

Object Oriented Development with Java

(CT038-3-2-OODJ and Version VC1)

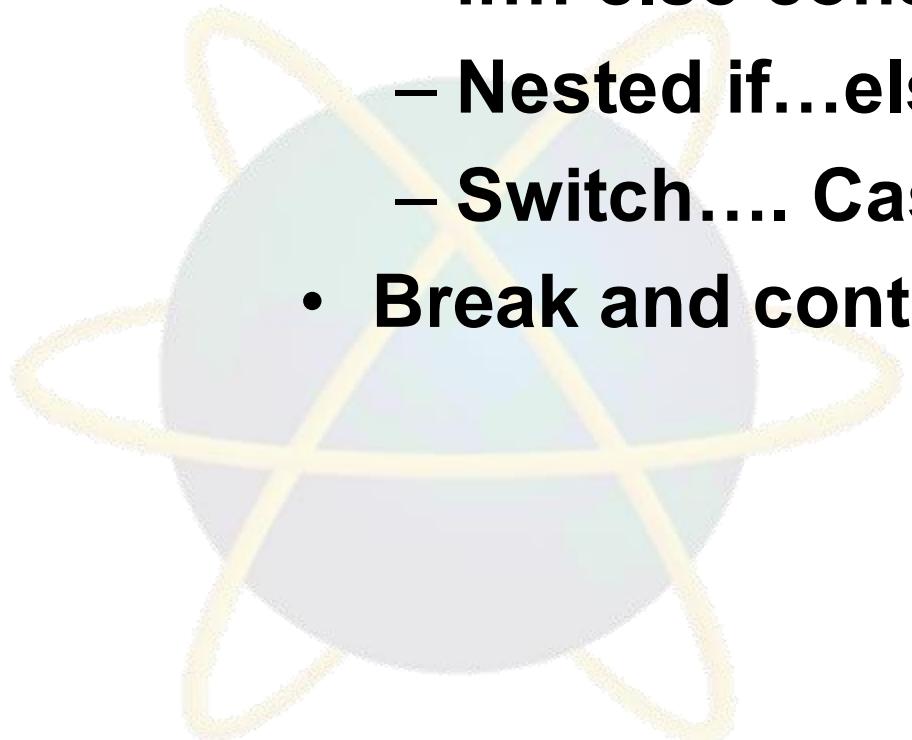


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Conditional Constructs

Topic & Structure of the lesson

- **Conditional constructs**
 - **if... else construct**
 - **Nested if...else constructs**
 - **Switch.... Case**
- **Break and continue statements**



Learning Outcomes

At the end of this topic, you should be able to:

- Write Java programs implementing the conditional constructs



Key Terms you must be able to use

If you have mastered this topic, you should be able to use the following terms correctly in your assignments and exams:

- Flow control – Program statements (including Java) execute in sequence only unless a flow control permits the change of the default sequential flow.
- switch - Java has a shorthand for certain types of multiple if statements, called the switch-case statement. In certain situations, the switch-case statement will be much more effective than multiple if statements.

The if – else statement

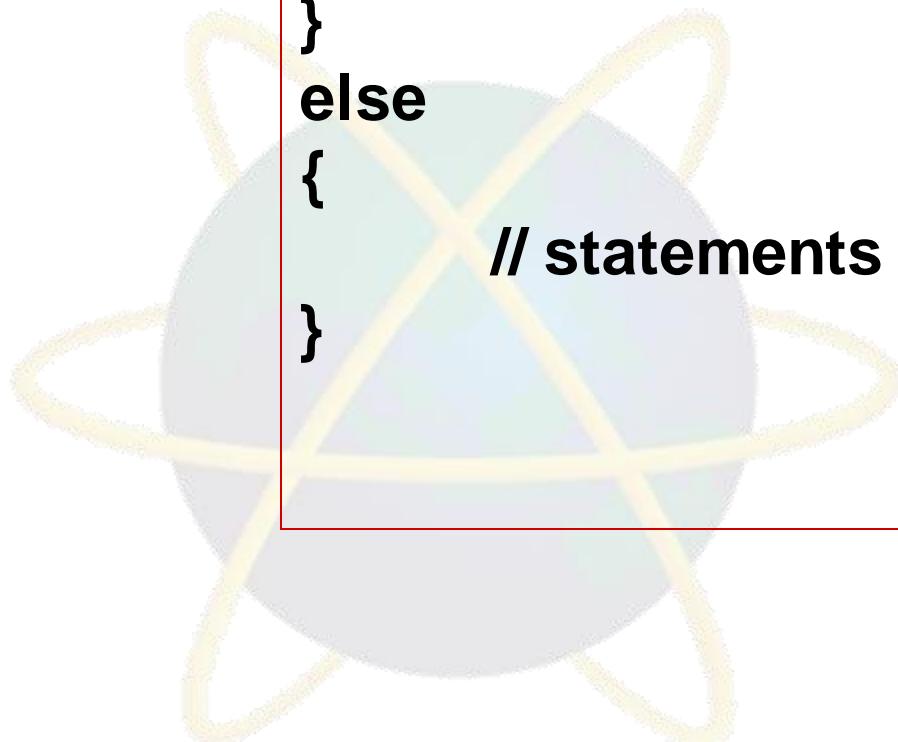
Generally, the simple form of if can be written like this:

```
if (expression)  
    statement
```

