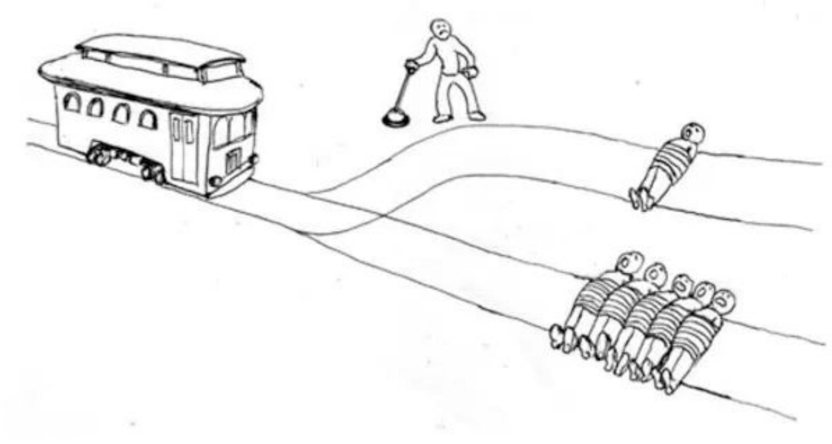

Conditionals

Motivation

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So far our code is BORING

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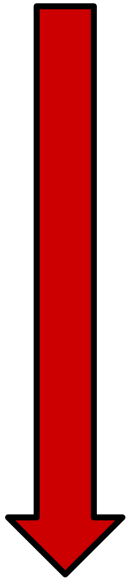
Execution (so far)



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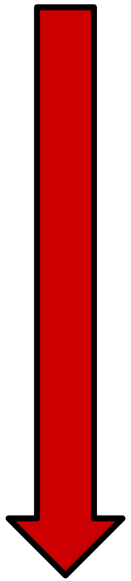
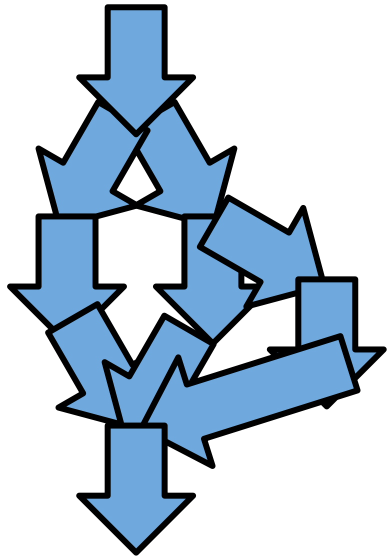


Execution (aspirational)



Computational thinking

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Computational thinking

Some classes at GV have many sections (like this class!)

Think of an algorithm to choose which section to sign up for!

If section is at 8am -> nope!
If section is taught by the worst prof -> nope!
If section conflicts with another class you want -> nope!

etc!

Branching code

We can make our code do different things based on yes/no questions

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We can have branching execution, not just top-down!

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So far we’ve talked about variables, functions,
	ints, floats, strings, etc.

MANY things in CS are named poorly or named
	after someone

We need to talk about **boolean** variables
	Named after George Boole

Booleans

We’re going to be asking yes/no questions

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However, we’ll refer to True (yes) or False (no)

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However, we’ll refer to True (yes) or False (no)

These are booleans (bools)!

Which of the following are true?

7 < 12

6 > 90

7 * 2 = 14

60 <= 200

Which of the following are true?

7 < 12 True

6 > 90 False

7 * 2 = 14 True

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Which of the following are true?

7 < 12 True

6 > 90 False

7 * 2 = 14 True

60 <= 200 True

Basic boolean expressions are just like what you’ve seen in math classes!

If statements

If statements allow us to start branching our code!

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Syntax:

If statements

If statements allow us to start branching our code!

