | --x; |
| x+=1; | x-=1; |

# 再談分支 (selection, branch) III
# 程式如何轉彎?

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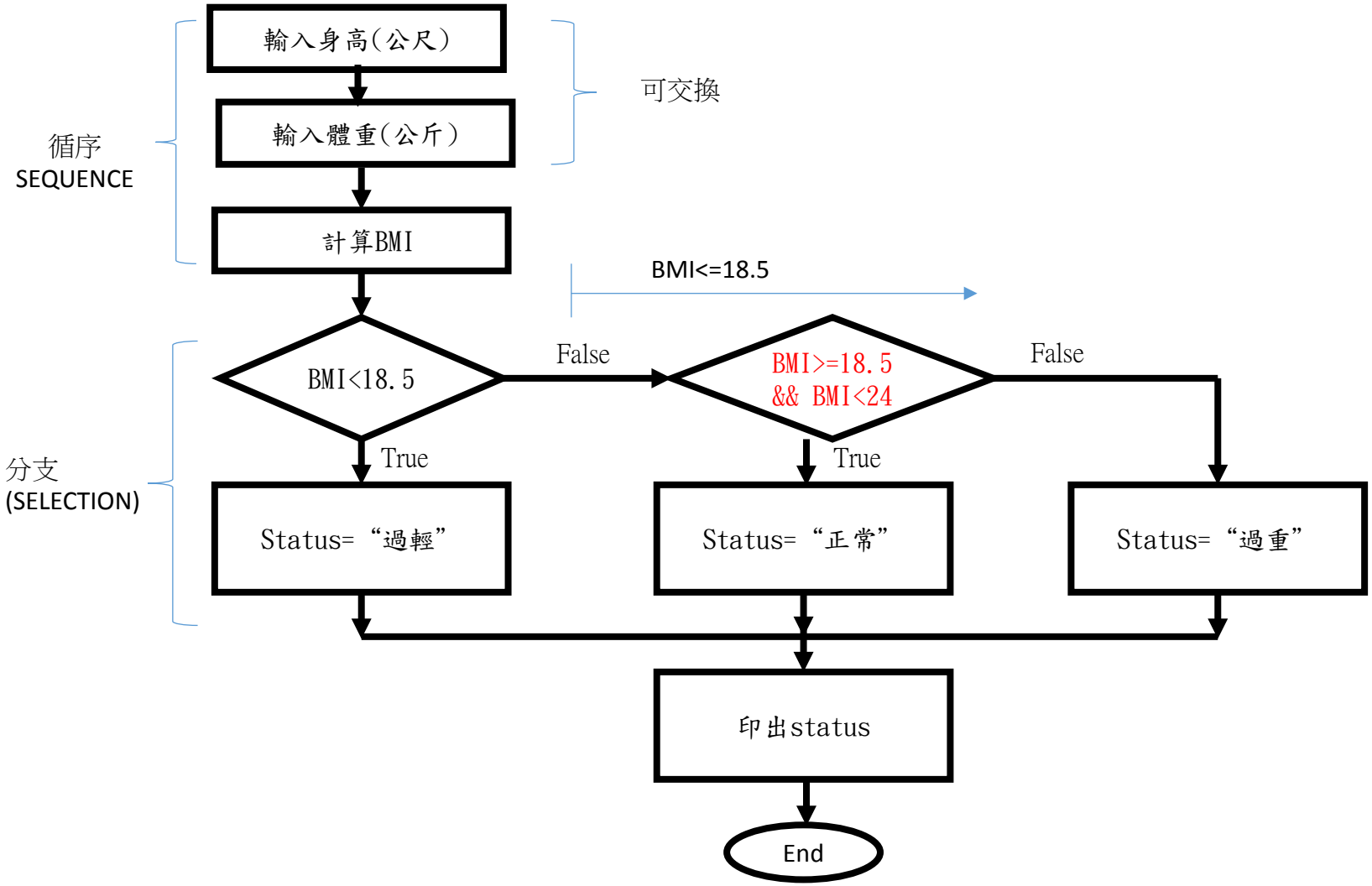
# Review BMI診斷:分成三層次(簡化)