So, what if you wanted to perform a different set of statements if the expression is false? Well, you can use the else statement for that. Consider another example. Suppose that your program needs to perform different actions depending on whether the user clicks on the OK button or the Cancel button in an alert window. Your program could do this using an if statement:

The if – else statement

```
if (conditional expression)
{
    // statements when true
}
else
{
    // statements when false
}
```



The if – else statement

```
// response is either OK or CANCEL depending
// on the button that the user pressed
...
if (response == "OK") {
    ...
    // code to perform OK action
    ...
} else {
    ...
    // code to perform Cancel action
    ...
}
```

The if – else statement

Example

Social Security tax on wages is calculated as follows:

$$\begin{aligned}\text{Tax} &= 0.124 \times \text{wages} && \text{if wages} \leq \$57600 \\ &= 0.124 \times \$57600 && \text{if wages} > \$57600\end{aligned}$$

Write an application to accept wages, calculate and display the Social Security tax.

The if – else statement

Example 1

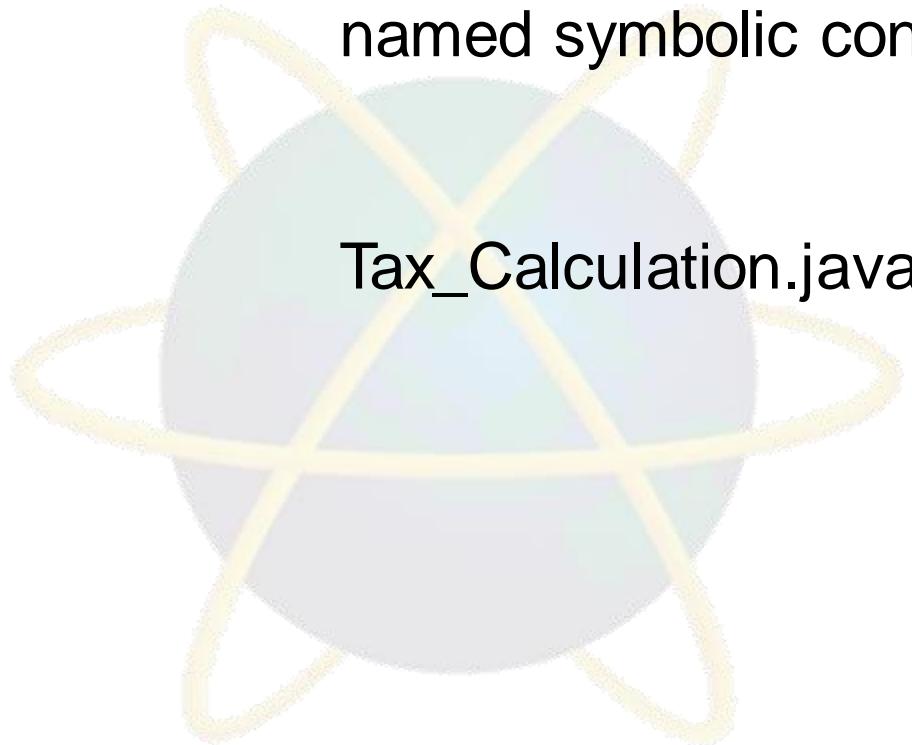
$$\text{Tax} = \begin{cases} 0.124 \times \text{wages} & \text{if wages} \leq \$57600 \\ 0.124 \times \$57600 & \text{otherwise} \end{cases}$$

This computation can be expressed neatly in Java by the *if* statement :

```
if (wages <= 57600)
    tax = 0.124 * wages;
else
    tax = 0.124 * 57600;
```

The if – else statement

This computation will be embedded in the following complete Java application with the values 0.124 and 57600 replaced by suitably named symbolic constants.



