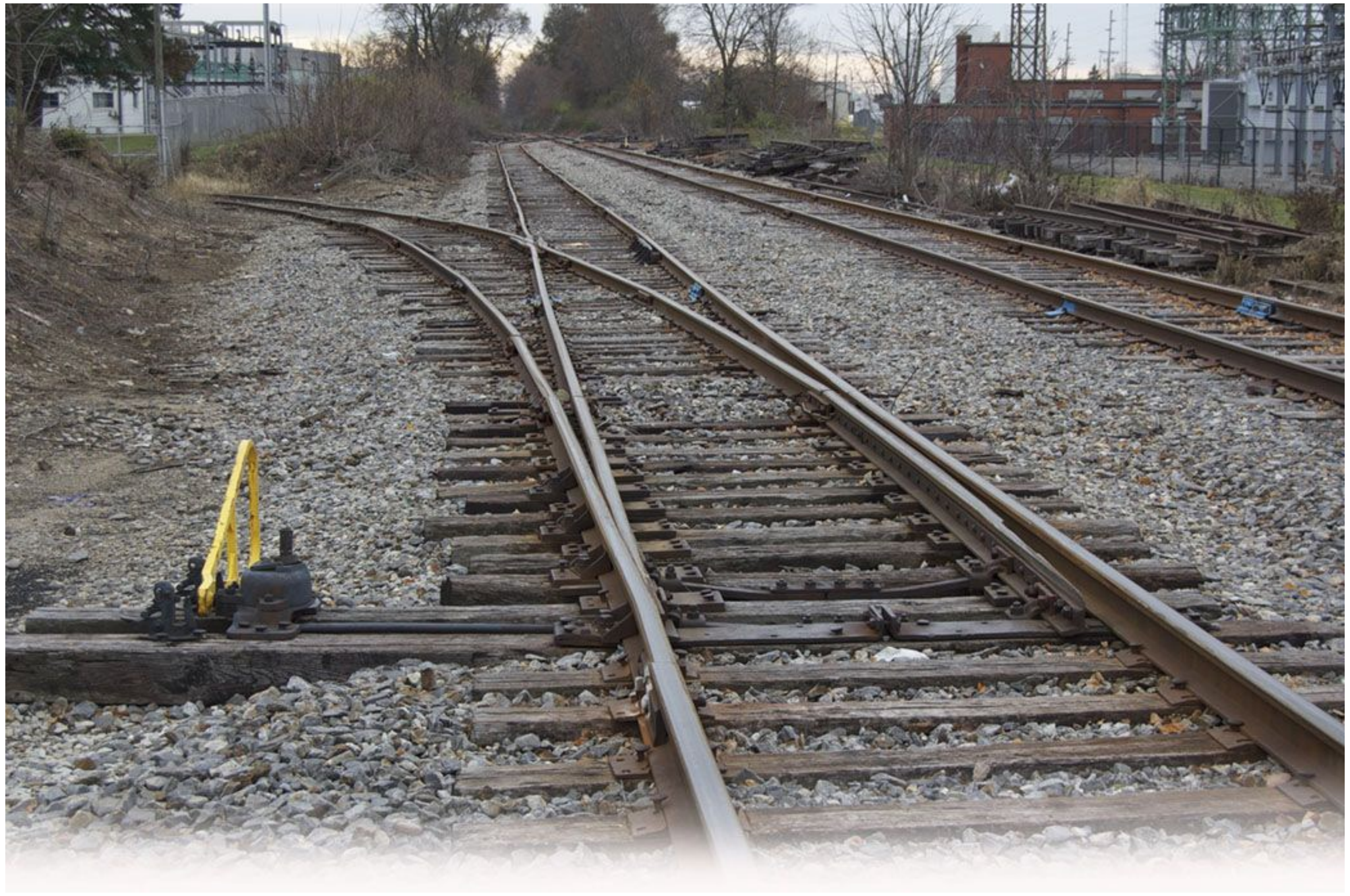
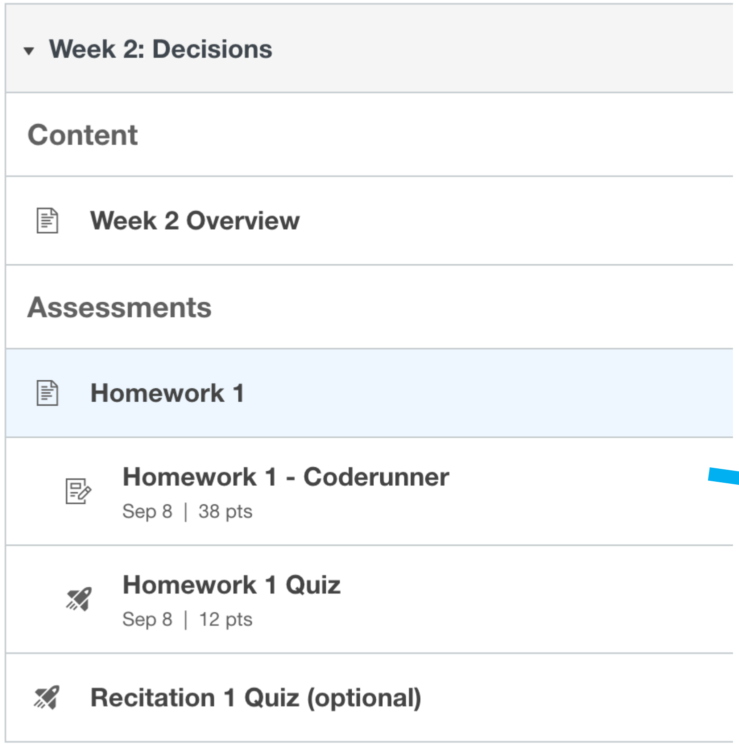


