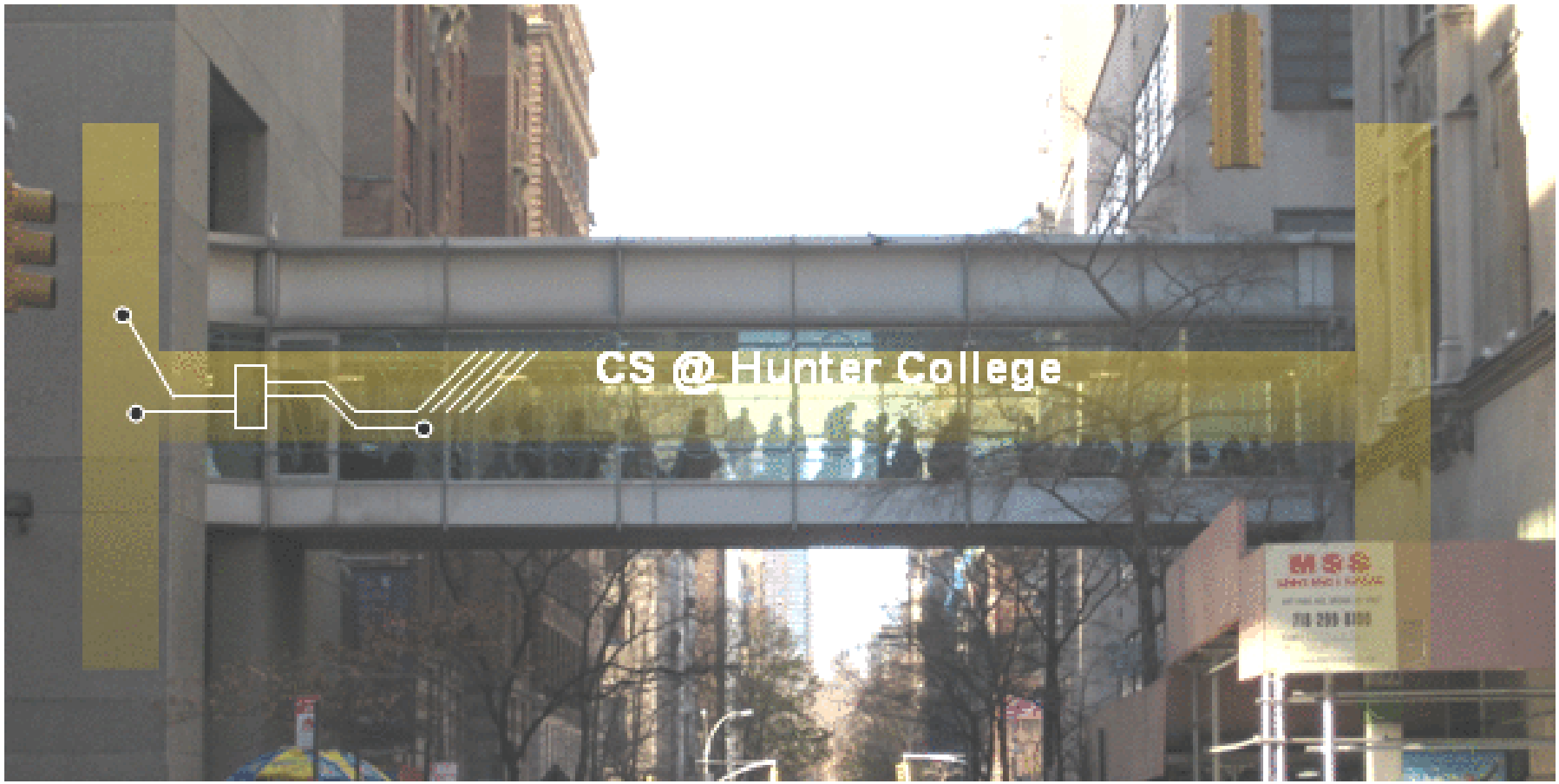
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

‘

Frequently Asked Questions

From email

Frequently Asked Questions

From email

- **What is pseudocode? Why do we use it?**

Frequently Asked Questions

From email

- **What is pseudocode? Why do we use it?**
  Pseudocode is the "informal high-level description of the operating principle of a computer program or other algorithm."