Tax_Calculation.java

The if – else statement

```
import java.util.Scanner;

public class Tax_Calculation {
    public static void main(String[] args)
    {
        final double MAXIMUM_WAGE = 57600, TAX_RATE = 0.124;
        double wages, tax;
        Scanner input= new Scanner( System.in );
        System.out.print("Your wages subject to Social Security Tax are : $ ");
        wages=input.nextInt();
        if (wages <= 57600)
            tax = TAX_RATE * wages;
        else
            tax = TAX_RATE * MAXIMUM_WAGE;
        System.out.println("Your Security Tax is :$ " + tax);
    }
}
```

The if – else statement

Output:

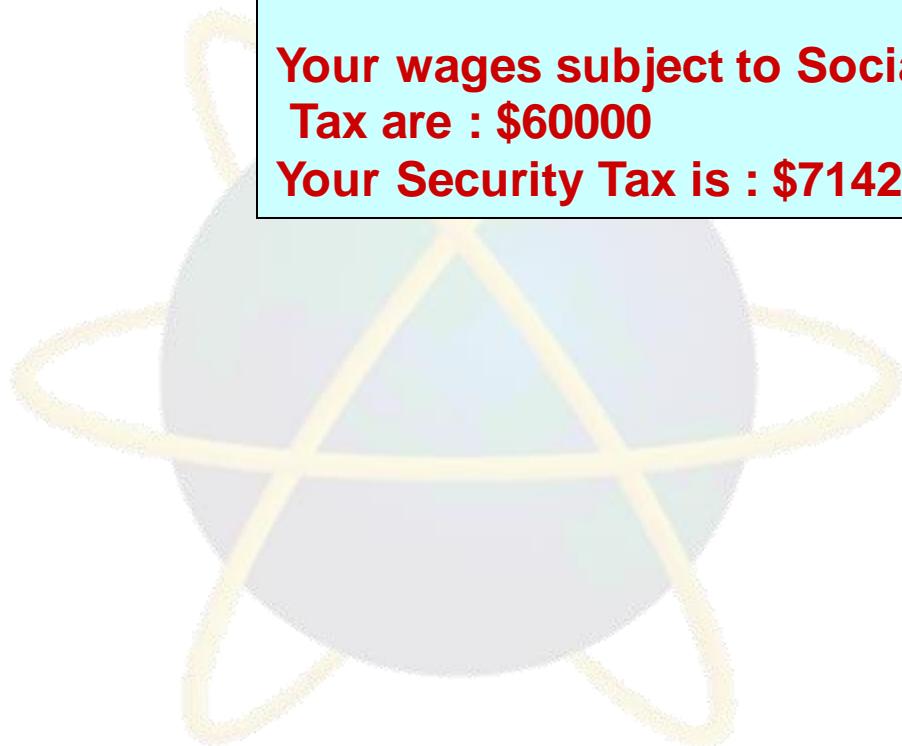
Your wages subject to Social Security Tax are : \$20000

Your Security Tax is : \$2480.0

Your wages subject to Social Security

Tax are : \$60000

Your Security Tax is : \$7142.4



Quick Review Question

You have seen and done the following examples:

1. Tax calculation

You should now be in a position to write a Java program that accepts data from the keyboard, uses the select statement and displays appropriate results.

This is your task:

Accept the temperature in degrees Fahrenheit from the user, convert and display the temperature in degrees centigrade. Display a message if the centigrade (Celcius)temperature exceeds 75 degrees.

Here is the formula to use

$$\text{degree C} = 5 (F - 32) / 9$$

The if – else statement

There is another form of the else statement,
else if
which executes a statement based on another expression.

Example

Grades are assigned based on the value of a test score:

A for a score of 70% or more

B for a score of 60% or more but not in the ranges above

C for a score of 50% or more but not in the ranges above

D for a score of 40% or more but not in the ranges above

F for a score below 40%

Write an appropriate select statement

The if – else statement

Example 2



The if – else statement

```
int testscore;  
char grade;  
if (testscore >= 70) {  
    grade = 'A';  
} else if (testscore >= 60) {  
    grade = 'B';  
} else if (testscore >= 50) {  
    grade = 'C';  
} else if (testscore >= 40) {  
    grade = 'D';  
} else {  
    grade = 'F';  
}
```

The if – else statement

When writing else if statements, the rule to always remember is:

