Java Summer 18
Class 4 Notes

Selection Statements

Objectives

After you have read and studied this chapter, you should be able to

- Implement a selection control using if statements
- Implement a selection control using switch statements
- Write boolean expressions using relational and boolean expressions
- Evaluate given boolean expressions correctly
- Nest an if statement inside another if statement
- Describe how objects are compared
- Choose the appropriate selection control statement for a given task
- Define and use enumerated constants

The if Statement

```
int testScore;

testScore = //get test score input

if (testScore < 70)

     System.out.println("You did not pass" );

else

     System.out.println("You did pass" );
```

This statement is executed if the testScore is less than 70.

This statement is executed if the testScore is 70 or higher.

Syntax for the if Statement

```
if ( <boolean expression> )

       <then block>
else

       <else block>
```

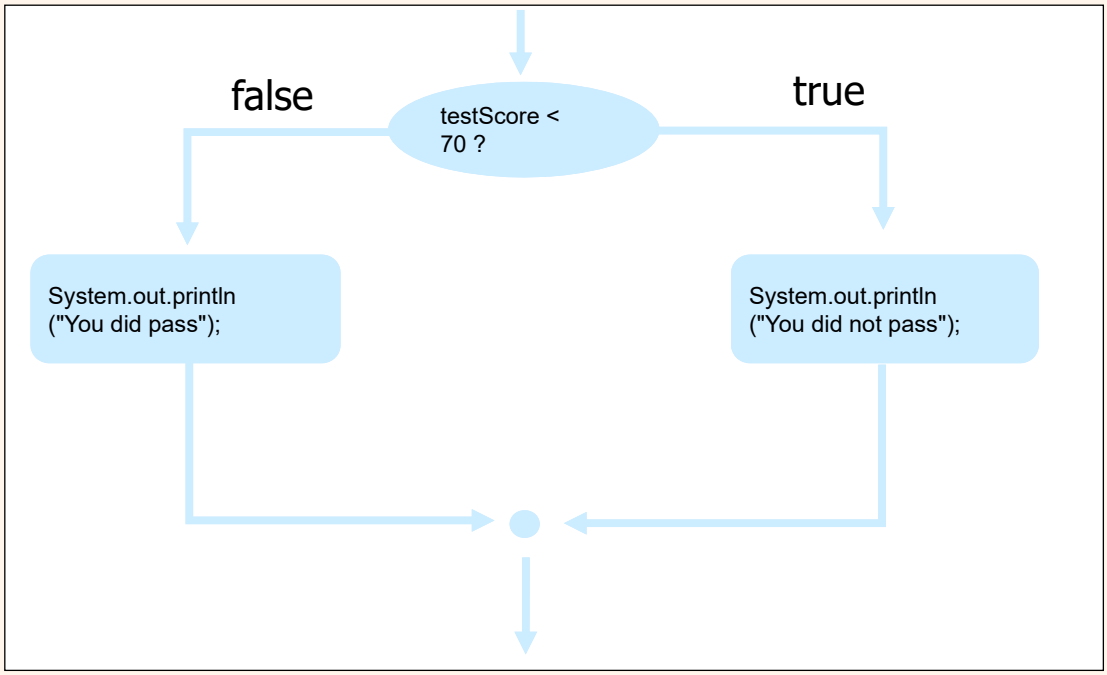
Boolean Expression

```
if (    testScore < 70      )
   System.out.println("You did not pass");
else
   System.out.println("You did pass ");
```

Then Block

Else Block

Control Flow



Relational Operators

```
<       //less than
<=      //less than or equal to
==      //equal to
!=      //not equal to
>       //greater than
>=      //greater than or equal to
```

```
testScore < 80
testScore * 2 >= 350
30 < w / (h * h)
x + y != 2 * (a + b)
2 * Math.PI * radius <= 359.99
```