Frequently Asked Questions

From email

- **What is pseudocode? Why do we use it?**
  Pseudocode is the "informal high-level description of the operating principle of a computer program or other algorithm."
  We use it to write down the ideas, before getting deep into the details.

Frequently Asked Questions

From email

- **What is pseudocode? Why do we use it?**
  Pseudocode is the "informal high-level description of the operating principle of a computer program or other algorithm."
  We use it to write down the ideas, before getting deep into the details.
- **What are types of variables?**

Frequently Asked Questions

From email

- **What is pseudocode? Why do we use it?**
  Pseudocode is the "informal high-level description of the operating principle of a computer program or other algorithm."
  We use it to write down the ideas, before getting deep into the details.
- **What are types of variables?**
  Different kinds of information takes different amounts of space.
  Types we have seen so far: `int`, `float`, `str` *and objects (e.g. turtles).*

Frequently Asked Questions

From email

- **What is pseudocode? Why do we use it?**
  Pseudocode is the "informal high-level description of the operating principle of a computer program or other algorithm."
  We use it to write down the ideas, before getting deep into the details.
- **What are types of variables?**
  Different kinds of information takes different amounts of space.
  Types we have seen so far: `int`, `float`, `str` *and objects (e.g. turtles).*
- **How can I tell strings from variables?**

Frequently Asked Questions

From email

- **What is pseudocode? Why do we use it?**
  Pseudocode is the "informal high-level description of the operating principle of a computer program or other algorithm."
  We use it to write down the ideas, before getting deep into the details.
- **What are types of variables?**
  Different kinds of information takes different amounts of space.
  Types we have seen so far: `int`, `float`, `str` *and objects (e.g. turtles).*
- **How can I tell strings from variables?**
  Strings are surrounded by quotes (either single or double).

Frequently Asked Questions

From email

- **What is pseudocode? Why do we use it?**
  Pseudocode is the "informal high-level description of the operating principle of a computer program or other algorithm."
  We use it to write down the ideas, before getting deep into the details.
- **What are types of variables?**
  Different kinds of information takes different amounts of space.
  Types we have seen so far: `int`, `float`, `str` *and objects (e.g. turtles).*
- **How can I tell strings from variables?**
  Strings are surrounded by quotes (either single or double).
  Variables names (identifiers) for memory locations are not.

Frequently Asked Questions

From email

- **What is pseudocode? Why do we use it?**
  Pseudocode is the "informal high-level description of the operating principle of a computer program or other algorithm."
  We use it to write down the ideas, before getting deep into the details.
- **What are types of variables?**
  Different kinds of information takes different amounts of space.
  Types we have seen so far: `int`, `float`, `str` *and objects (e.g. turtles).*
- **How can I tell strings from variables?**
  Strings are surrounded by quotes (either single or double).
  Variables names (identifiers) for memory locations are not. Ex: `'num'` *vs.* `num`.

Today's Topics

- Recap: Decisions
- Logical Expressions
- Circuits
- Binary Numbers

Today's Topics

- **Recap: Decisions**
- Logical Expressions
- Circuits
- Binary Numbers

Challenge

Some challenges with types & decisions:

```
#What are the types:
y1 = 2017
y2 = "2018"
print(type(y1))
print(type("y1"))
print(type(2017))
print(type("2017"))
print(type(y2))
print(type(y1/4.0))

x = int(y2) - y1
if x < 0:
    print(y2)
else:
    print(y1)
```

```
cents = 432
dollars = cents // 100
change = cents % 100
if dollars > 0:
    print('$'+str(dollars))
if change > 0:
    quarters = change // 25
    pennies = change % 25
    print(quarters, "quarters")
    print("and", pennies, "pennies")
```

Python Tutor

```
#What are the types:
y1 = 2017
y2 = "2018"
print(type(y1))
print(type("y1"))
print(type(2017))
print(type("2017"))
print(type(y2))
print(type(y1/4.0))

x = int(y2) - y1
if x < 0:
    print(y2)
else:
    print(y1)
```