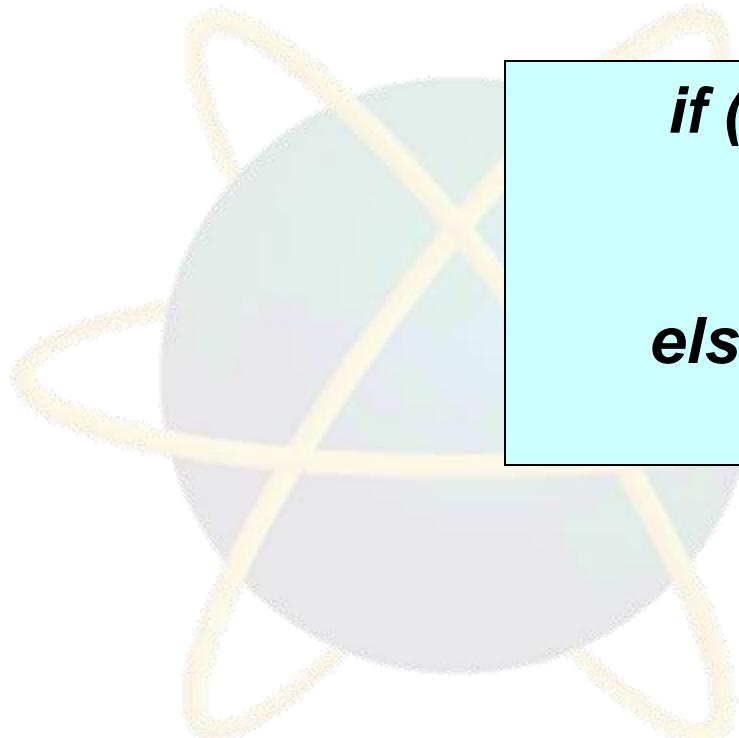
“No else without parent if”



The if – else statement

BUG ALERT : Dangling else

Nested if statements can become quite complicated.
Indentation alone is not sufficient such as the example below :



```
if (condition-1)
    if (condition-2)
        statement-1
else
    statement-2
```

The if – else statement

BUG ALERT : Dangling else (cont'd)

may be interpreted as below :

```
if (condition-1)
    if (condition-2)
        statement-1
    else
        statement-2
```

The rule is that an **else** is paired with the nearest unmatched **if** preceding.

The if – else statement

BUG ALERT : Dangling else (cont'd)

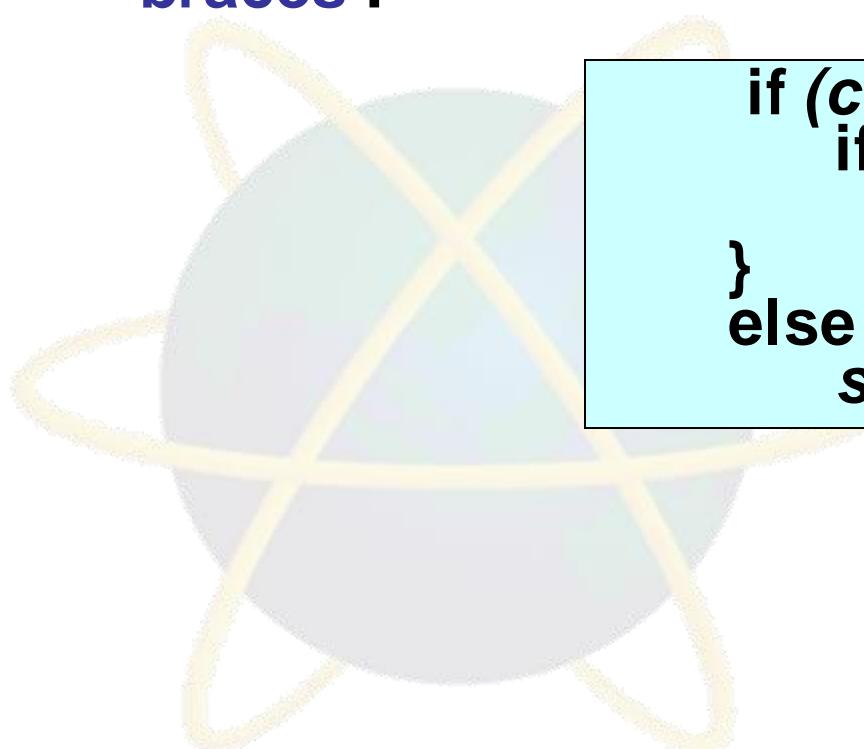
To get the desired effect, the programmer can either insert a **dummy else** as in :

```
if (condition-1)
    if (condition-2)
        statement-1
    else;
else
    statement-2
```

The if – else statement

BUG ALERT : Dangling else (cont'd)

Or the “then” clause can be enclosed in a pair of braces :



```
if (condition-1) {  
    if (condition-2)  
        statement-1  
    }  
    else  
        statement-2
```

The if – else statement

BUG ALERT : Dangling else (cont'd)

The best solution, however, is to reorganize the code to :

```
if (not condition-1)
    statement-2
else if (condition-2)
    statement-1
```

Remember to match each **else** with the correct **if**. The rule is that an **else** is paired with the nearest unmatched **if** preceding.

