Java Programming

— Basics of Java Programming: Conditional branch —

Waseda University

Problem

Example

When height and weight are given (e.g. 172.0cm, 77.5kg), output the message according to the difference between Std. weight and given weight. Messages are the following:

Weight−Std. weight	Message
less than -10	`Underweight`
greater than or equal to -10, less than or equal to10	`Normal`
greater than 10	`Overweight`

Equation for calculating Std. weight:

$$\text{Std. weight(kg)} = \text{Height(m)}^2 \times 22$$

- For outputting suitable message, we need conditional branch
- There is `if statement` for selection control.

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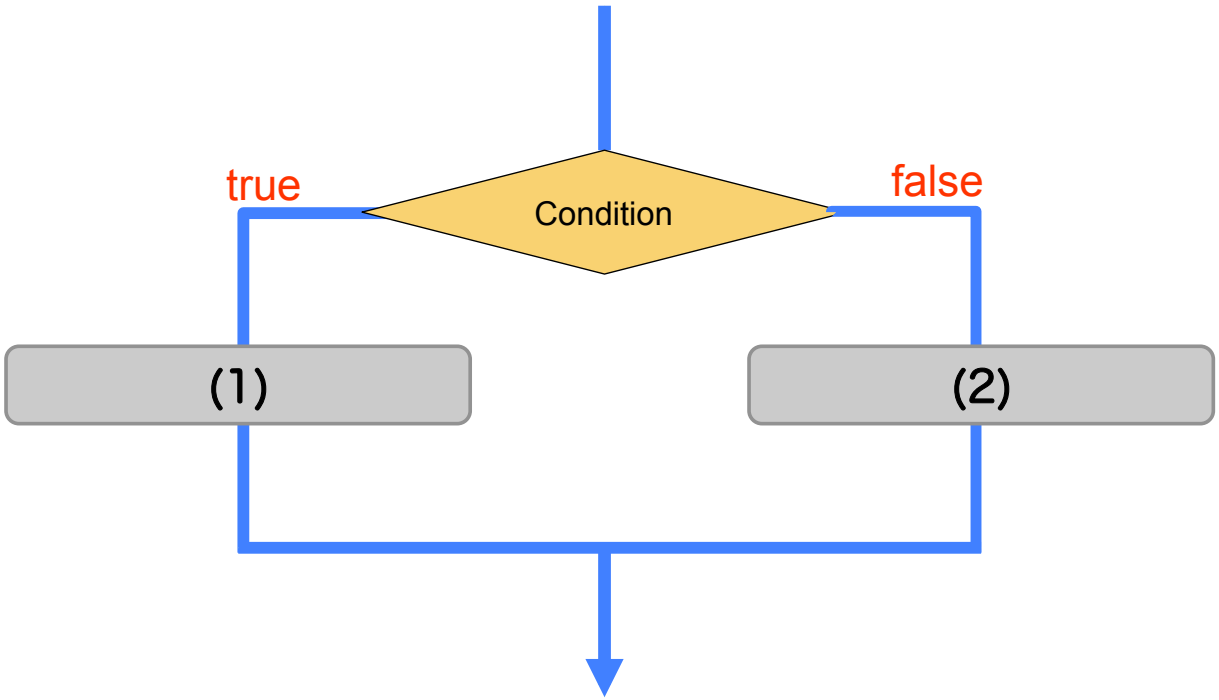
Conditional branch

if-else statement

```
if (condition) {
 (1): statement when condition is true
} else {
 (2): statement when condition is false
}
```

