Control Flow Statements

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https://github.com/swacademy/Core-Java

Simple Programming Constructs

- Conditions - Decide at runtime whether to perform certain statements.
- Loops - Decide at runtime how many times to perform certain statements.
- Branches

The `if` construct

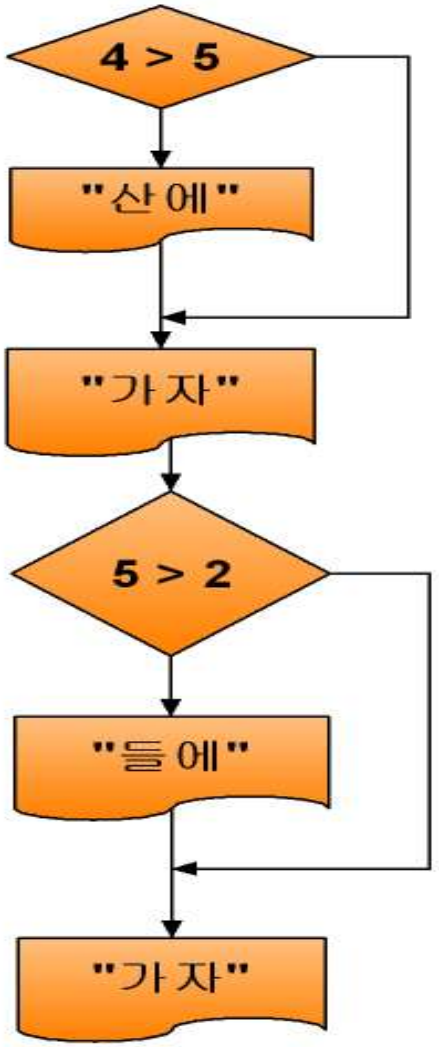
- Allows your program to make simple decisions based on stored values.
- JVM checks whether the **`Boolean`** expression is **`true`** or **`false`**.
- Can decide between two different statements with one condition.
- Can extend the **`if`** clause with the **`else`** clause.
- Can use **`if`** with code blocks.

Syntax - if

```
if (boolean expression) {
    statement ;
}
```

```
2 public class IfDemo {
3    public static void main(String[] args) {
4       if( 4 > 5 ) System.out.println("산에");
5       System.out.println("가자");
6       if( 5 > 2 ) System.out.println("들에");
7       System.out.println("가자");
8    }
9 }
```

```
가자
들에
가자
```

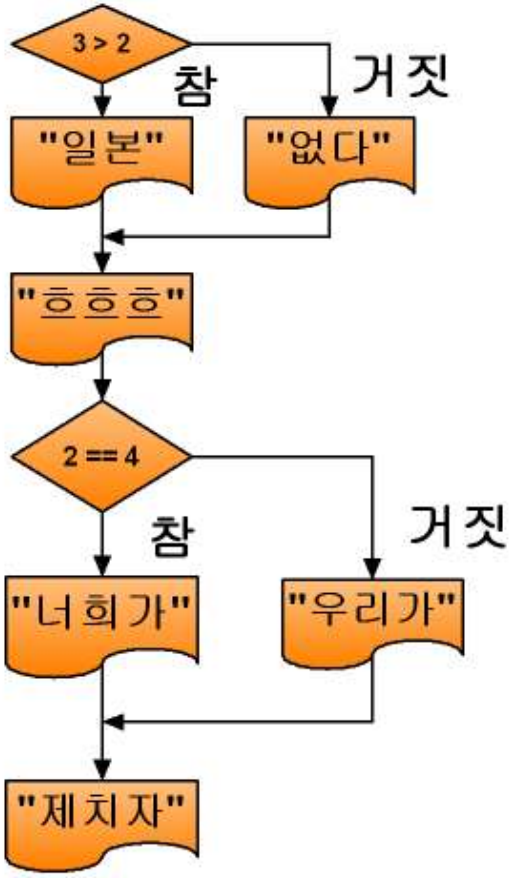


Syntax – `if` (Cont.)

```
if (boolean expression) {
    statement ;
} else {
    statement ;
}
```