Syntax:

```
if expression:
   # do stuff if True!
   …
```

Example: warn user if input integer is negative

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```
user_val = int(input())
```

Example: warn user if input integer is negative

```
user_val = int(input())
if ???:
   ???
```

Example: warn user if input integer is negative

```
user_val = int(input())
if user_val < 0:
    ???
```

Example: warn user if input integer is negative

```
user_val = int(input())
if user_val < 0:
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What is printed when user_val is -5?

What is printed when user_val is 5?

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What is printed when user_val is -5? The warning, then -5

What is printed when user_val is 5?

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```

What is printed when user_val is -5? The warning, then -5

What is printed when user_val is 5? 5

What if we want one or the other?

What if we want one or the other?

If (expresion) is true do A, *otherwise* do B

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If (expresion) is true do A, *otherwise* do B -> use <u>else</u>!

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What is printed when user_val is -5? The warning, -5

What is printed when user_val is 5? The confirmation, 5

What if we want more than two options?

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`elif`

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`elif` - short for “else if”

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```
if expression_A:
   # Code that only runs if A is True
elif expression_B:
   # Code that only runs if A is False and B is True
else:
   # Code that only runs if A and B are both False
```

What if we want more than two options?

`elif` - short for “else if”

Only one option will execute!

```
if expression_A:
    # Code that only runs if A is True
elif expression_B:
    # Code that only runs if A is False and B is True
else:
    # Code that only runs if A and B are both False
```

Work through some examples of what this code is doing

```
temp = float(input())
if temp < -460:
   print(“Impossible!”)
elif temp < 32:
   print(“Solid”)
elif temp < 212:
   print(“Liquid”)
else:
   print(“Gas”)
```

Comparison operators

There are many ways to compare two values!
All these expressions will evaluate to True or False

For numbers:

- a < b : Less than
- a <= b : Less than or equal to
- a > b: Greater than
- a >= b: Greater than or equal to
- a == b: Equal to
- a != b: Not equal to

A note on floats

Floats are weird

Try not to ask if a float == another float

Either use `math.isclose()`

Or use some epsilon

```
if abs(x - 0.3) < 0.001:
    # Do stuff
```

Comparison operators

For strings:

- a == b: Equal to
- a != b: Not equal to
- a < b, a > b, a <= b, a >= b: Comparing lexicographically
  - a < b implies a would come before b in the dictionary
    - (extended for numbers and symbols)
- a in b: True if a is a substring of b
  - E.g., “the” in “get these out of here” evaluates to true

Boolean operations

Imagine we want to bring an umbrella if

it’s cloudy AND there’s a >25% chance of rain

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A and B is only true if both A and B are true!

Boolean operations

Imagine we want to bring an umbrella if

it’s cloudy AND there’s a >25% chance of rain

We often do this in code. We want to *combine* two boolean statements

A and B is only true if both A and B are true!

```
if is_cloudy == True and rain_chance > 0.25:
    bring_umbrella()
```

Boolean operations

A and B is True if **both** are True!

Value of `A`	Value of `B`	Value of `A and B`
False	False	

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Boolean operations

A <u>or</u> B is True if **either** is True!

Value of `A`	Value of `B`	Value of `A or B`
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False	False	False
False	True	True
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Boolean operations

A or B is True if **either** is True!

Value of `A`	Value of `B`	Value of `A or B`
False	False	False
False	True	True
True	False	True
True	True	True

Boolean operations

not A just flips the boolean!

Value of `A`	Value of `not A`
False	True
True	False

Order of operations

not comes before and, and comes before or

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When in doubt, just use parentheses!

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```
class_is_fine = (prof_is_cool and class_is_hard) or class_is_easy
```

Order of operations

not comes before and, and comes before or

When in doubt, just use parentheses!

```
class_is_fine = (prof_is_cool and class_is_hard) or class_is_easy
```

All comparisons (==, <, in, etc.) come before not/and/or

https://docs.python.org/3/reference/expressions.html