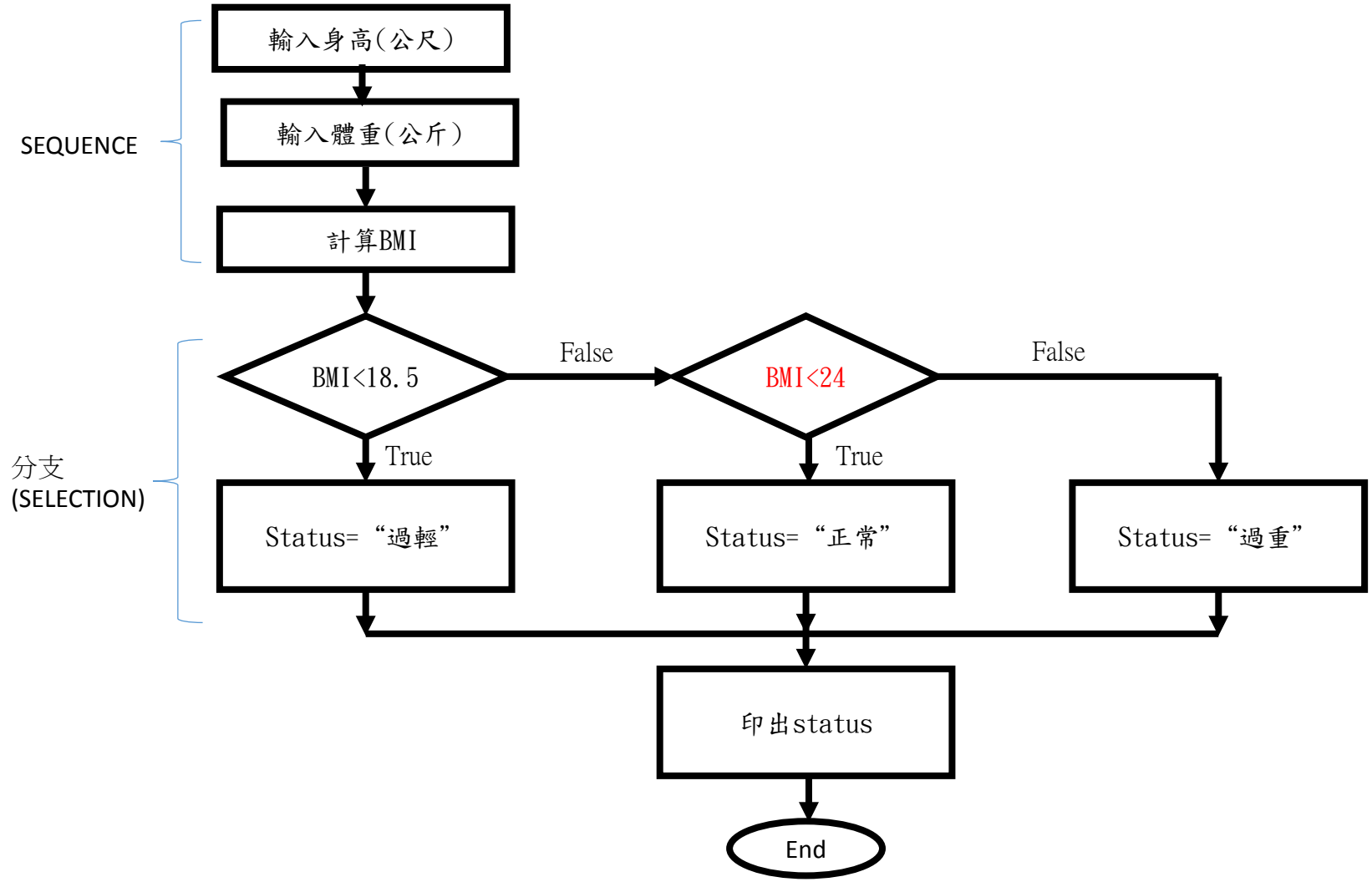
```
import java.util.Scanner;
public class BMI_2 {
public static void main(String[] args) {
    Scanner input = new Scanner(System.in);
    System.out.print("輸入身高：");
    double height = input.nextDouble();
    System.out.print("輸入體重：");
    double weight = input.nextDouble();
    double bmi = Math.round((weight/ (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);
  }//main
}//class
```

| 成人肥胖定義 | 身體質量 |
| --- | --- |
| 體重過輕 | BMI<18.5 |
| 健康體位 | 18.5<=BMI<24 |
| 體位異常 | 過重：24<=BMI<27<br>輕度肥胖：27 <= BMI < 30<br>中度肥胖：30 <= BMI < 35<br>重度肥胖：BMI >= 35 |

# 多分支流程圖


輸入身高(公尺)
輸入體重(公斤)
計算BMI
可交換
循序
SEQUENCE
BMI<=18.5
BMI<18.5
False
BMI>=18.5
&& BMI<24
False
True
True
分支
(SELECTION)
Status=“過輕”
Status=“正常”
Status=“過重”
印出status
End

# 多分支流程圖


SEQUENCE
輸入身高(公尺)
輸入體重(公斤)
計算BMI
分支
(SELECTION)
BMI<18.5
False
BMI<24
False
True
True
Status=“過輕”
Status=“正常”
Status=“過重”
印出status
End

# BMI診斷

- 完整BMI診斷需要分支?
- 流程圖如何畫?

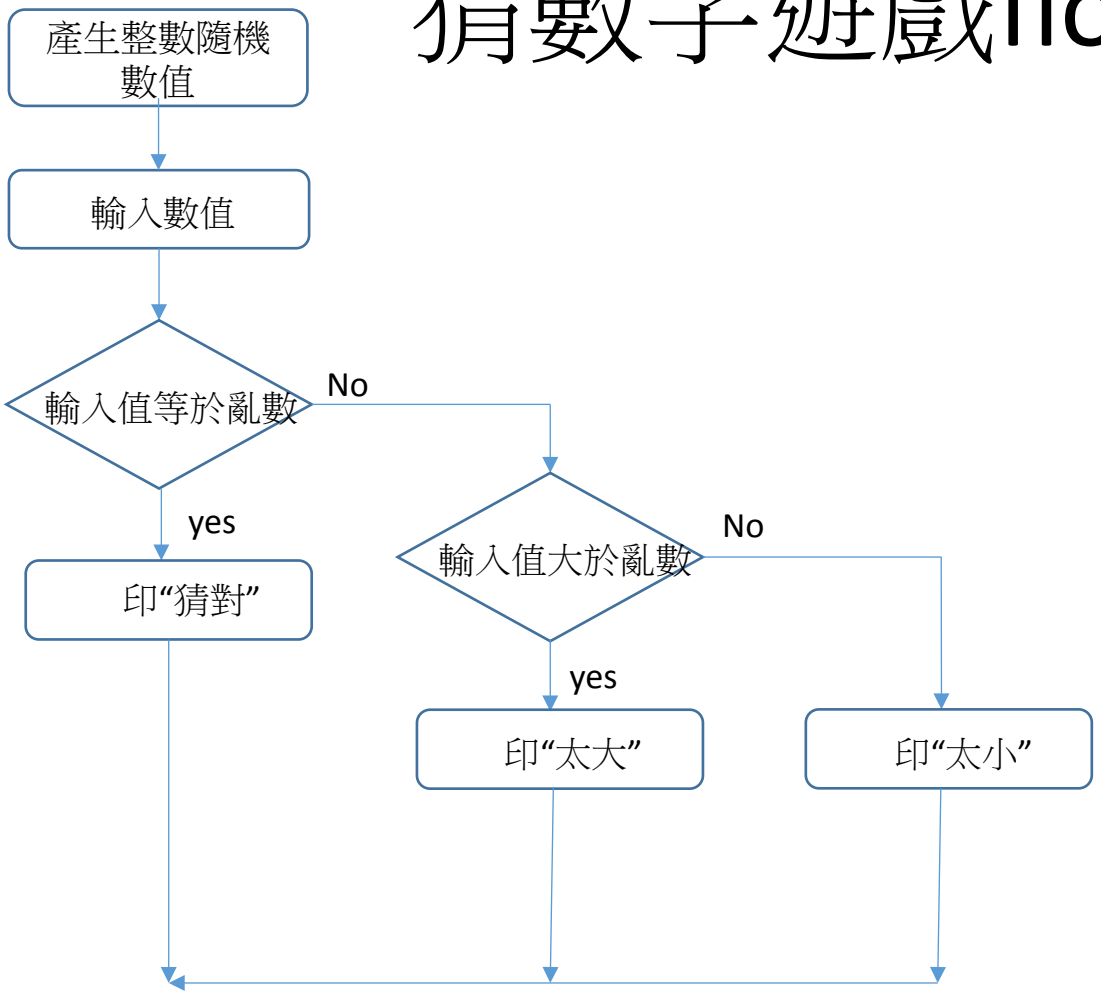
| 成人肥胖定義 | 身體質量 |
| --- | --- |
| 體重過輕 | BMI<18.5 |
| 健康體位 | 18.5<=BMI<24 |
| 體位異常 | 過重：24<=BMI<27<br>輕度肥胖：27 <= BMI < 30<br>中度肥胖：30 <= BMI < 35<br>重度肥胖：BMI >= 35 |