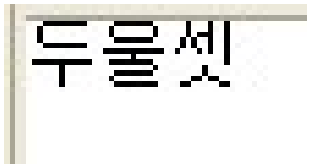
```
2 public class IfDemo1 {
3   public static void main(String[] args) {
4     if (3 > 2) System.out.println("일본");
5     else  System.out.println("없다");
6     System.out.println("흐흐흐");
7     if (2== 4 ) System.out.println("너희가");
8     else   System.out.println("우리가") ;
9     System.out.println("제치자") ;
10  }
11 }
```

```
일본
흐흐흐
우리가
제치자
```



Warning – block processing

```
2  public class IfDemo2 {
3      public static void main(String[] args) {
4          int a = 5, b = 3;
5          if( b > a ) System.out.print("하나");
6                      System.out.print("두울");
7                      System.out.print("셋");
8      }
9  }
```




```
2  public class IfDemo2 {
3      public static void main(String[] args) {
4          int a = 5, b = 3;
5          if( b > a ) {
6              System.out.print("하나");
7              System.out.print("두울");
8          }
9          System.out.print("셋");
10     }
11 }
```

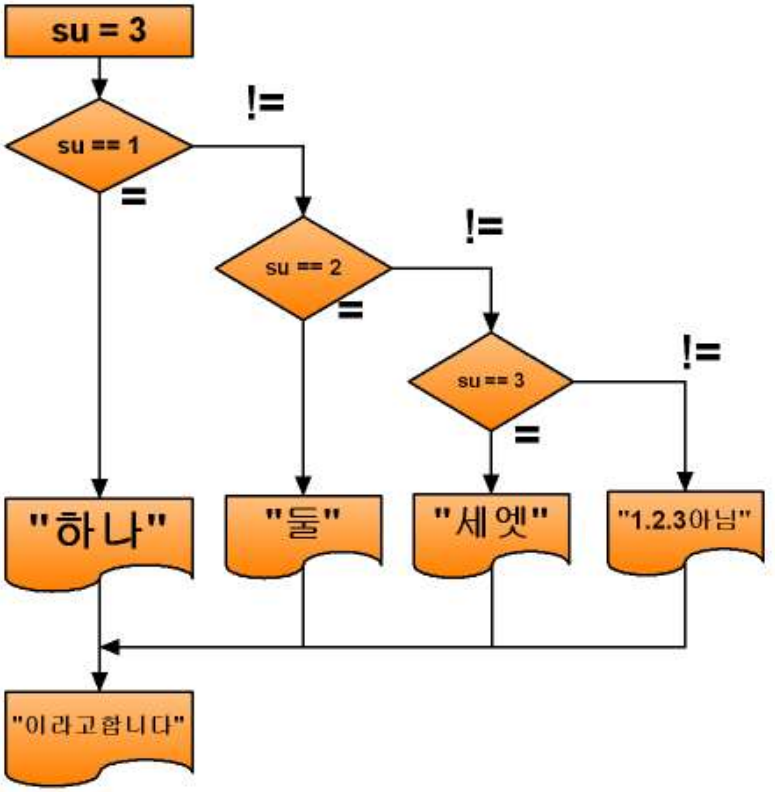
Syntax – `if` (Cont.)

```
if (boolean expression) {
   statement ;
} else if (boolean expression) {
   statement ;
} else if (boolean expression) {
   statement ;
} else {
   statement ;
}
```

Syntax – `if` (Cont.)

```
2  public class IfDemo3 {
3      public static void main(String[] args) {
4          int su = 3;
5          if( su == 1 ) System.out.println("하나");
6          else if ( su == 2 ) System.out.println("두울");
7          else if ( su == 3 ) System.out.println("세엣");
8          else  System.out.println("1.2.3. 아님");
9          System.out.println("이라고 합니다");
10     }
11 }
```

```
세엣
이라고 합니다
```



Exercise : Using the `if` Construct

- Generate a random number between 1 and 10 and print a message (“Bananas”) if the number is greater than 5.
- Use to create a random integer number in the range of 1 and a variable called ***max***.

```
int  i = (int)(( Math.random() * max ) + 1) ;
```

Exercise : Using the `if` Construct (Cont.)