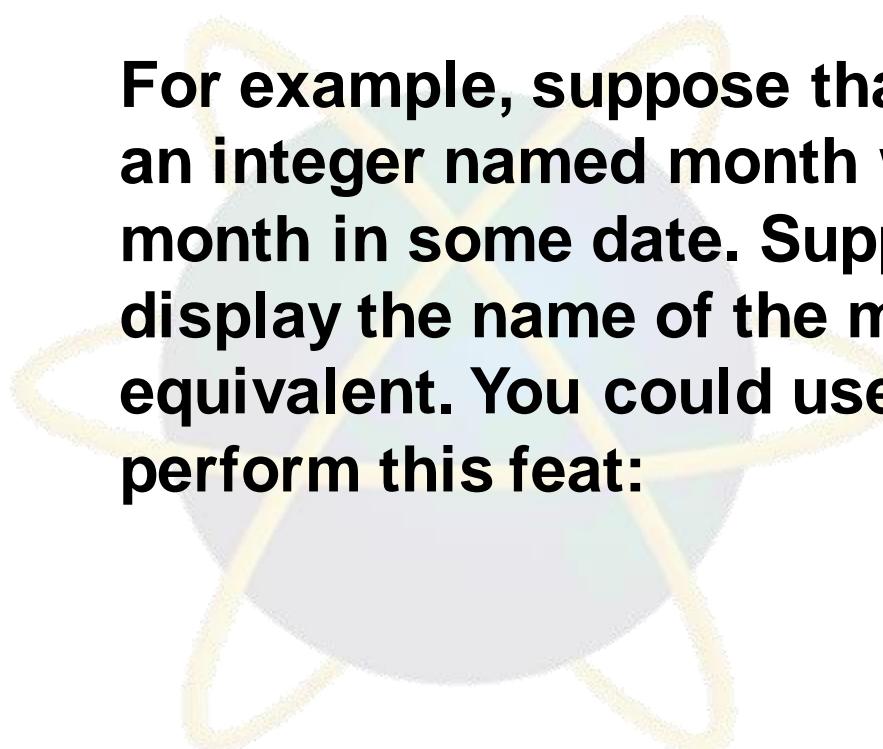
Quick Review Question

Let us test what you have just learned:

1. Write a program segment to find the largest of 2 double numbers x and y.
2. Write a program segment to find the largest of 3 double numbers x, y and z.

Java's switch statement

Use the switch statement to conditionally perform statements based on some expression.



For example, suppose that your program contained an integer named month whose value indicated the month in some date. Suppose also that you wanted to display the name of the month based on its integer equivalent. You could use Java's *switch statement* to perform this feat:

Java's switch statement

```
int month;  
...  
switch (month) {  
    case 1: System.out.println("January"); break;  
    case 2: System.out.println("February"); break;  
    case 3: System.out.println("March"); break;  
    case 4: System.out.println("April"); break;  
    case 5: System.out.println("May"); break;  
    case 6: System.out.println("June"); break;  
    case 7: System.out.println("July"); break;  
    case 8: System.out.println("August"); break;  
    case 9: System.out.println("September"); break;  
    case 10: System.out.println("October"); break;  
    case 11: System.out.println("November"); break;  
    case 12: System.out.println("December"); break;  
}
```