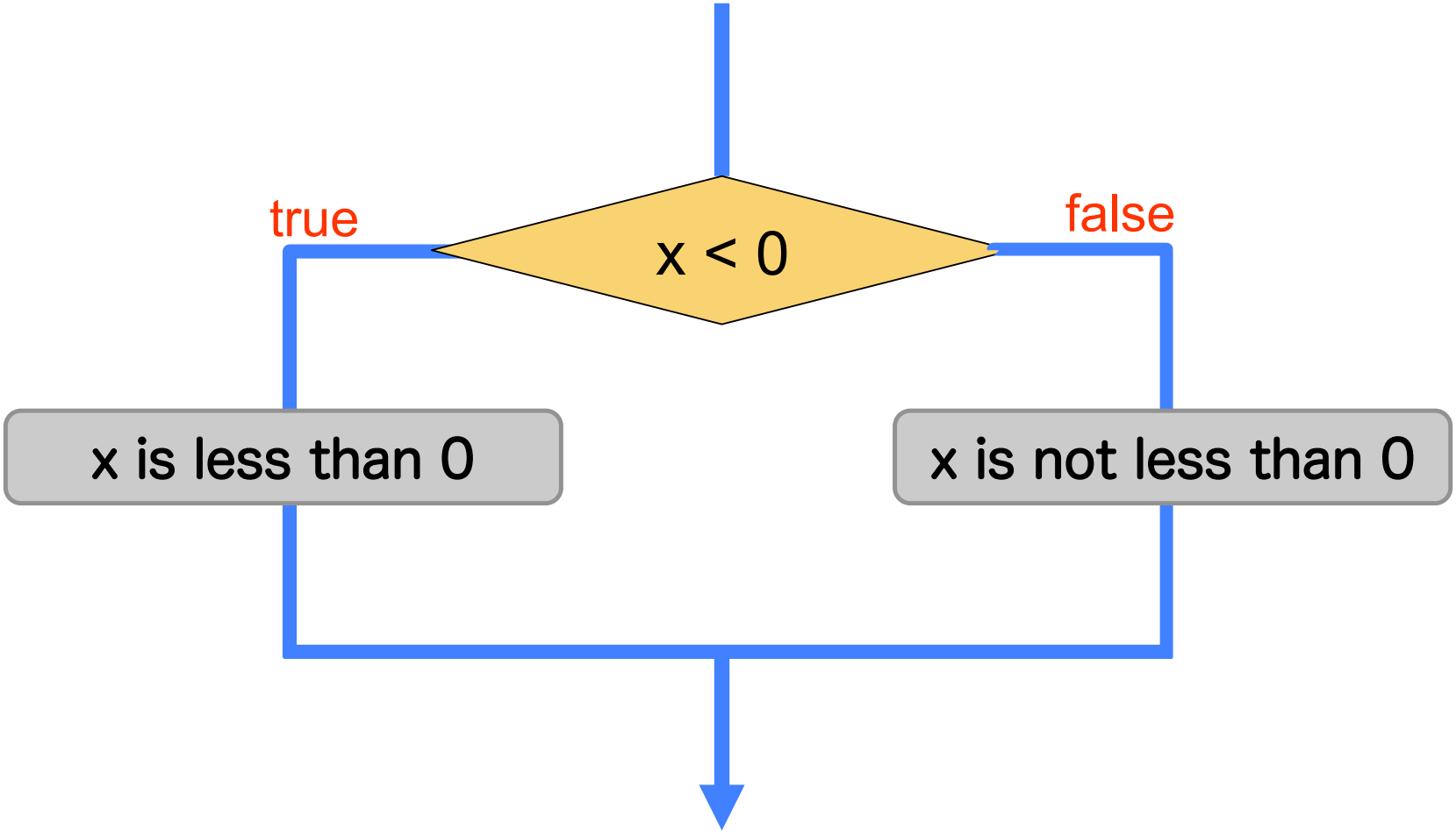


`if-else` **statement**

SampleIf.java

```
public class SampleIf {
  public static void main(String[] args) {
    int x = -5;
    if (x < 0) {
      System.out.println("x is less than 0.");
    } else {
      System.out.println("x is not less than 0.");
    }
  }
}
```

`if-else` **statement**

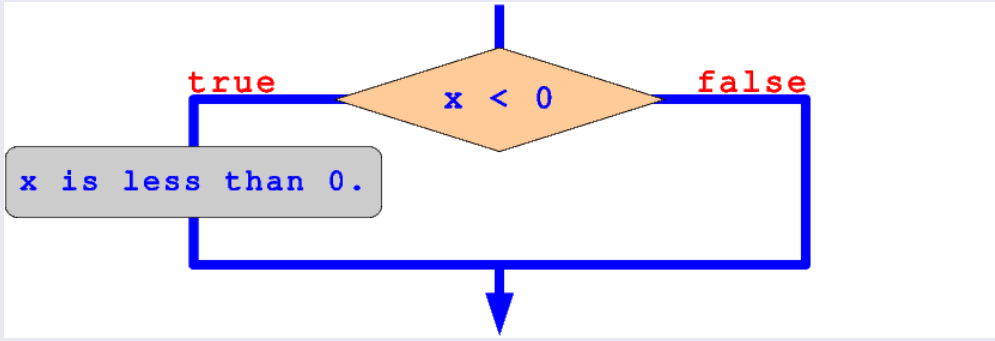


`if-else` statement

```
int x = *;
if (x < 0) System.out.println("x is less than 0.");
else       System.out.println("x is not less than 0.");
```

- When the statement in `{ }` is one, we can omit `{ }`.

```
int x = *;
if (x < 0) {
  System.out.println("x is less than 0.");
}
```



- We can omit after `else`.