- Generates two different random numbers in the range 1 to 10 called rand1 and rand2, and prints out the following messages.
- If rand1<=3 print the message “Bananas”.
- If rand1>3 and rand2<=5 print the message “Oranges”.
- If rand1>3, rand2>5 print the message “Pears”

The `switch` Construct

- Is used if all of the conditions are equality tests against a single variable.
- The type of `i` can be only `char`, `byte`, `short`, or `int`, and `enum` (*JDK 1.5 higher*).
- The `case` labels must be literals.
- The `default` case is the same as the `else` in an `if` construct.
- The `break` statement is used to exit out of a `switch` statement.
- If a `case` statement does not contain a `break`, the line of code a fter the completion of the `case` will be executed.

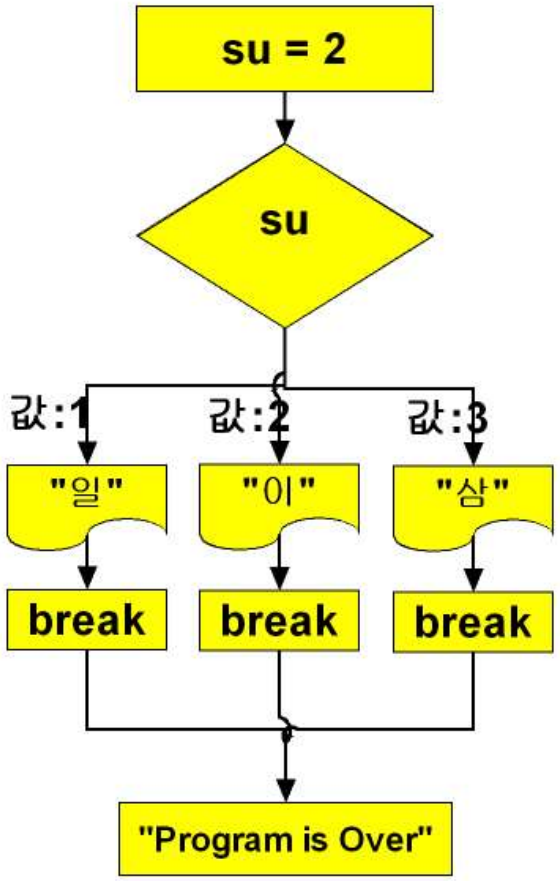
Syntax – `switch`

```
switch ( variable ) {
    case constant1 :
                statement ;
                break ;
    case constant2 :
                statement ;
                break ;
    default :
                statement ;
}
```

Syntax – `switch` (Cont.)

```
2  public class SwitchDemo {
3      public static void main(String[] args) {
4          int su = 2;
5          switch( su ) {
6              case 1 :  System.out.println("일"); break;
7              case 2 :  System.out.println("이"); break;
8              case 3 :  System.out.println("삼"); break;
9          }
10         System.out.println("Program is Over...");
11     }
12 }
```

```
이
Program is Over...
```



Exercise: Using the `switch` Statement

- Generates a random number in the range of 1 to 10 and prints the following messages based on the value:

  1 : “Bananas”

  2 : ”Oranges”

  3 : “Peach”

  3 or 4 : “Apples”

  3 or 4 or 5 : “Plums”

  6 : “Pineapples”

  7 : No message – ignore this case

  Any other value : “Nuts”

The `for` Loop

- Provides a compact way to iterate over a range of values.
- Initialize - Is the section that is processed *once*, before any other part of the loop.
- Condition - Is the section that is processed just before each iteration of the loop.
- Statement - Is the statement or code block which is processed with every loop iteration.
- Update - Is the section that is processed after the body but before each subsequent retest of the condition.