# 猜數字遊戲

解題方法:

- 運用亂數函數(亂數類別)產生整數隨機數值
- 猜數字:讓使用者輸入數值
- 判斷答對與否，且輸出回饋信息

# 猜數字遊戲flow chart



# 猜數字遊戲(1):運用亂數設計猜數字遊戲程式

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

public class GuessN_0 {
  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) {
       System.out.println("恭喜猜對!");
        }
    else 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);
        }//main
}//class
```

多重分支
Multi-way if

# 產生1~100亂數

- 建立亂數類別SecureRandom之物件，再以此類別nextInt函數(方法)產生1~100隨機整數
  - Secure:安全，Random:亂數、隨機

```
SecureRandom sr = new SecureRandom();
a = sr.nextInt(100)+1;
```

- new SecureRandom()以建立sr物件，再用.nextInt(100)方法/method產生0~99隨機整數
  - sr.nextInt(100) +1
- import java.security.SecureRandom;
- 如何產生10~90隨機整數?

# 猜數字遊戲(2):運用亂數設計猜數字遊戲程式

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

public class GuessN_1 {
  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) {
       System.out.println("恭喜猜對!");
        }
    else {//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);
        }//main
}//class
```

巢狀分支
Nested if

# 猜數字遊戲(3):運用亂數設計猜數字遊戲程式

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

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
```

巢狀分支
Nested if

# 不同分支，相同結果

- 多重Multi-way if

```
if (a == b) {
   System.out.println("恭喜猜對!");
    }
else if (a > b)
    System.out.println("猜的太小囉\n");
else
    System.out.println("猜的太大囉\n");
```

三個分支

- 巢狀分支Nested if

```
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!");
```

```
if (a == b)
   System.out.println("恭喜猜對!");
else {//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);
        }//else
```

# 巢狀分支Nested if

第一層:二個分支

```
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!");
```

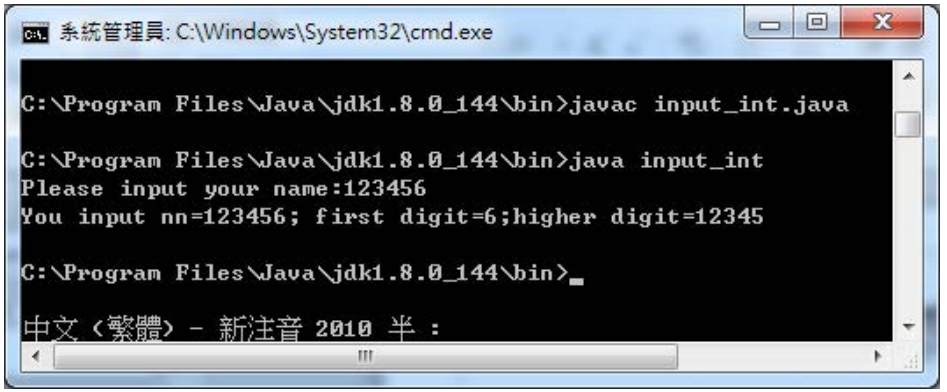
第二層:二個分支