Equality and relational operator

- Two numbers can be compared using the relational operators.
- In the relational expression,
  it is established → "`true`"
  it is not established → "`false`"
- Example of relational expression

```
3 < 5    → true
4 == 8   → false
```

Equality and relational operator

Operator	Meaning
==	Equality
!=	Inequality
<	less than
>	grater than
<=	less than or equal to
>=	greater than or equal to

Example

```
int a = 5;
System.out.println(a > 0);  → true
System.out.println(a <= 3); → false
System.out.println(a != 3); → true
```

Equality and relational operator

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Example

```
int a = 5;
System.out.println(a > 0);  → true
System.out.println(a <= 3); → false
System.out.println(a != 3); → true
```

Equality and relational operator

In case of example

```
if (diff < -10) {
  System.out.println("Underweight.");
}
```

- Variable `diff` : The difference between weight and Std. weight
- When `diff` is less than -10, it outputs `Underweight`.

Weight−Std. weight	Message
less than -10	`Underweight`
less than or equal to -10, greater than or equal to 10	`Normal`
greater than 10	`Overweight`

Equality and relational operator

"greater than or equal to -10 and less than or equal to10" ?

```
if (-10 <= diff <= 10) {
  System.out.println("Normal.");
}
```

←— This is wrong description

- By using logical operators, we can write it.

Logical operator

- The logical operators can be used to create a compound relational expression.
- Logical conjunction (`A && B`)

  `A and B`
  `A` and `B` is `true` → `true`, otherwise `false`.
- Logical disjunction (`A || B`)

  `A or B`
  Either `A` or `B` is true → `true`, otherwise `false`.
- Negation (`!A`)

  `A` is `true` → `false`, `A` is `false` → `true`

Logical operators

Operators	Meanig
&&	Conjunction
||	Disjunction
!	Negation

Logical operator

In case of example:

$-10 \leq \text{diff} \leq 10$

$\rightarrow$ "greater than or equal to -10" **and** "less than or equal to 10"

```
if (diff >= -10 && diff <= 10) {
  System.out.println("Normal.");
}
```

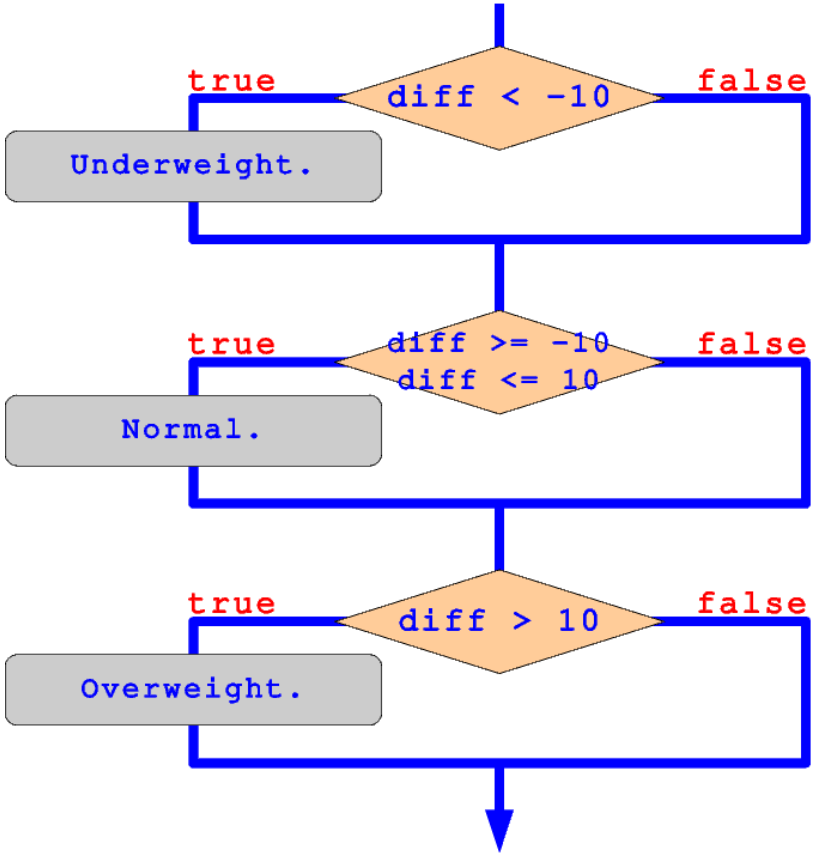
OR

```
if ((diff >= -10) && (diff <= 10)) {
  System.out.println("Normal.");
}
```