Syntax - `for`

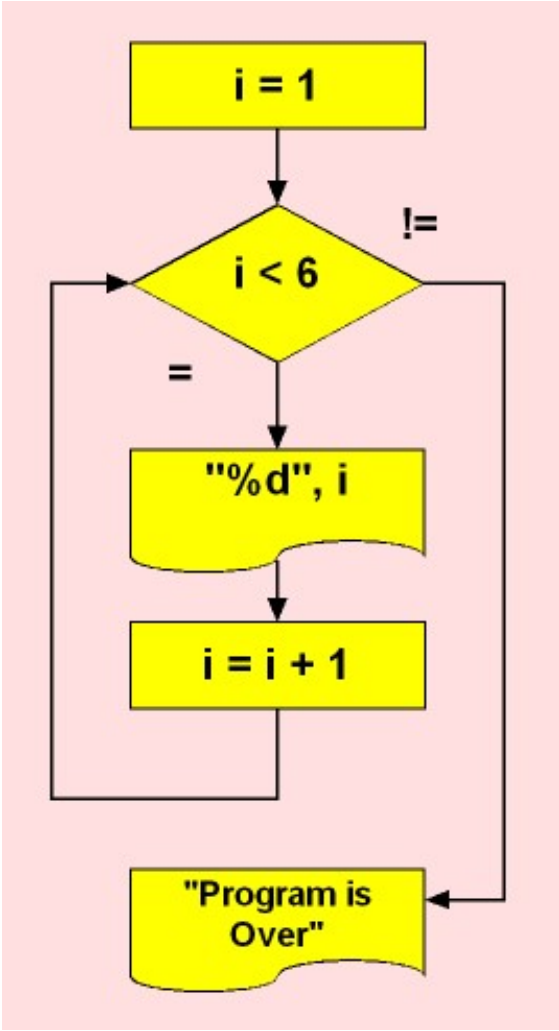
```
for ( initialize;condition;update ) {
    statement ;
}
```

- Multiple initializations must be separated with commas(`,`) not semi-colons(`;`).
- Condition must be a ***boolean*** expression.

Syntax – `for` (Cont.)

```
2 public class ForDemo {
3     public static void main(String[] args) {
4         for ( int i = 1 ; i < 6 ; i++){
5             System.out.printf("%d\t", i);
6         }
7     }
8 }
```

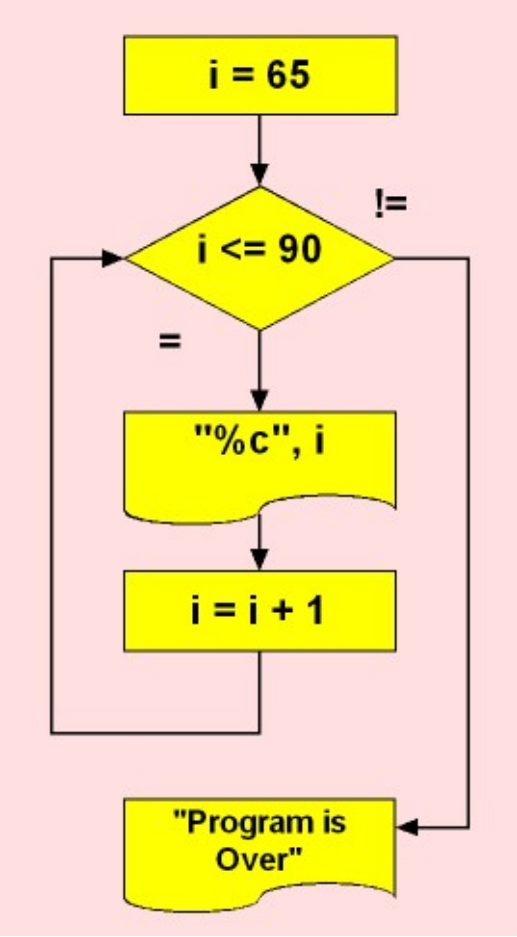
```
1	2	3	4	5
```



Syntax – `for` (Cont.)

```
2  public class ForDemo {
3      public static void main(String[] args) {
4          System.out.printf("%40s\n", "** 영문 대문자 **");
5          int i = 65 ;
6          for(    ; i <= 90 ;     ){
7              System.out.printf("%2c", i);
8              i++;
9          }
10         System.out.println("\nProgram is Over...");
11     }
12 }
```

```
                    ** 영문 대문자 **
 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Program is Over...
```



Syntax – `for` (Cont.)

```
2  public class ForDemo {
3      public static void main(String[] args) {
4          int a, b;
5          for ( a = 1, b = 200 ; a <=3 ; b -= 50, a++) {
6              System.out.printf("a = %d      b = %d\n", a, b );
7          }
8          System.out.println("\nProgram is Over...");
9      }
10 }
```

```
a = 1      b = 200
a = 2      b = 150
a = 3      b = 100

Program is Over...
```

