DECISIONS: IF, IF-ELSE

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Computer can make decisions on its own, such as following:

- Checking username and password
- Displaying the letter grade based on the numerical value
- Automatically calculate tips based on the number of customers.
- ...
HOW DOES COMPUTER DECIDE?

- Computer can only carry out instructions that are absolutely clear.
- We construct statements that instructs computer—"If A is true, then do B."

such as the following:
- If user’s name and password matches, then access is granted.
- If the grade is greater than 93, then the student receives A in class.
- If there’s a party of four or more, then tips is automatically calculated.
**IF STATEMENTS**

if (A is true)  
    then (do B)

if (username & password match)  
    then (grant access)

if (grade > 93)  
    then (letter grade = A)

if (party# >= 4)  
    then (calculate tip)

**Syntax**

if (boolean condition)  
do something

**Example**

if (x == y)  
cout << “x and y is equal.”;
What do we use to test the conditions?

- Use comparison operators to compare values.
- Resulting condition will return **true** or **false** value.

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<td>==</td>
<td>Test for equality</td>
<td>x == y</td>
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<td>!=</td>
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<td>x != y</td>
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<td>&gt;</td>
<td>Greater than</td>
<td>x &gt; y</td>
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<td>&lt;</td>
<td>Less than</td>
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<td>&gt;=</td>
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<tr>
<td>&lt;=</td>
<td>Less than or equal to</td>
<td>x &lt;= y</td>
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Utilized when multiple statements (actions) need to be executed.

Multiple statements are enclosed (blocked) in a pair of curly braces.

Treated as a single statement by C++ compiler.

```cpp
if (boolean condition) {
    Do something1;
    Do something2;
    Do something3;
}
```

```cpp
if (x == y) {
    cout << "x and y are the same." << endl;
    cout << "x = y = " << x << endl;
}
```

Computer treats the whole block as single statement!
IF-ELSE

What if A is not true? What is the fallback option?

if (A is true)
    then (do B)
else
    then (do C)

Syntax

    if (boolean condition)
        do something
    else
        do something for all other conditions

Example

    if (x == y)
        cout << "x and y is equal."
    else
        cout << "x does not equal y.";
What if we want to test for a second condition — B is true?

if (A is true)
    then (do B)
else if (C is true)
    then (do D)

Syntax

if (boolean condition)
    do something
else if (boolean condition 2)
    do something

Example

if (x == y)
    cout << “x and y is equal.”;
else if (x > y)
    cout << “x is greater than y.”;
**IF-ELSE IF-ELSE**

**Syntax**

```plaintext
if (boolean condition)
do something
else if (boolean condition 2)
do something
else
do something for all other conditions
```

**NOTE:** all the nested statements may be compound statements, as long as statements are blocked in curly braces!

**Example**

```plaintext
if (x == y)
cout << “x and y is equal.”;
else if (x > y)
cout << “x is greater than y.”;
else
cout << “x is less than y.”;
```
### CHAINING STATEMENTS

- Multiple if statements may be chained by using if and else-if statements as follows:

```cpp
if (x % 5 == 0)
    cout << “x is divisible by 5.” << endl;
else if (x % 3 == 0)
    cout << “x is divisible by 5.” << endl;
else if (x % 2 == 0)
    cout << “x is divisible by 5.” << endl;
else
    cout << “x is not divisible by 2, 3 or 5.” << endl;
```
What if there’s more than one condition to test at once?

- Use logical operators – AND, OR, NOT
- Make sure there’s parentheses ( ) surrounding all the conditions!

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<td>&amp;&amp;</td>
<td>Test for BOTH conditions to be true</td>
<td>expr1 &amp;&amp; expr2</td>
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<td></td>
<td></td>
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<tr>
<td>!</td>
<td>Test for condition to be false</td>
<td>! expr</td>
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</table>
Example

if ( (x%5 == 0) && (x%2 == 0) )
    cout << "x is divisible by both 5 and 2." << endl;
else if ( (x%5 == 0) || (x%2 == 0) )
    cout << "x is divisible by either 5 and 2." << endl;
else if (! (x%5 == 0) )
    cout << "x is not divisible by 5" << endl;
NESTING STATEMENTS

- All statements can be used as part of if-else statements.
- Single if-else statement can also be nested another if or else if statement.
  ```java
  if (boolean_condition) {
    if (boolean condition)
      do something
    else
      do something else
  }
  ```
- Else if … else are also nested in the similar manner.