```
if (a == b)
   System.out.println("恭喜猜對!");
else {//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);
        }//else
```

# 猜數字遊戲之反思

- **目標: 讓初學者熟悉**巢狀分支Nested if、多重分支Multi-way if
  - 邏輯變化
  - 分支結構
- **缺點:**無法讓使用者依據太大、太小的回饋訊息再次輸入數字， 應重複直至使用者答對或不想玩。
  - **Loop** (迴圈) can do it

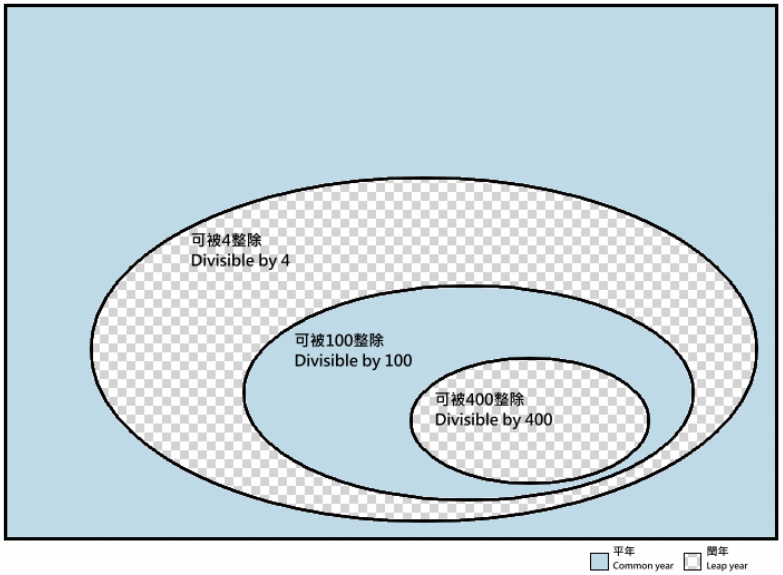
```
System.out.print("Please input a 3-digit decimal:");
 Scanner ipt = new Scanner(System.in);
 int nn = ipt.nextInt();
 int n1=nn%10;
 int n2=nn/10;
 System.out.print("You input nn="+nn+"; first digit="+n1+";");