Syntax – `for` (Cont.)

```
2  public class MultiForDemo {
3      public static void main(String[] args) {
4          int a, b, c = 100;
5          System.out.println("<<<다중 for 문>>>");
6          for ( a = 1 ; a <= 2 ; a++) {
7              for ( b = 1 ; b <= 3 ; b++) {
8                  c += 10 ;
9                  System.out.printf("%5d\n", c);
10             }
11         }
12         System.out.println("Program is Over...");
13     }
14 }
```

```
<<<다중 for 문>>>
  110
  120
  130
  140
  150
  160
Program is Over...
```

Enhanced `for` Loop from Java 1.5

- a.k.a. the *for in* loop and *for each* loop
- Is used to iterate through an array or collection of any object that implements Iterable.
- The loop is executed once for each element of the array or collection
- Does not use a counter, as the number of iterations is already deter mined.
- See also http://java.sun.com/j2se/1.5.0/docs/guide/language/foreach.html
- Syntax :

```
for ( Type Identifier : Expression)
```

Enhanced `for` Loop in Java 1.5 (Cont.)

```
2  public class NewForDemo {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          int [] array = {5,6,7,8,9};
6          /*old version's for loop
7          for(int i = 0 ; i< array.length ; i++){
8              System.out.println(array[i]);
9          }
10         */
11         //new version's for loop
12         for(int su : array){
13             System.out.println(su);
14         }
15     }
16 }
```

The `while` loop

- Continually execute a block of statements while a condition remains *true*.
- Can perform more than one statement by using a code block.

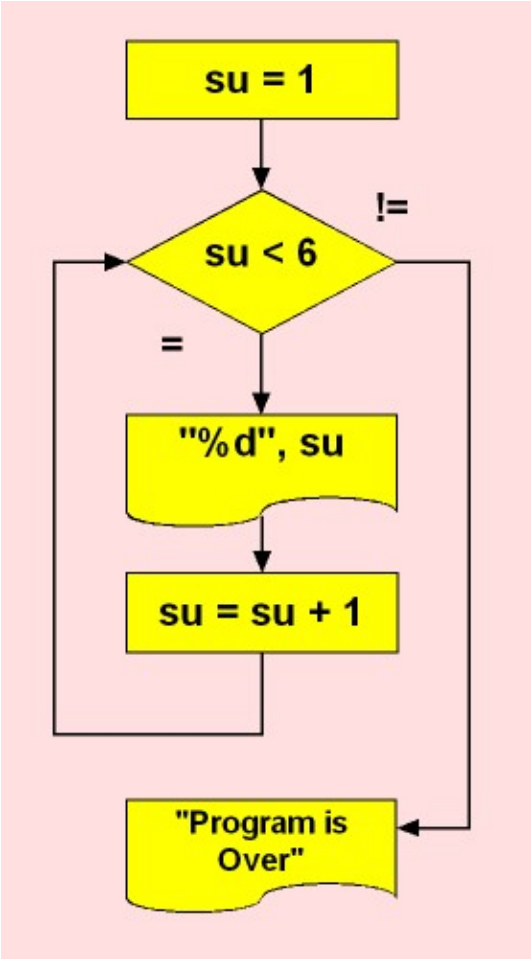
Syntax – `while`

```
initialization ;
while (boolean expression) {
      statement ;
      update ;
}
```

Syntax – `while` (Cont.)

```
2  public class WhileDemo {
3      public static void main(String[] args) {
4          int su = 1;
5          while ( su < 6 ) {
6              System.out.printf("%d\t", su);
7              su++;
8          }
9          System.out.println("\nProgram is Over...");
10     }
11 }
```

```
1	2	3	4	5
Program is Over...
```



Syntax – `while` (Cont.)

```
2  public class MultiWhileDemo {
3     public static void main(String[] args) {
4        int a, b;
5        a = 1;
6        while ( a < 11) {
7           b = 1;
8           while ( b <= a ){
9              System.out.printf("%d", b);
10             b++;
11          }
12          System.out.println();
13          a++;
14       }
15       System.out.println("\nProgram Is Over...");
16    }
17 }
```

```
1
12
123
1234
12345
123456
1234567
12345678
123456789
12345678910

Program Is Over...
```

The `do` Loop

- **`while`** and **`for`** loops are used for ***zero/many*** iterative loops.
- **`do`** is used for ***one/many*** iterative loops.
- Condition at the bottom of the loop is processed after the body.
- Body of loop is processed at least ***once***.