Example

By using relational and logical operators,

```
if (diff < -10) {
  System.out.println("Underweight.");
}
if ((-10 <= diff) && (diff <= 10)) {
  System.out.println("Normal.");
}
if (diff > 10) {
  System.out.println("Overweight.");
}
```

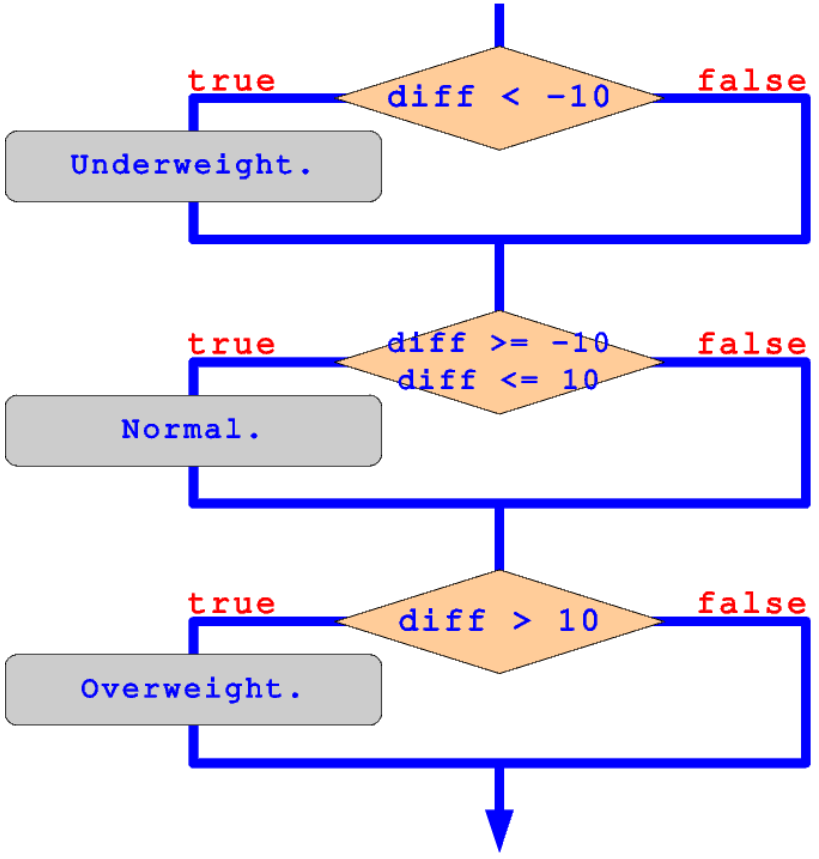


- It is simple, but it is wastefulness.
- 3 if statement are always processed.
- When `diff` is -12, first `if` statement is only congruent, but all `if` statement is performed.

Example

By using relational and logical operators,

```
if (diff < -10) {
  System.out.println("Underweight.");
}
if ((-10 <= diff) && (diff <= 10)) {
  System.out.println("Normal.");
}
if (diff > 10) {
  System.out.println("Overweight.");
}
```



- It is simple, but it is wastefulness.
- 3 if statement are always processed.
- When `diff` is -12, first `if` statement is only congruent, but all `if` statement is performed.