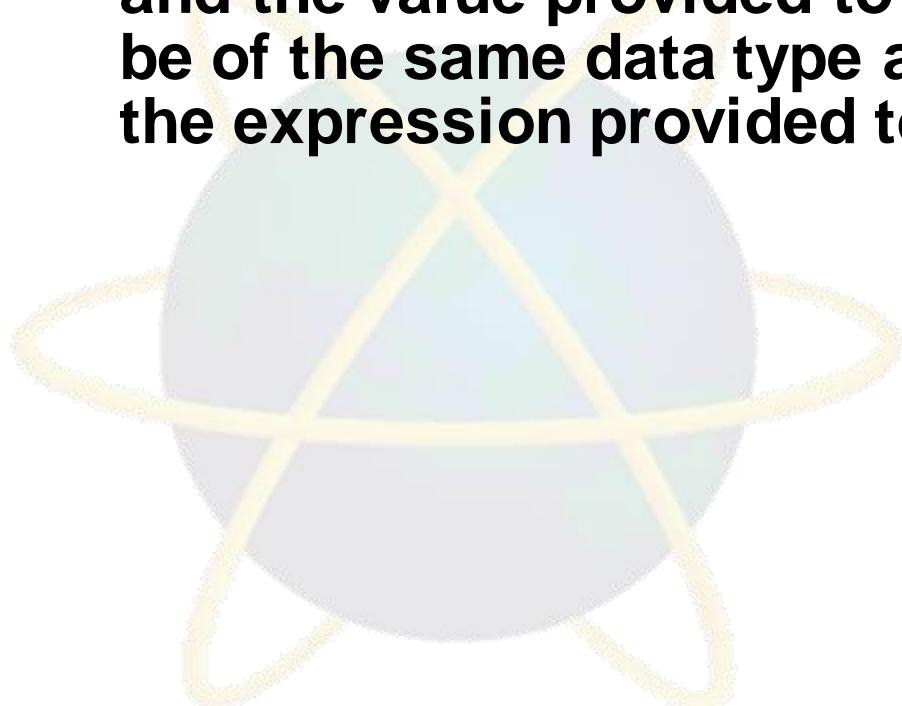
Java's switch statement

The switch statement evaluates its expression, in this case, the value of month, and executes the appropriate case statement. Of course, you could implement this as an if statement:

```
int month;  
...  
if (month == 1) {  
    System.out.println("January");  
} else if (month == 2) {  
    System.out.println("February");  
}  
...  
// you get the idea  
...
```

Java's switch statement

switch Vs else-if : Deciding whether to use an if statement or a switch statement is a judgment call. You can decide which to use based on readability and other factors. Each case statement must be unique and the value provided to each case statement must be of the same data type as the data type returned by the expression provided to the switch statement.



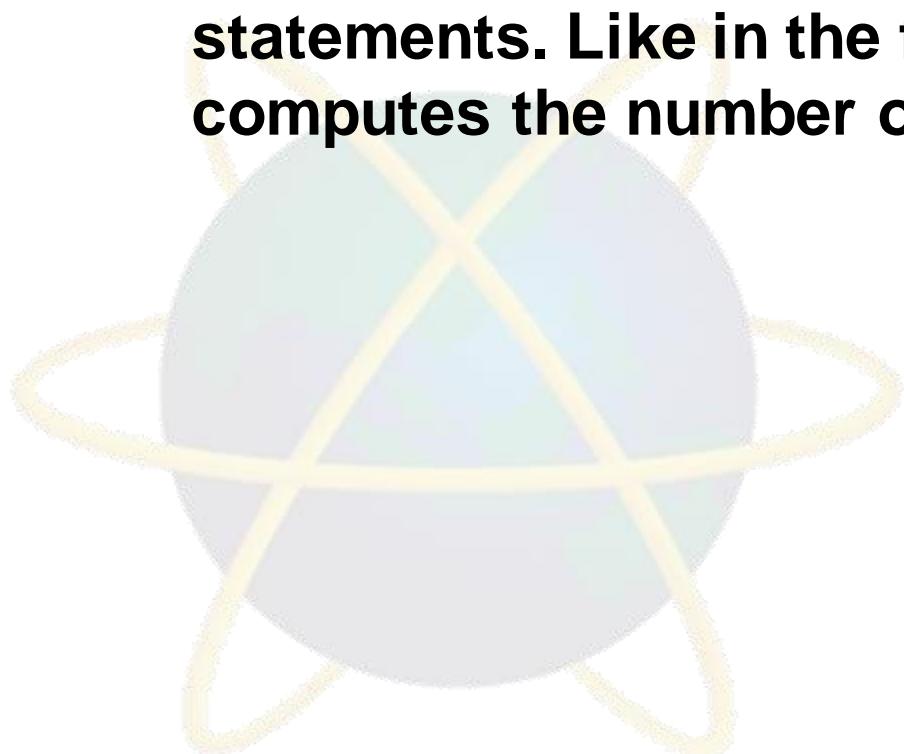
Java's switch statement

break statements : The break statements cause control to break out of the switch and continue with the first statement following the switch. The break statements are necessary because case statements fall through. That is, without an explicit break control will flow sequentially through subsequent case statements.



Java's switch statement

However, there are certain scenarios when you do want control to proceed sequentially through case statements. Like in the following Java code that computes the number of days in a month :