Compound Statements

- Use braces if the <then> or <else> block has multiple statements.

```
if (testScore < 70)
{
     System.out.println("You did not pass“ );
     System.out.println(“Try harder next time“ );
}
else
{
     System.out.println(“You did pass“ );
     System.out.println(“Keep up the good work“ );
}
```

Then Block

Else Block

Style Guide

```
if ( <boolean expression> ) {
    …
} else {
    …
}
```

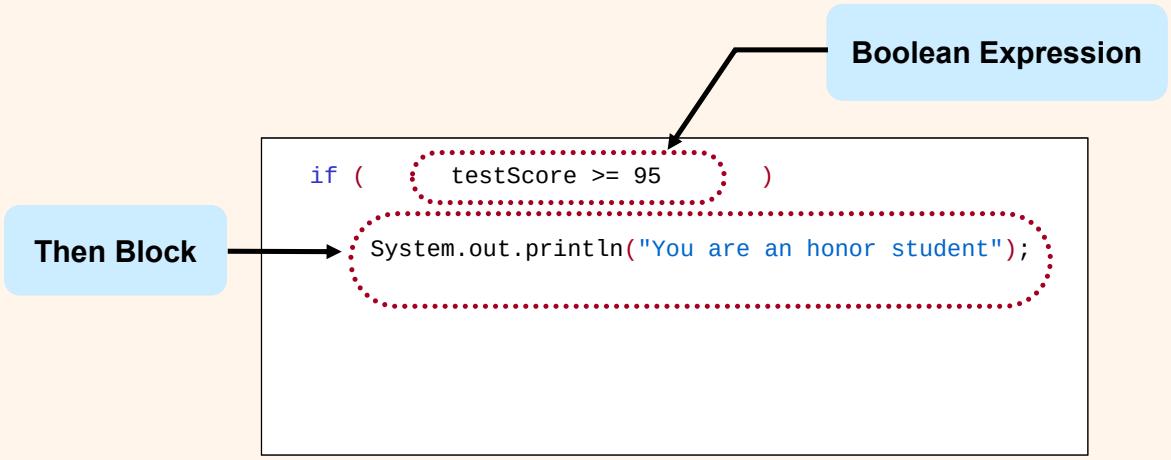
Style 1

```
if ( <boolean expression> )
{
    …
}
else
{
    …
}
```