 System.out.println("higher digit="+n2);
```



# 判斷閏年(leap year)、平年(common year)

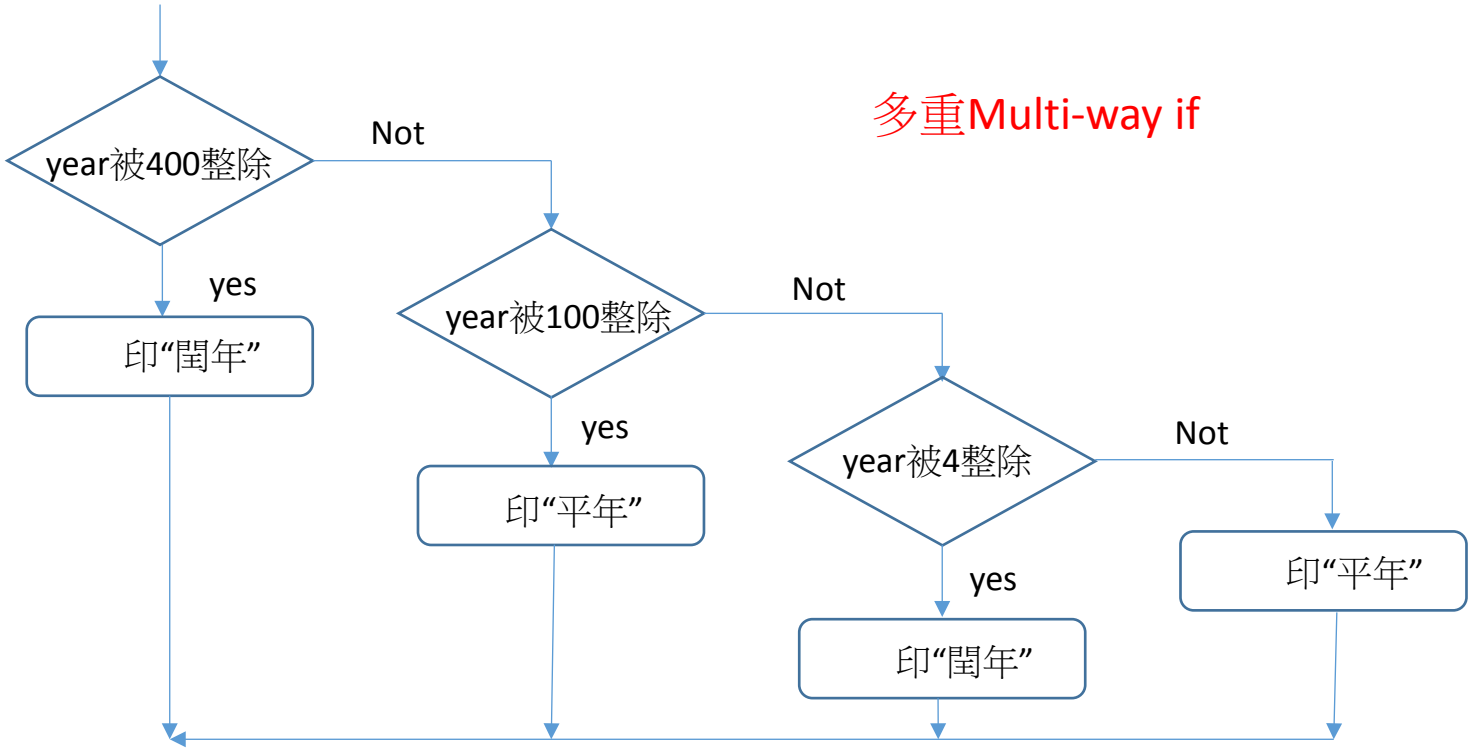
# 閏年、平年

- 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）



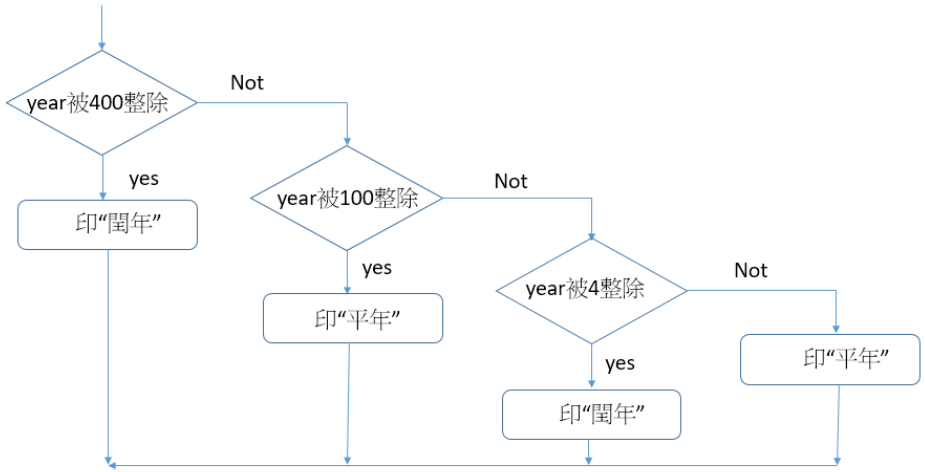

- https://zh.wikipedia.org/wiki/%E9%97%B0%E5%B9%B4

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

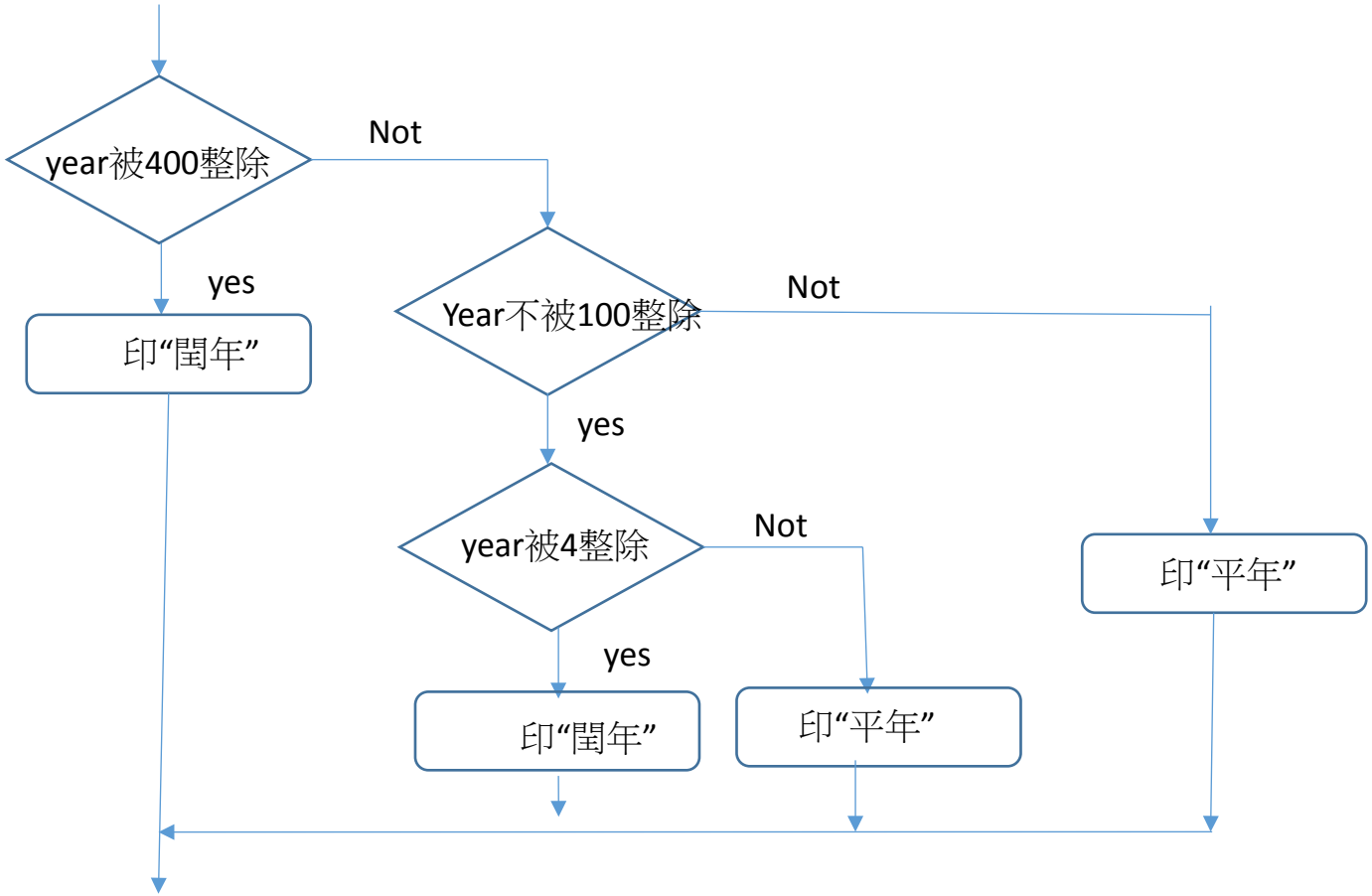



多重Multi-way if

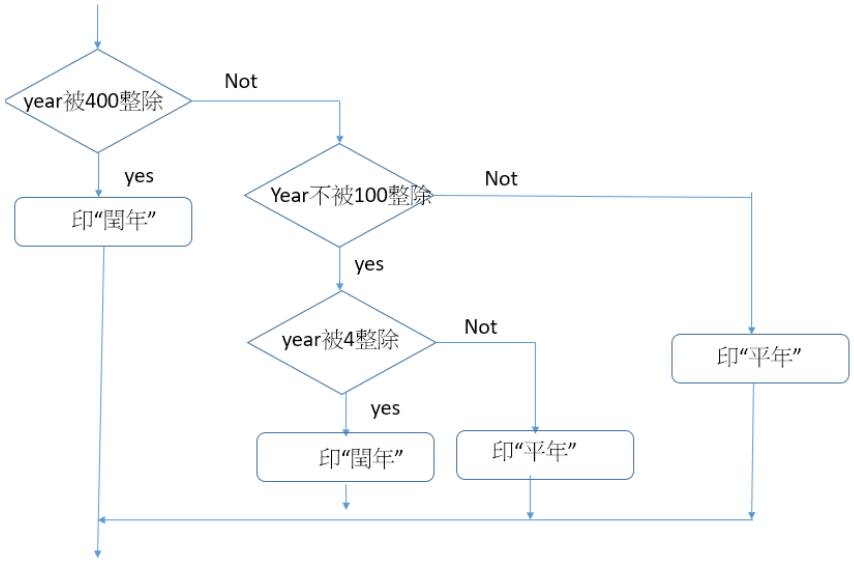
```
import java.util.Scanner;
//閏年:閏年是比普通年分多出一段時間的年分
public class leap_year_0a {