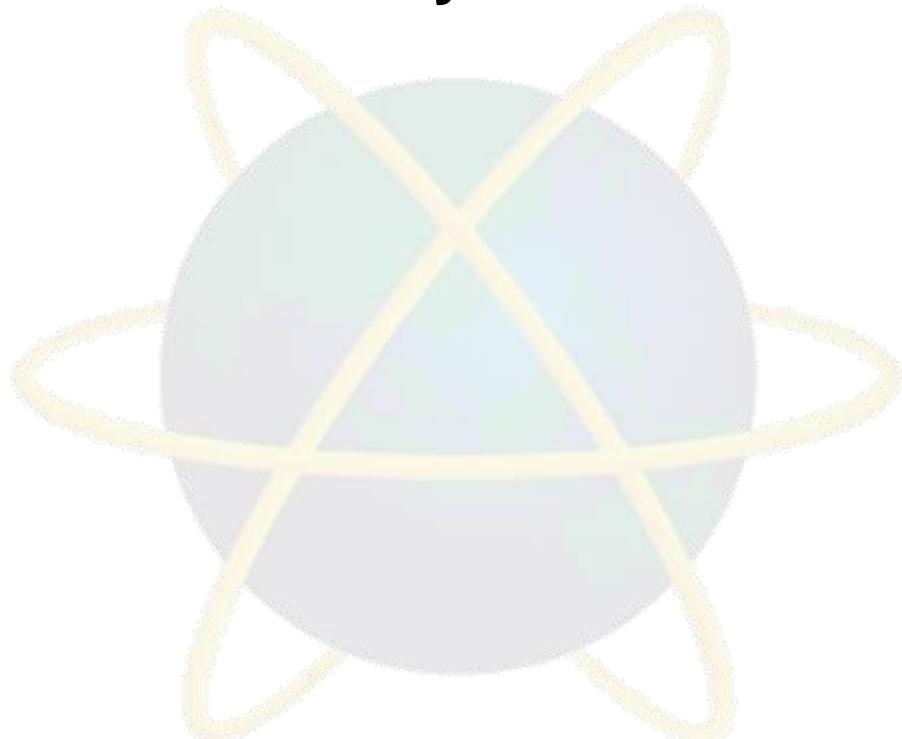


Java's switch statement

```
int month;
int numDays;
...
switch(month) {
    case 1:
    case 3:
    case 5:
    case 7:
    case 8:
    case 10:
    case 12:
        numDays = 31;
        break;
    case 4:
    case 6:
    case 9:
    case 11:
        numDays = 30;
        break;
    case 2:
        if ( ((year % 4 == 0) && !(year % 100 == 0))
            || (year % 400 == 0) )
            numDays = 29;
        else
            numDays = 28;
        break;
}
```

Java's switch statement

Finally, you can use the *default statement* at the end of the switch to handle all values that aren't explicitly handled by one of the case statements.

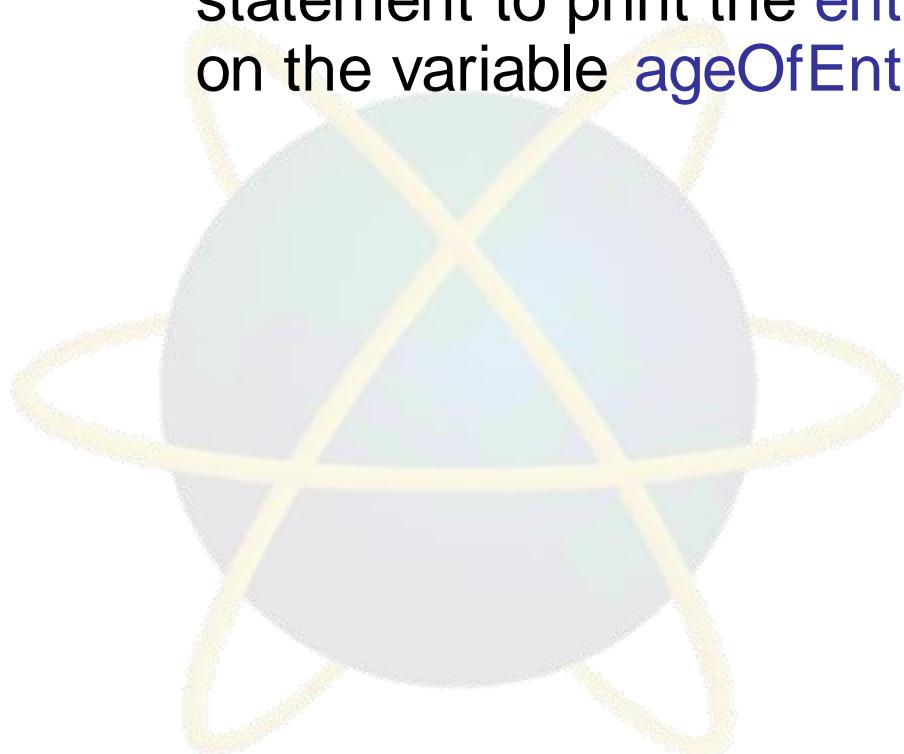


Java's switch statement

```
int month;  
.  
.  
.  
switch (month) {  
    case 1: System.out.println("January"); break;  
    case 2: System.out.println("February"); break;  
    case 3: System.out.println("March"); break;  
    case 4: System.out.println("April"); break;  
    case 5: System.out.println("May"); break;  
    case 6: System.out.println("June"); break;  
    case 7: System.out.println("July"); break;  
    case 8: System.out.println("August"); break;  
    case 9: System.out.println("September"); break;  
    case 10: System.out.println("October"); break;  
    case 11: System.out.println("November"); break;  
    case 12: System.out.println("December"); break;  
    default: System.out.println("Hey, that's not a valid month!");  
    break;  
}
```

Quick Review Question

The entry fee for the local art museum is calculated as follows : children under 5 years, free; adults 65 years and older, \$1.50; all others, \$2.50. Write an if statement to print the `entryFee` (of type `double`) based on the variable `ageOfEntrant` (of type `int`).