Decisions

Due this week

- **Homework 1**
  - Write solutions in VS Code
  - Paste in Autograder, **Homework 1 CodeRunner**.
  - Complete the quiz
- Check the due date! **No late submissions!!**

Homework 1 - CodeRunner



▾ Week 2: Decisions

Content

Week 2 Overview

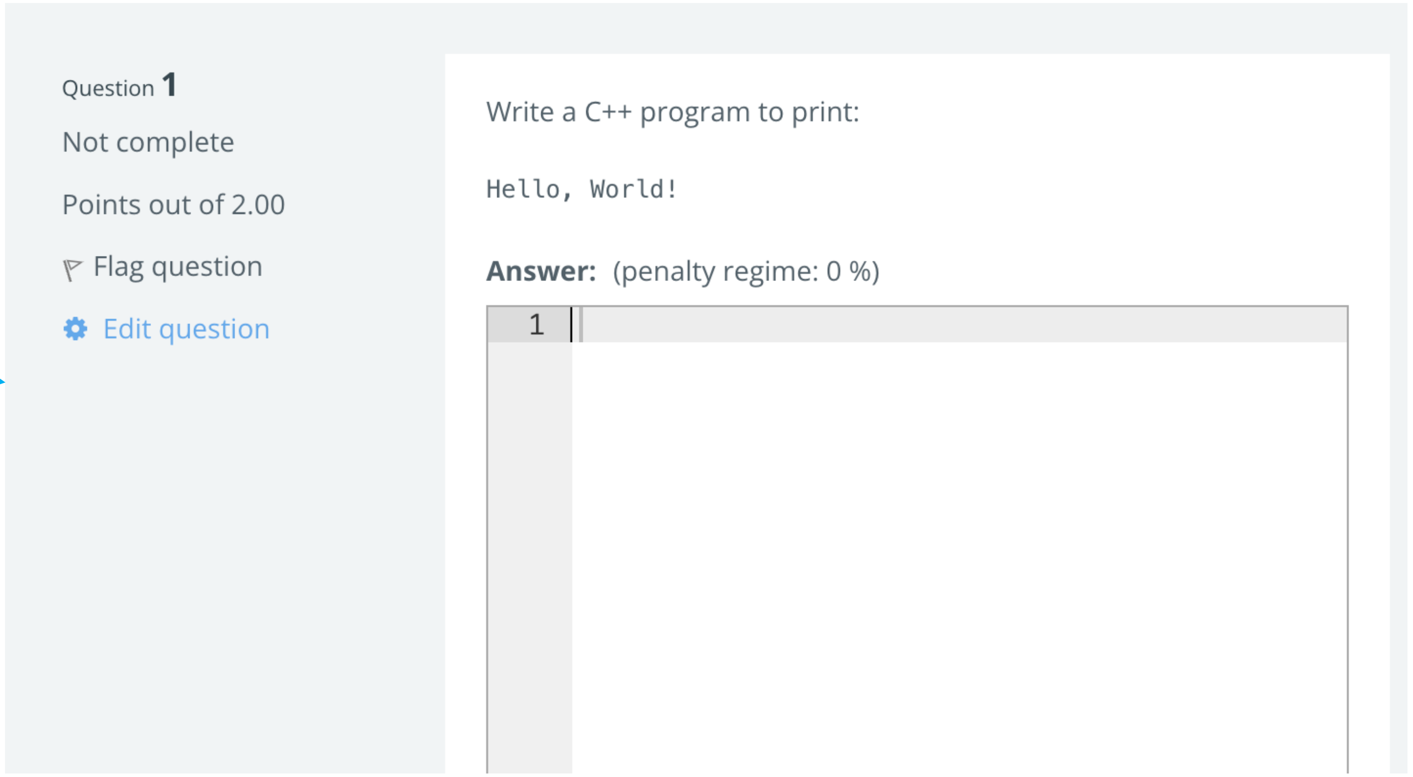
Assessments

Homework 1

Homework 1 - Coderunner
Sep 8 | 38 pts

Homework 1 Quiz
Sep 8 | 12 pts

Recitation 1 Quiz (optional)



Question 1
Not complete
Points out of 2.00
Flag question
Edit question

Write a C++ program to print:

```
Hello, World!
```

Answer: (penalty regime: 0 %)

Today

- Boolean variables
- Relational operators
- Logical Operators
- The `if` statement

Boolean Variables & Operators

Boolean Variables and Operators

- Sometimes you need to evaluate a logical condition in one part of a program and use it elsewhere.
- To store a condition that can be **`true`** or **`false`**, you use a Boolean variable
- Variables of type **`bool`** can hold exactly two values, **`false`** or **`true`**.
    - **not** strings.
    - **not** integers; they are special values, just for Boolean variables.

- BUT actually zero is **false**, and any non-zero value is treated as **true**.

Relational Operators

C++	Math Notation	Description
>	>	Greater than
>=	≥	Greater than or equal
<	<	Less than
<=	≤	Less than or equal
==	=	Equal
!=	≠	Not equal

Boolean Variables

- Here is a declaration of a Boolean variable, initialized to false:

```
bool failed = false;
```

- Here's another example:

```
// If the value of x is negative, set the boolean variable to True
bool is_negative = x < 0;
```

Boolean Variables - `cout`

- Boolean variables that hold the value True, print the value 1 when displayed to the console via cout
- Boolean variables that hold the value False, print the value 0 when displayed to the console via cout
- Here's an example:

```
int x = -3;
bool is_negative = (x < 0);
bool is_positive = (x > 0);
cout << is_negative << " " << is_positive << endl;
```

Output: `1 0`

Expression	Value	Comment
3 <= 4	true	3 is less than 4; <= tests for "less than or equal".
3 =< 4	Error	The "less than or equal" operator is <=, not =<. The "less than" symbol comes first.