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
```

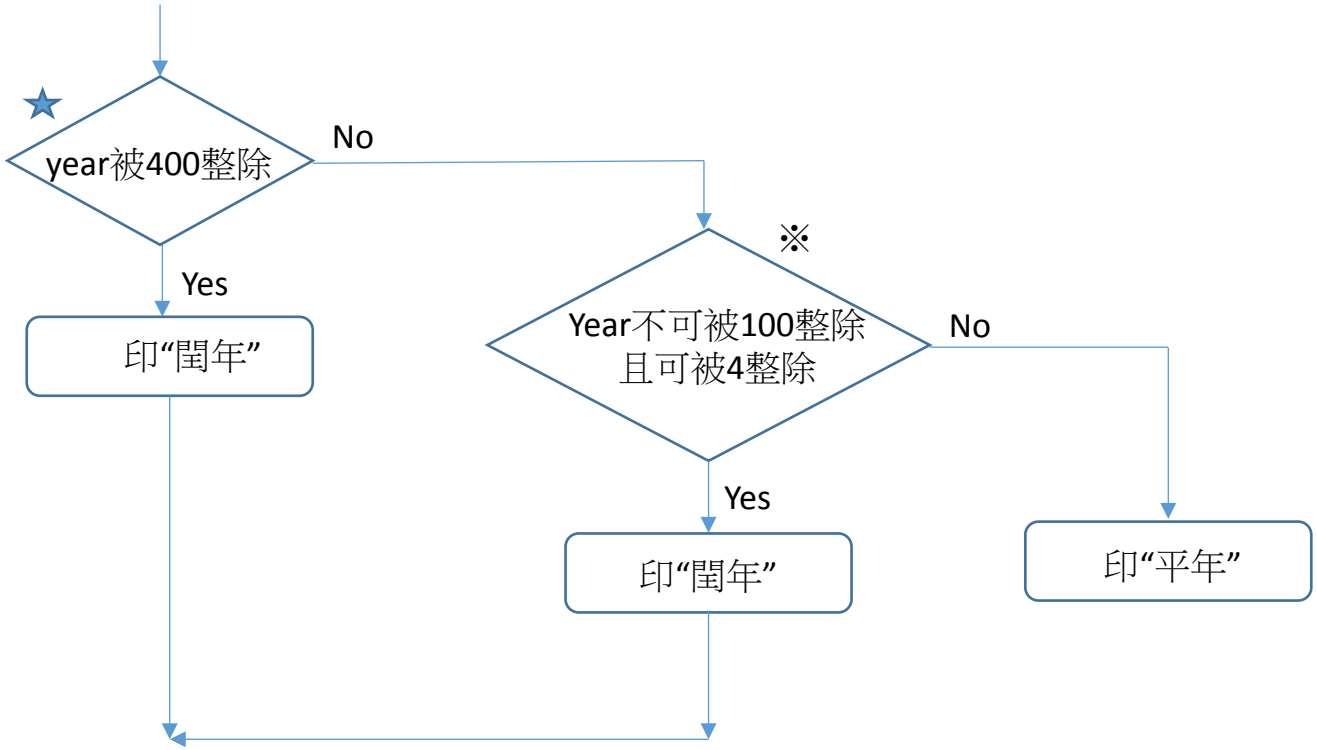


# 巢狀分支Nested if

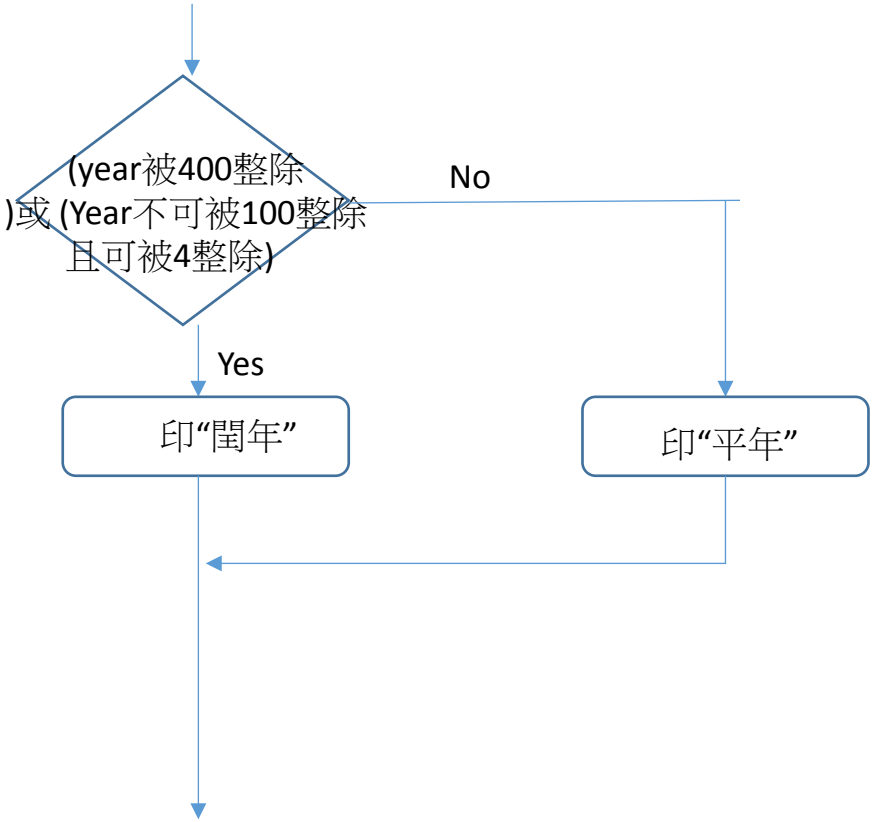