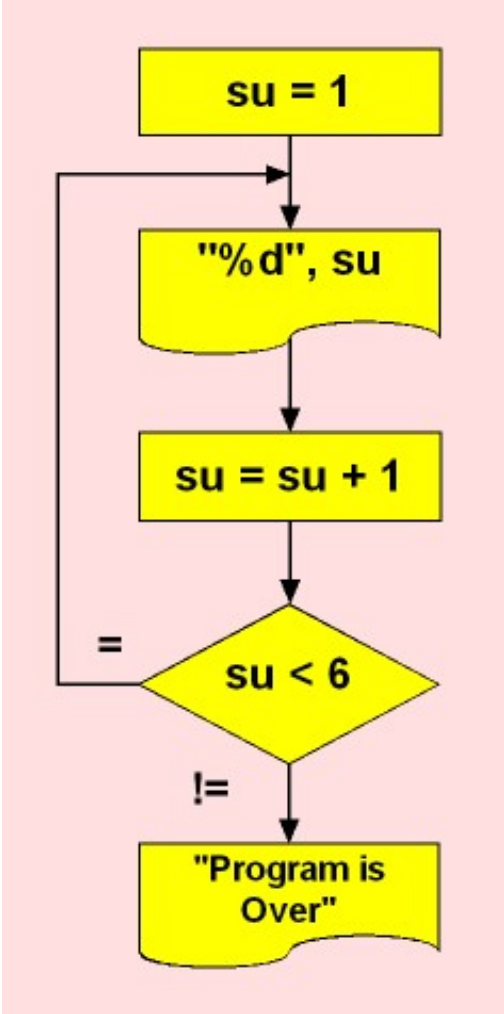
Syntax - do

```
initialization ;
do {
    statement ;
    update;
} while ( boolean expression) ;
```

Syntax – do (Cont.)

```
2  public class DoDemo {
3      public static void main(String[] args) {
4          int su = 1;
5          do {
6              System.out.printf("%d\t", su);
7              su++;
8          }while( su < 6);
9          System.out.println("\nProgram Is Over...");
10     }
11 }
```

```
1       2       3       4       5
Program Is Over...
```



Exercise : Using the `while` *Loop*

1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Comparing Loop Constructs

- **`while`** – Iterates indefinitely through statements and performs the statements zero or more times.
- **`do`** – Iterates indefinitely through statements and performs the statements ***one*** or more times.
- **`for`** – Steps through statements a predefined number of times

Transfer of Control

- `break [ label ] ;`
- `continue [ label ] ;`
- `label : statement ;` //Where statement be
  // any legal statement

The `break` Statement

- The **`break`** statement permits the controlled and immediate termination of a loop or **`switch`** statement.
- It can be used to prevent fall thru.
- The **`break`** statement is valid inside **`while`**, **`for`**, **`do`**, and **`switch`** constructs only.

The `break` Statement (Cont.)

```
1  public class  Test{
2     public static void main(String[] args) {
3        for(int i = 0 ; i < 3 ; i++){
4           for(int  j = 0 ; j < 5 ; j++){
5              System.out.printf("(%d, %d)\n", i, j);
6              if(i == 1 && j == 3) break;
7           }
8        }
9        System.out.println("End");
10    }
11 }
```

```
(0,  0)
(0,  1)
(0,  2)
(0,  3)
(0,  4)
(1,  0)
(1,  1)
(1,  2)
(1,  3)
(2,  0)
(2,  1)
(2,  2)
(2,  3)
(2,  4)
End
```

The `break [label]` Statement

- Forces a break of the loop statement immediately following the label.
- Labels are typically used with **`for`** and **`while`** loops, when there are nested loops and there is a need to identify which loop to break.
- To label a loop or a statement, place the label statement immediately before the loop or statement being labeled, as follows:

```
scanScoreTable:
 for (int r = 0;r < size ; r++) { //Labeled
    for (int c = 1; c <= 18; c++) {
        System.out.println("R:" + r + " C:" + c);
        break scanScoreTable; //Exit loops
    }
 }
```