3 > 4	false	> is the opposite of <=.
4 < 4	false	The left-hand side of < must be strictly smaller than the right-hand side.
4 <= 4	true	Both sides are equal; <= tests for "less than or equal".

Relational Operators – Some Notes

- The == operator is initially confusing to beginners.
- In C++, = already has a meaning, namely assignment
- The == operator denotes equality testing:

```
floor = 13; // Assign the value 13 to floor
floor == 13; // Check whether value of floor equals 13
```

- You can compare strings as well:

```
         if (input == "Quit") ...
```

Confusing = and ==

- In C++, assignments have values.
- The value of the assignment expression `floor = 13` is 13.
- These two features conspire to make a horrible pitfall:

```
if (floor = 13) …
```

- is legal C++.

- The code sets floor to 13, and since that value is not zero, the condition of the if statement is always true.

SO… Use only == inside tests/conditions.
Use = outside tests/conditions.

Expression	Value	Comment
3 == 5-2	true	== tests for equality.
3 != 5-1	true	!= tests for inequality. It is true that 3 is not 5 – 1.
3 = 6 / 2	Error	Use == to test for equality.
1.0 / 3.0 == 0.333333333	false	Although the values are very close to one another, they are not exactly equal. See Common Error 3.3.
"10" > 5	Error	You cannot compare a string to a number.

The if statement

Syntax of the `if()` Statement

```
if (condition)//never put a semicolon after the parentheses!!
{
  statement1; //executed if condition is true
}
else  //the else part is optional
{
  statement2; //executed if condition false
} //braces are optional but recommended
```

Common Error – The Do-nothing Statement

- This is *not* a compiler error.
- The compiler does not complain.
- It interprets this **`if`** statement as follows:
  - If floor is greater than 13, execute the do-nothing statement (semicolon by itself is the do-nothing statement)
  - Then execute the code enclosed in the braces.
- Any statements enclosed in the braces are no longer a part of the if statement.

```
if (floor > 13); // ERROR?
{
   floor = floor - 1;
}
```

The `if` Statement: Elevator Example

We must write the code to control the elevator.