```
Scanner input = new Scanner(System.in);
int year=2000;
  System.out.print("輸入公元年：");
  year = input.nextInt();
  if (year%400==0)
      status = "閏年(leap year)!";
  else if (year%100!=0)
   {
    if (year%4==0)
      status = "閏年(leap year)!";
    else //can be omitted
      status = "平年(common year)!"; //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)


(year被400整除
)或 (Year不可被100整除
且可被4整除)
No
Yes
印“閏年”
印“平年”

# 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);
```

```
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
```

# 迴圈(loop)概念：讓程式繞圈圈

# 迴圈(loop)

應用:

- 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。

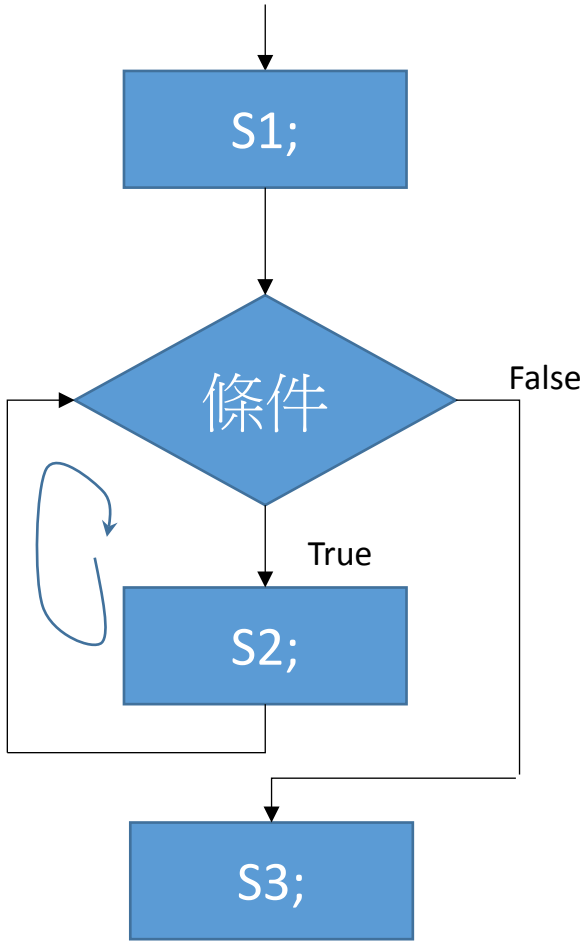
常見型態：for、while、do…while

- 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)

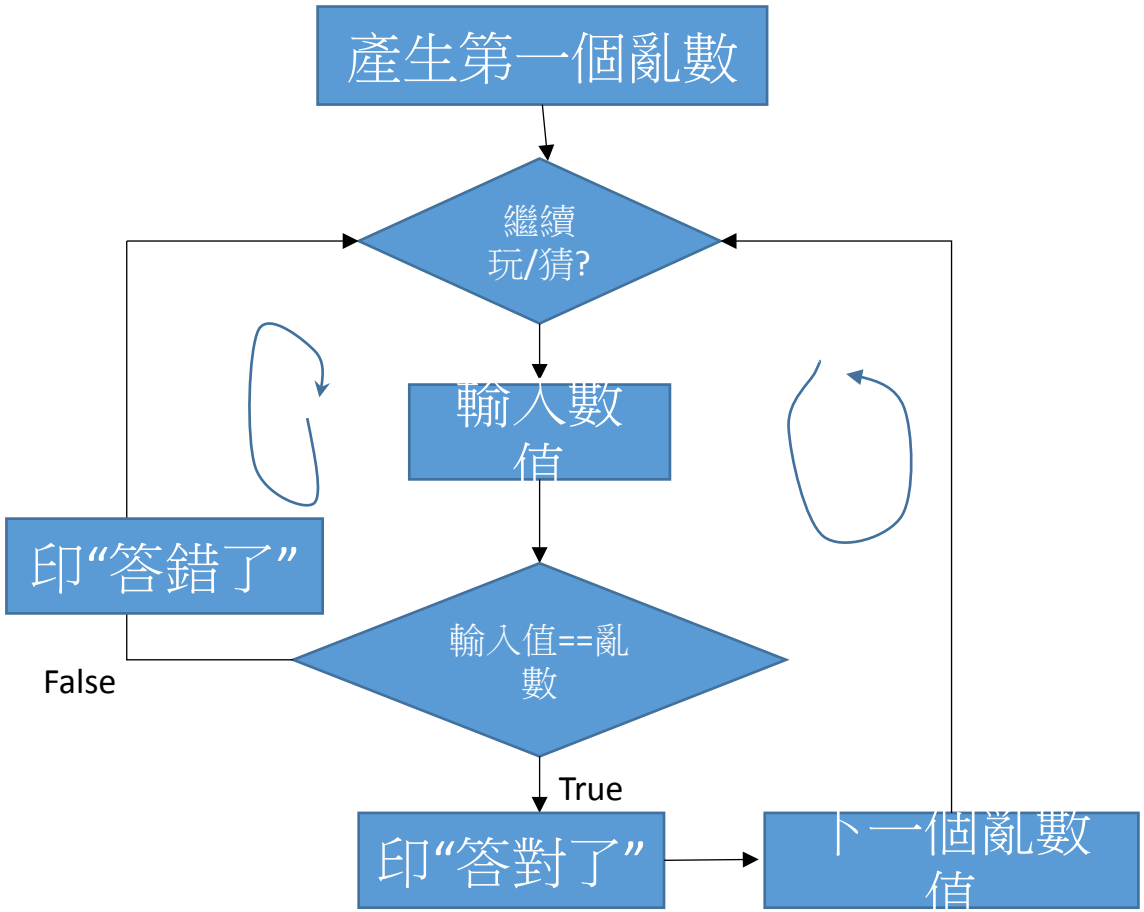
```
S1;
while (條件) {
    S2;
}
S3;
```



# 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

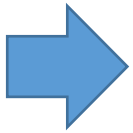
建立亂數類別SecureRandom之物件
以此類別nextInt函數(方法)產生1~100隨機整數
猜數字:讓使用者輸入數值
判斷答對與否，且輸出回饋信息