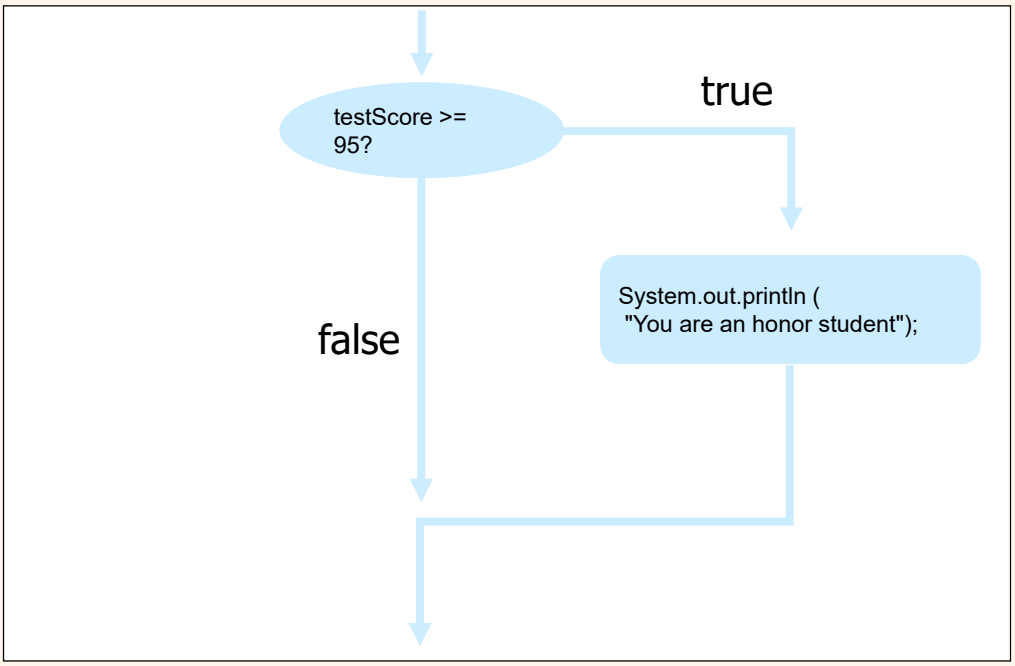
Style 2

The if-then Statement

```
if ( <boolean expression> )

      <then block>
```



Control Flow of if-then

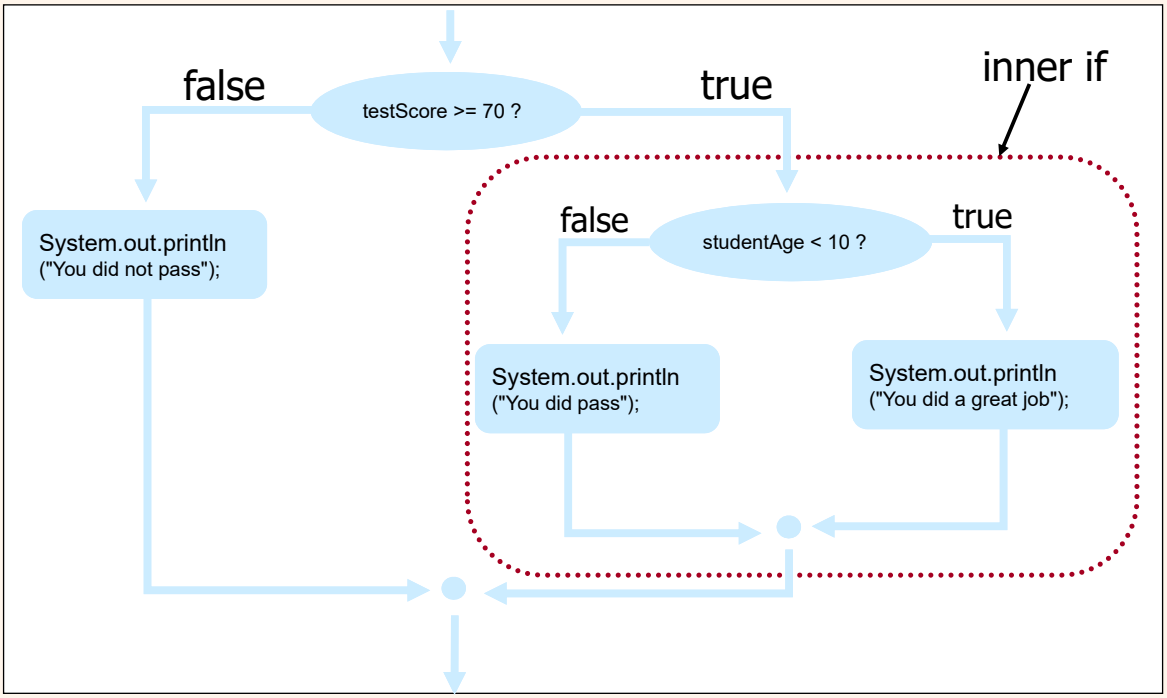


The Nested-if Statement

- The then and else block of an if statement can contain any valid statements, including other if statements. An if statement containing another if statement is called a nested-if statement.

```
if (testScore >= 70) {
    if (studentAge < 10) {
        System.out.println("You did a great job");
    } else {
        System.out.println("You did pass"); //test score >= 70
    }                                        //and age >= 10
} else { //test score < 70
     System.out.println("You did not pass");
}
```