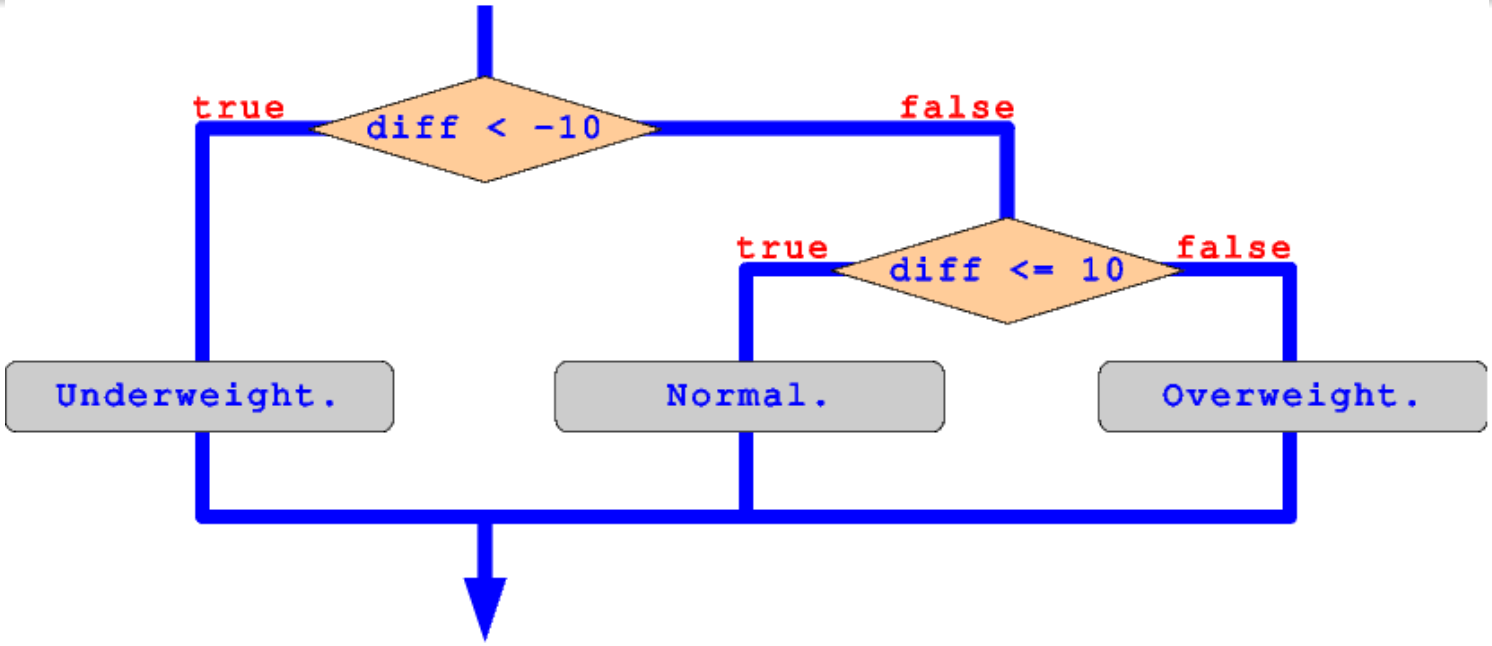
`else if` **statement**

```
if (condition1) {
    statement when condition1 is true
} else if (condition2) {
    statement when condition1 is false
    and condition2 is true
} else {
    statement (otherwise)
}
```

- In this template, else if statement makes processing 3 branches.
- To add "`else if (condition i) { ··· }`", we can make processing multidirectional branches.

Example

```
if (diff < -10) {
  System.out.println("Underweight.");
} else if (diff <= 10) {
  System.out.println("Normal.");
} else {
  System.out.println("Overweight.");
}
```



Example program

Weight4.java

```
public class Weight4{
  public static void main(String[] args){
    double diff, height, std_weight, weight;

    height = 1.73;
    weight = 68.0;
    System.out.println("Height:" + height + "m, Weight:" + weight + "kg");

    std_weight = height * height * 22;
    System.out.println("Standard weight : " + std_weight + "kg");

    diff = weight - std_weight;
    if(diff < -10){
      System.out.println("Underweight");
    } else if(diff<=10) {
      System.out.println("Normal.");
    } else {
      System.out.println("Overweight.");
    }
  }
}
```

Multiway branch using switch statement

switch statement

```
switch (int expression) {
    case int expression 1:
        statement 1
        break;
    case int expression 2:
        statement 2
        break;
      ⋮
    default:
        statement n
}
```

- Switch statement takes an integer type and selects among a number of alternative `case` branches.
- The `default` case, which is optional, can be used to perform actions when none of the specified cases matches the int expression.
- The keyword `break` is optional. The break statement immediately ends the switch statement.

Example of `switch` statement

SampleSwitch.java

```
public class SampleSwitch {
  public static void main(String[] args) {
    int x = *;
    switch (x) {
      case 1:
        System.out.println("x is 1.");
        break;
      case 2:
        System.out.println("x is 2.");
        break;
      case 3:
        System.out.println("x is 3.");
        break;
      default:
        System.out.println("other number.");
    }
  }
}
```