```
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

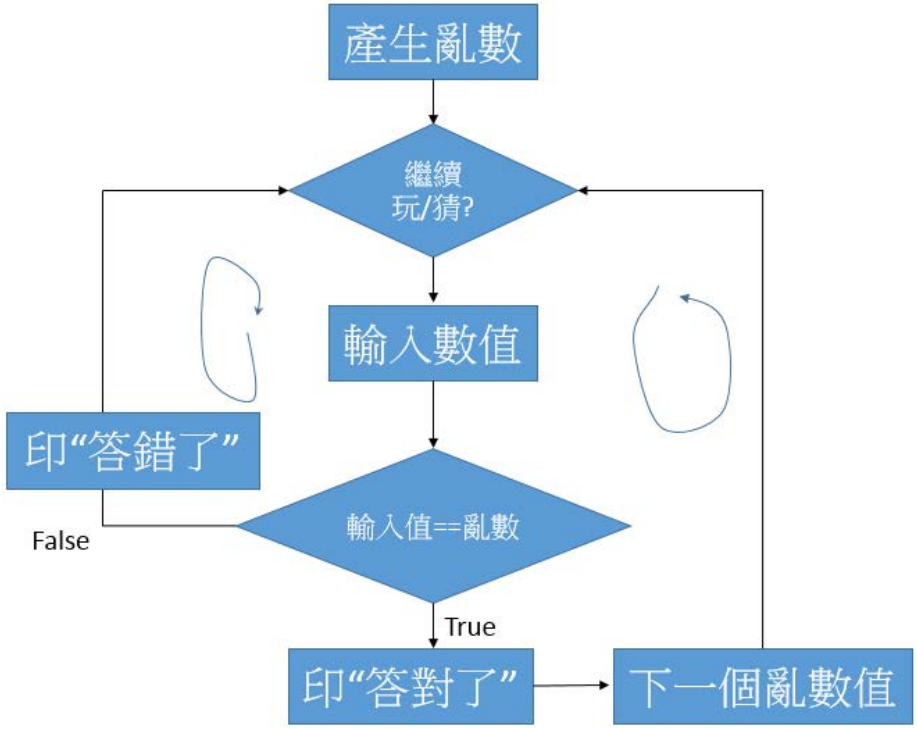
```
public class GuessN_2 {
  public static void main(String[] args) {

    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
```

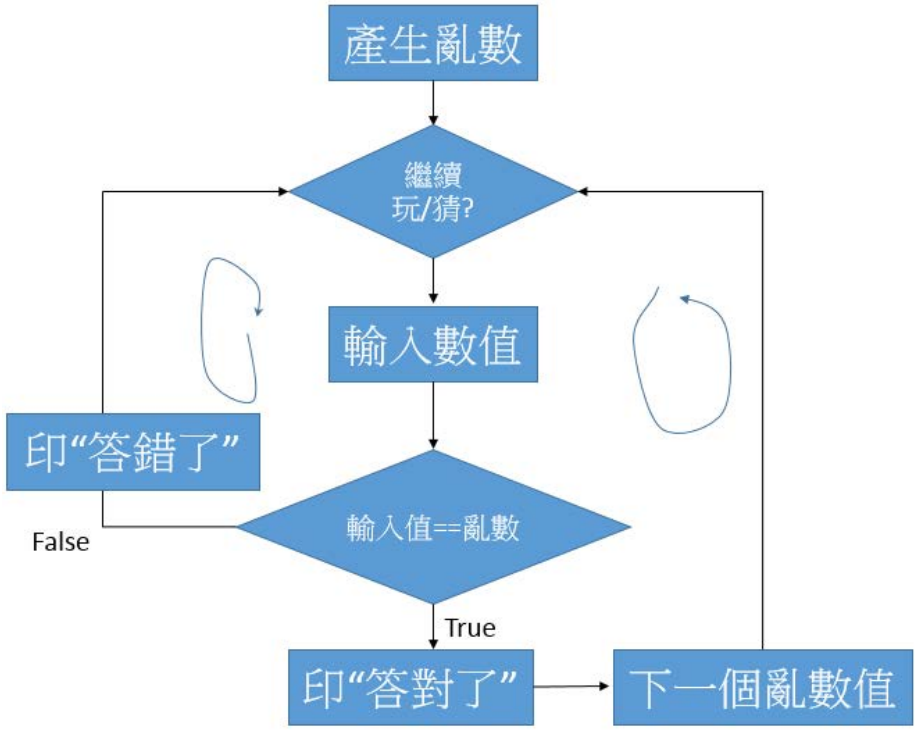
# 程式與流程圖對應

```
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
```



```
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 = 0;
   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");
                    } //if
    else {
            System.out.println("恭喜猜對!\n");
            a = sr.nextInt(100)+1;
           }//else
     }//while
                    }//main
}//class
```

# 迴圈會執行? Why?



# 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<=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
- 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<=-100