Control Flow of Nested-if Statement



Writing a Proper if Control

```
if (num1 < 0)
    if (num2 < 0)
        if (num3 < 0)
            negativeCount = 3;
        else
            negativeCount = 2;
    else
        if (num3 < 0)
            negativeCount = 2;
        else
            negativeCount = 1;
else
    if (num2 < 0)
        if (num3 < 0)
            negativeCount = 2;
        else
            negativeCount = 1;
    else
        if (num3 < 0)
            negativeCount = 1;
        else
            negativeCount = 0;
```

```
negativeCount = 0;

if (num1 < 0)
       negativeCount++;
if (num2 < 0)
       negativeCount++;
if (num3 < 0)
       negativeCount++;
```

The statement

negativeCount++;

increments the variable by one

if – else if Control

Test Score	Grade
90 ≤ score	A
80 ≤ score < 90	B
70 ≤ score < 80	C
60 ≤ score < 70	D
score < 60	F

```
if (score >= 90)
   System.out.print("Your grade is A");

else if (score >= 80)
    System.out.print("Your grade is B");

else if (score >= 70)
    System.out.print("Your grade is C");

else if (score >= 60)
    System.out.print("Your grade is D");

else
    System.out.print("Your grade is F");
```

Matching else

Are A and B different?

A

```
if (x < y)
   if (x < z)
       System.out.print("Hello");
else
    System.out.print("Good bye");
```

B

```
if (x < y)
   if (x < z)
     System.out.print("Hello");
   else
     System.out.print("Good bye");
```

Both A and B means...

```
if (x < y) {
   if (x < z) {
      System.out.print("Hello");
   } else {
      System.out.print("Good bye");
   }
}
```


Boolean Operators

- A *boolean operator* takes boolean values as its operands and returns a boolean value.
- The three boolean operators are
  - and: &&
  - or: ||
  - not !

```
if (temperature >= 65 && distanceToDestination < 2) {
     System.out.println("Let's walk");
} else {
     System.out.println("Let's drive");
}
```

Semantics of Boolean Operators

- Boolean operators and their meanings:

P	Q	P && Q	P || Q	!P
false	false	false	false	true
false	true	false	true	true
true	false	false	true	false
true	true	true	true	false

De Morgan's Law

- De Morgan's Law allows us to rewrite boolean expressions in different ways

```
Rule 1: !(P && Q) ⟷ !P || !Q

Rule 2: !(P || Q) ⟷ !P && !Q
```

```
!(temp >= 65 && dist < 2)

   ⟷ !(temp >=65) || !(dist < 2) by Rule 1

   ⟷ (temp < 65 || dist >= 2)
```

Short-Circuit Evaluation

- Consider the following boolean expression:

```
x > y || x > z
```

- The expression is evaluated left to right. If x > y is true, then there's no need to evaluate x > z because the whole expression will be true whether x > z is true or not.
- To stop the evaluation once the result of the whole expression is known is called *short-circuit evaluation*.
- What would happen if the short-circuit evaluation is not done for the following expression?

```
z == 0 || x / z > 20
```


Operator Precedence Rules

Group	Operator	Precedence	Associativity
Subexpression	( )	10 (If parentheses are nested, then innermost subexpression is evaluated first.)	Left to right
Postfix increment and decrement operators	++ --	9	Right to left
Unary operators	- !	8	Right to left
Multiplicative operators	* / %	7	Left to right
Additive operators	+ -	6	Left to right
Relational operators	< <= > >=	5	Left to right
Equality operators	== !=	4	Left to right
Boolean AND	&&	3	Left to right
Boolean OR	||	2	Left to right
Assignment	=	1	Right to left

Boolean Variables

- The result of a boolean expression is either **true** or **false**. These are the two values of data type **boolean**.
- We can declare a variable of data type **boolean** and assign a boolean value to it.

```
boolean pass, done;
pass = 70 < x;
done = true;
if (pass) {
        …
} else {
        …
}
```