How can we skip the 13th floor?

`if()` Elevator Example Code

- If the user inputs 20, the program must set the actual floor to 19.
- Otherwise, we simply use the supplied floor number.

We need to decrement the input only under a certain condition:

`if()` Elevator Example Code

```
int floor;
cout << “Enter the desired floor: “;
cin >> floor;
int actual_floor;
if (floor > 13)   //never put a semicolon after the parentheses!!
{
   actual_floor = floor - 1; //
}
else
{
   actual_floor = floor;
}
```

Is the **else** part necessary?

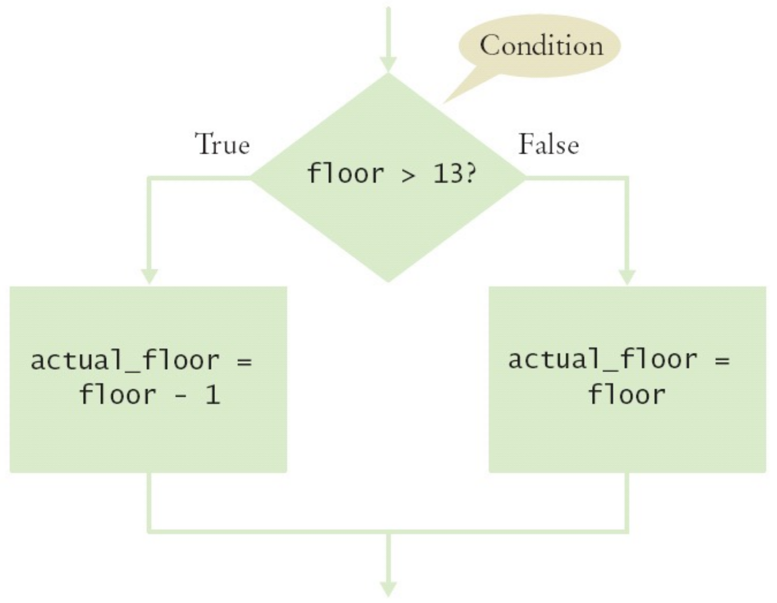
`if()` Elevator Example without `else`

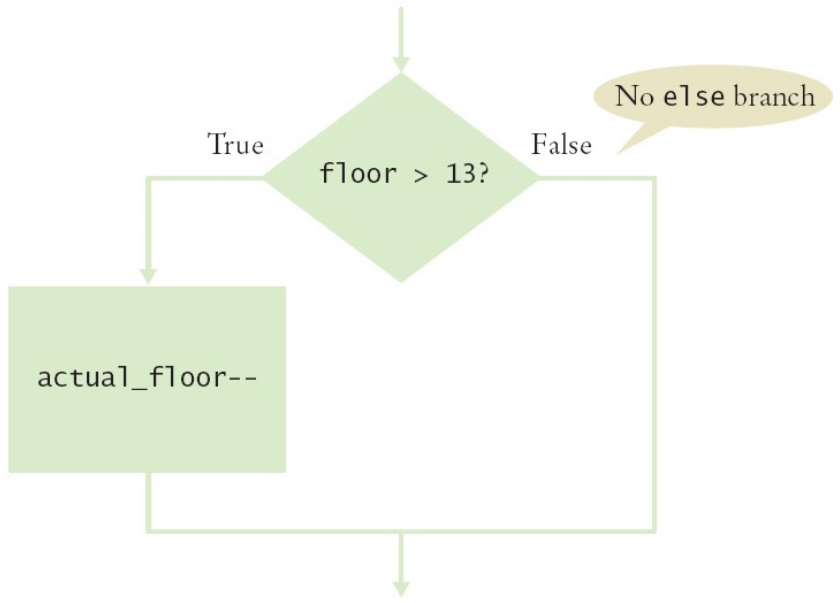
Here is another way to write this code:
We only need to decrement when the floor is greater than 13.

We can set **actual_floor** before testing:

```
int actual_floor = floor;
if (floor > 13)
{
    actual_floor = floor - 1;
} // No else needed
```

The `if` Statement Flowcharts





With else

Without else

The `if` Statement – Always use Braces

- When the body of an **`if`** statement consists of a single statement, you need not use braces:

```
if (floor > 13)
   floor = floor - 1;
```

- However, it is a good idea to always include the braces:
  - the braces makes your code easier to read, and
  - you are less likely to make errors

The `if` Statement – Brace Layout

- Making your code easy to read is good practice.
- Lining up braces vertically helps.

```
if (floor > 13)
{
   floor--;
}
```