Quick Review Question

The current rule for Social Security contributions is this: 7.65% of your salary, up to \$67500, is taken as Social Security (FICA) tax, then 1.45% of everything above that is taken as Medicare tax. However, if you are self-employed, it is 15.3% up to \$67,500, then 2.9% above that. Write a program that first asks the user whether he or she is self-employed and then asks for the annual salary, and calculates the FICA tax, the Medicare tax, and the total. For example :

Are you self-employed (Enter 1 for yes, 0 for no) : 1

Your annual earnings : 91450

Your FICA tax is \$10327.500

Your Medicare tax is \$694.550

Your total security tax is \$11022.050

Follow Up Assignment

Work on this assignment for discussion in the next lesson.

The Center for Disease Control in Atlanta, Georgia, has computed various “recommended values” for a person’s body mass index. The body mass index is a person’s weight in kilograms divided by the square of his or her height in meters. For men, an index of 27.8 or more is considered high; for nonpregnant women, the cutoff is 27.3. Write an application to read a person’s gender, height and weight, determine the bodyMassIndex, and print a message as to whether it is high or not. Your application should convert height from inches to meters (1 meter is 39.37 inches) and weight from pounds to kilograms (1 kilogram is 2.20 pounds).

Follow Up Assignment

Your output should look like this :

BODY MASS CALCULATION

Enter your gender (0 for male, 1 for female) : 1

Enter your height in inches : 69

Enter your weight in pounds : 141

Your body-mass-index is 20.90; this is not considered high.

BODY MASS CALCULATION

Enter your gender (0 for male, 1 for female) : 1

Enter your height in inches : 61

Enter your weight in pounds : 145

Your body-mass-index is 27.47; this is considered high.

Summary of Main Teaching Points

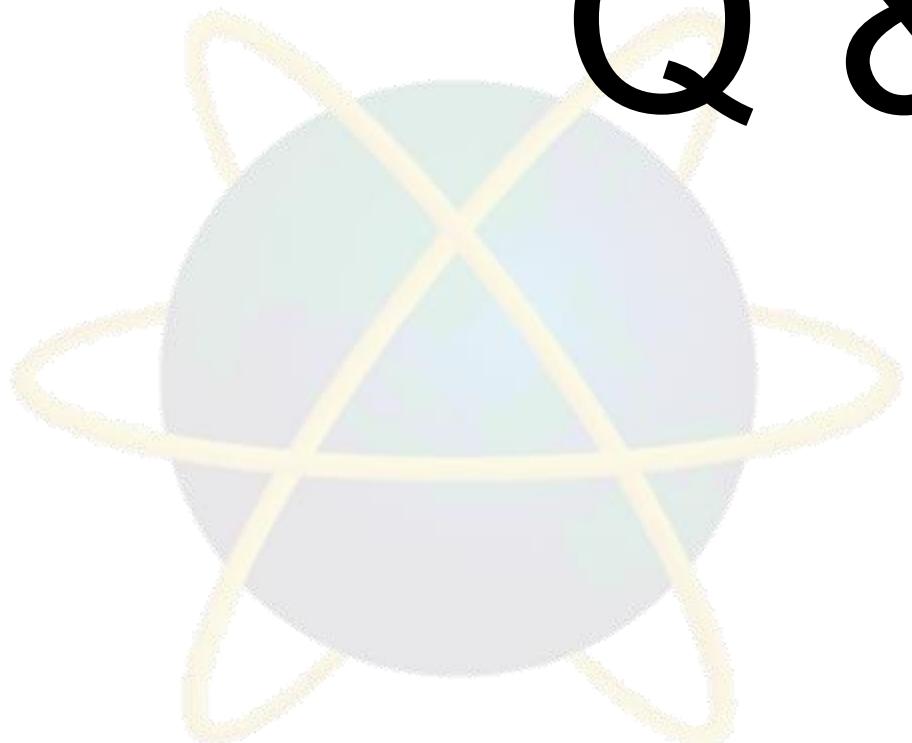
Flow Control

- The if-else Statement
 - Examples
- Nested if...else constructs.
 - Examples
 - The else if statement
 - Dangling else case (No parent, no child rule)
- Java's switch Statement
 - Using the break statement
 - Not using the break statement
 - The default clause

Question and Answer Session



Q & A



Next Session

- Iteration / Loop
 - The **while** Statement
 - The **for** Statement
 - The **do ... while** Statement
 - Reading Input In A Loop
 - The **break** statements in Loops