The `break [label]` Statement(Cont.)

```
1  public class  Test{
2     public static void main(String[] args) {
3        outer :
4        for(int i = 0 ; i < 3 ; i++){
5           for(int  j = 0 ; j < 5 ; j++){
6              System.out.printf("(%d, %d)\n", i, j);
7              if(i == 1 && j == 3) break outer;
8           }
9        }
10       System.out.println("End");
11    }
12 }
```

```
(0, 0)
(0, 1)
(0, 2)
(0, 3)
(0, 4)
(1, 0)
(1, 1)
(1, 2)
(1, 3)
End
```

The `break [label]` Statement(Cont.)

```
2  public class LabelDemo {
3      public static void main(String[] args) {
4          outer :
5          for ( int i = 0 ; i < 3 ; i++ ) {
6              System.out.print("Line : " + i + " -> ");
7              for ( int j = 0 ; j < 10 ; j++ ) {
8                  if ( j == 5 ) {
9                      break outer;
10                 }
11                 System.out.print( j + "    ") ;
12             }
13         }
14         System.out.println("\nProgram is Over...") ;
15     }
16 }
```

```
Line : 0 -> 0    1    2    3    4
Program is Over...
```

The `continue` Statement

- Permits to end a loop iteration.
- Used inside **`while`**, **`for`**, and **`do`** loops only.
- Should be used only when the alternative code is much more complex.

```
for (int i = 0; i < Player.getNumPlayers(); i++) {
    Player p = players[i];
    if (!p.getUnderParFlag( ))
        continue;
    else
        p.displayUnderPar( );
}
```

The `continue` Statement (Cont.)

```
1 public class  Test{
2     public static void main(String[] args) {
3         for(int i = 0 ; i < 10 ; i++){
4             if(i == 5) continue;
5             System.out.print(i + "\t");
6         }
7         System.out.println("End");
8     }
9 }
```

```
0    1    2    3    4    6    7    8    9    End
```

The `continue [label]` Statement

```
1  public class  Test{
2     public static void main(String[] args) {
3        outer :
4        for(int i = 0 ; i < 3 ; i++){
5           for(int  j = 0 ; j < 5 ; j++){
6              if(i == 1 && j == 3) continue outer;
7              System.out.printf("(%d, %d)\n", i, j);
8           }
9        }
10       System.out.println("End");
11    }
12 }
```

```
(0, 0)
(0, 1)
(0, 2)
(0, 3)
(0, 4)
(1, 0)
(1, 1)
(1, 2)
(2, 0)
(2, 1)
(2, 2)
(2, 3)
(2, 4)
End
```

The `break`, `continue` label Statement

```
2  /*
3     Environment : Windows XP Service Pack 3, EditPlus 3.31
4     Reference : 남궁성, 『Java의 정석 2nd Edition』(서울:도우출판, 2009), p.105
5  */
6
7  public class  BreakContinueLabelDemo{
8     public static void main(String[] args) {
9        Loop1 :
10          for(int i = 2 ; i <= 9 ; i++){
11             for(int j = 1 ; j <=9 ; j++){
12                if(j == 5)
13                   break Loop1;
14                   //break;
15                   //continue Loop1;
16                   //continue;
17                System.out.println(i + " * " + j + " = " + i * j);
18             } //end of for j
19          } //end of for i, end of Loop1
20    }
21 }
```

break, continue

```
1  import java.io.*;
2  public class BreakContinueDemo {
3      public static void main(String[] args) throws IOException{
4          char [] pass = {'A', 'B','C','D'} ;
5          System.out.print("Enter your Password : ");
6          BufferedReader br = null;
7          br = new BufferedReader(new InputStreamReader(System.in));
8          String userValue = br.readLine().trim();  //사용자가 입력한 값
9          char [] userArray = userValue.toCharArray();
10         int i;
11         for ( i = 0 ; i < userArray.length; i++ ) {
12             if ( pass[i] == userArray[i] ) continue;  // 사용자가 입력한 값과 원값과 하나씩 비교
13             else break; //한개라도 틀리면 바로 break;
14         }
15         if ( i == 4) System.out.println("Success");
16         else System.out.println("Failure");
17     }
18 }
```

```
Enter your Password : ABCd
Failure
```