The switch Statement

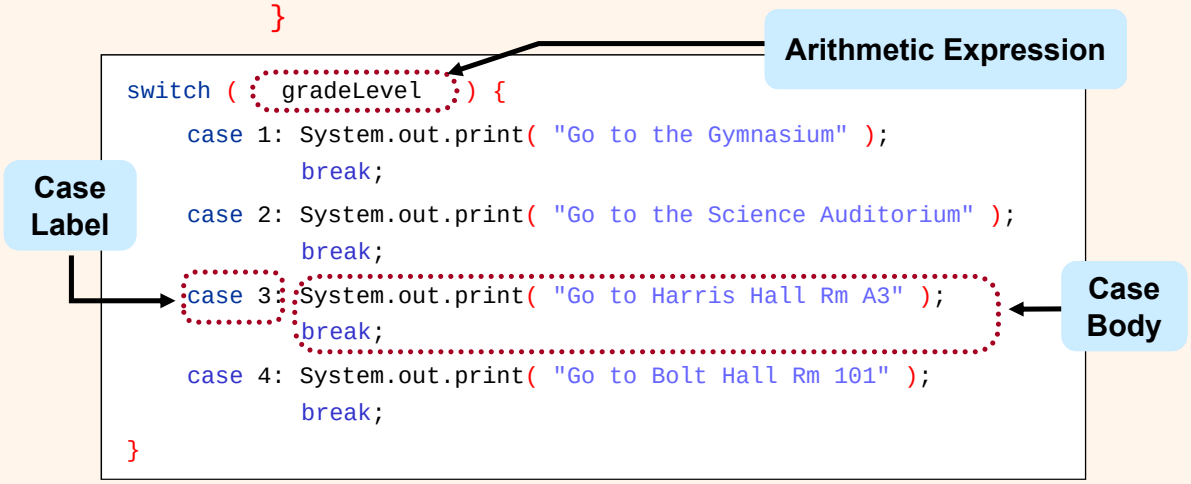
```
Scanner scanner = new Scanner(System.in);

System.out.println( "Grade (Frosh-1,Soph-2,...):“);
int gradeLevel = scanner.nextInt();

switch (gradeLevel) {
    case 1: System.out.print("Go to the Gymnasium");
            break;

    case 2: System.out.print("Go to the Science Auditorium");
            break;

    case 3: System.out.print("Go to Harris Hall Rm A3");
            break;

    case 4: System.out.print("Go to Bolt Hall Rm 101");
            break;
}
```

This statement is executed if the gradeLevel is equal to 1.

This statement is executed if the gradeLevel is equal to 4.

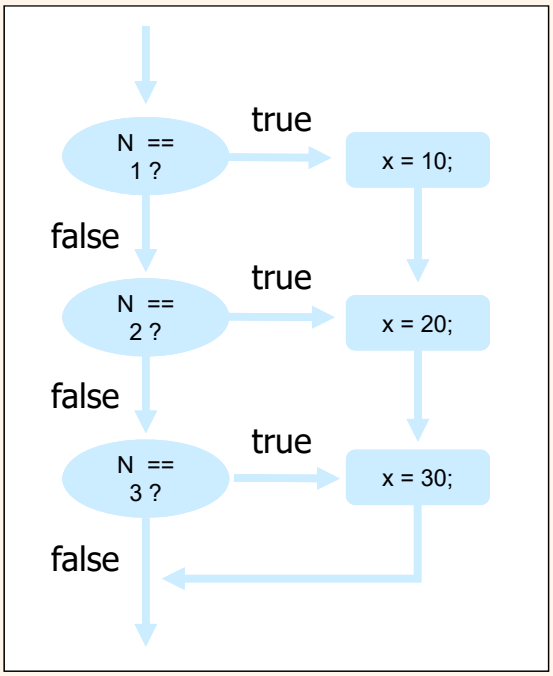
Syntax for the switch Statement

```
switch ( <arithmetic expression> ) {
        <case label 1> : <case body 1>
        …
        <case label n> : <case body n>
}
```



switch With No break Statements

```
switch ( N ) {
   case 1: x = 10;
   case 2: x = 20;
   case 3: x = 30;
}
```



switch With break Statements

```
switch ( N ) {
   case 1: x = 10;
           break;
   case 2: x = 20;
           break;
   case 3: x = 30;
           break;
}
```