
Relational Operators and the If Statement

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Today

- We're going to start looking at Chapter 4:
Making Decisions

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Conditionals (4.1)

- So far, we can Input, Output and Calculate

- How can we explore relationships between
data?

- How can our program only do things
sometimes?

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Decisions!

- Relational Expressions allow our program to *make a decision*
 - based on the **data** in the program
- What are some decisions we might want our program to make?
- We will use:
 - Relational Expressions
 - Relational Operators

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Relational Expression

- An expression is a statement that _____
 - Relational expression: an expression that uses a Relational Operator
 - its value is a **Boolean value** (True or False)
- ```
int x = 9, y = 42;
x > y
y == x // y = x; is the assignment operator
x <= (x * y + 99)
```

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## Relational Operators

| Operator | Meaning                  |
|----------|--------------------------|
| >        | Greater than             |
| <        | Less than                |
| >=       | Greater than or equal to |
| <=       | Less than or equal to    |
| ==       | Equal to                 |
| !=       | Not equal to             |

- All are binary operators
- Left to right associativity

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## Precedence (page 1125)

| Precedence Operators (Highest to Lowest) |    |    |    |    |    |
|------------------------------------------|----|----|----|----|----|
| (unary negation) -                       |    |    |    |    |    |
| *                                        | /  | %  |    |    |    |
| +                                        |    | -  |    |    |    |
| >                                        | >= | <  | <= |    |    |
| ==                                       |    |    | != |    |    |
| =                                        | += | -= | *= | /= | %= |

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## Q.1. Practice

- What is the value of the following Relational Expressions?

```
int x = 99, y = 42;
```

```
x > y
```

```
y <= x
```

```
y != x
```

```
x == (x + 1)
```

```
y == y + 1
```

```
y == x - 45
```

Relational Operators work on Integers, Floating point numbers, and Characters.

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## Boolean value (True or False)

- How does the computer represent True and False?
- New data type: `bool`

```
bool tValue = true; // 1
```

```
bool fValue = false; // 0
```

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## Q.2. Practice

```
bool value;
int x = 5, y = 10;
value = x > y; // value = ??
value = x == y; // value = ??
value = x == y - 5; // value = ??

// what does this output look like?
cout << "Value is: " << value;
```

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## Q.3. Practice

- What C++ statement would we write to make the following determinations?

```
bool value;
int yourAge = 22, currentYear = 2008;
```

- Are you old enough to vote?
  - value = ????
- Were you born before 1980?
- Is your age evenly divisible by 7?

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## The `if` Statement (4.2)

- We execute each statement in our program in order.
- What `if` we only want to execute a statement sometimes?
- The `if` Statement!

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## The if Statement

```
int x = 5, y = 10;

if(x > y)
{
 cout << x << ">" << y << endl;
}
```

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## Formally defined

```
if(expression)
{
 statement 1;
 statement 2;
 . . .
 statement n;
}
```

Just like a **function**, start at the top and execute in order to the bottom

- What is an expression?

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## Q.4. What is the output?

```
int x = 5, y = 10;
bool value = x > y;

if(value)
{
 cout << "value is True" << endl;
}
if(x < y)
{
 cout << x << " < " << y;
 cout << " is true" << endl;
}
```

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## Q.5. Practice

- For the problem below:
  - what data will you need?
  - what will you need to do conditionally?
    - what data will you use in your decision?
- Calculate the average grade for all three exams in a course. Print a message showing the letter grade the student received and a message stating if the student passed the course.

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## Coding Standards

```
If(expression)
{
 statement 1;
}
```

If you only have ONE statement in the body of the if, the {} are optional in C++.

➔ For this class, the {} must **ALWAYS** be used. Not using {} will result in a loss of style points.

```
If(expression)
 statement 1;
```

The {} must also be on their own line.

Why?

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## More on Truth

- Expressions that evaluate to non-zero are considered **true**

```
int x = 5, y = 0;
if(x + y)
{ // This will be executed
 cout << "x + y is True" << endl;
}
if(y)
{ // This will NOT be executed
 cout << "y is True" << endl;
}
```

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## Q.6. Practice

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- Write the C++ code for the following problem
- Calculate the average grade for all three exams in a course. Print a message showing the letter grade the student received and a message stating if the student passed the course.

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