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## Relational Operators and the If Statement

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### Conditionals

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- So far, we can Input, Output and Calculate
  
- How can we explore relationships between data?
  
- How can our program only do certain things *sometimes*?

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### Decisions!

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- 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?

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## Relational Expression

- Relational expression: an expression that uses a **Relational Operator**
  - Relational expressions produce a value that is a **Boolean value** (True or False)

```
int height = 32;
int minHeight = 34;
bool bVal;

bVal = height > minHeight;
bVal = height == minHeight;
bVal = height >= (minHeight - 2);
```

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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 operators are binary
- Each operator is left associative. What does this mean again?

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## Operator Precedence (highest to lowest)

|                                       |           |                   |
|---------------------------------------|-----------|-------------------|
| Unary plus & minus                    | + -       | Left associative  |
| Multiplication, division, and modulus | * / %     | Left associative  |
| Addition & subtraction                | + -       | Left associative  |
| Relational operators                  | < <= > >= | Left associative  |
| Relational operators                  | == !=     | Left associative  |
| Assignment                            | =         | Right associative |
|                                       |           |                   |
|                                       |           |                   |
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## const Declarations

- Constant declaration

```
const double PI = 3.14;
```

```
const double RADIUS = 5.4;
```

- Constant declarations are fixed and cannot be changed
- By convention, constants are always UPPERCASE

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## Practice

- What is the value of the following Relational Expressions?

```
int width = 99;
const int HEIGHT = 42;
bool bVal;

bVal = width > HEIGHT;
bVal = -width <= HEIGHT;
bVal = width != HEIGHT;
bVal = width == (width + 1);
bVal = width == width + 1;
```

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

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## The if Statement

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

- The if Statement!
- Single-alternative if

```
if ( condition )
{
    //statements
}
```

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### Practice: What is the output?

```
int age;
const int VOTING_AGE = 18;

cin >> age;

if ( age >= VOTING_AGE )
{
    cout << age << " > " << VOTING_AGE;
    cout << " You can vote!" << endl;
}
```

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### Practice

Write a C++ program segment that allows the user the ability to enter 3 exam scores one at a time. If the average exam score is higher than 60, output "You Passed"; otherwise output "You failed". Sum the scores as they are entered.

1. What variables (including their types) are needed in this program segment?

Hint: If the variable count contains the value 0, what is the value of count after executing the statement count = count + 1;

2. What do you need to do conditionally?

3. What data is necessary to use in the condition?

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### Example

- Your local bookstore has asked you to write a program to help them determine the cost of shipping of customer orders. If the order is \$30 or less then shipping will cost \$5, if the order is over \$30 then shipping will be \$3.
- Write the program to solve this problem

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## Problem

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- The bookstore has now changed it's shipping policy so that
  - If the order is \$30 or less, shipping is \$5
  - If the order is over \$30 but less than \$50, shipping is \$3
  - If the order is \$50 or more then shipping is \$2
  
- What would we need to change in the program?

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