(Demo with pythonTutor)

Decisions

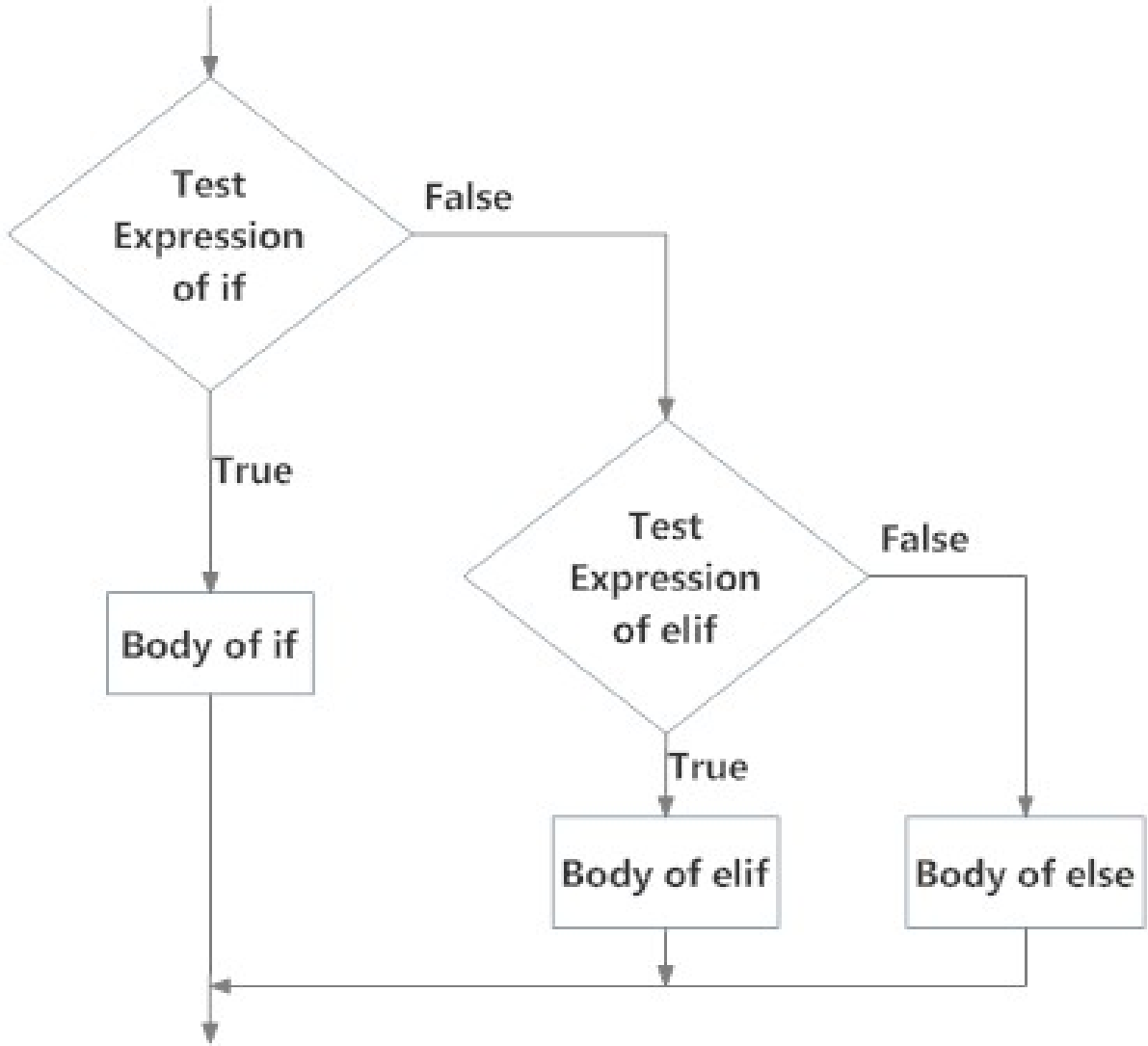
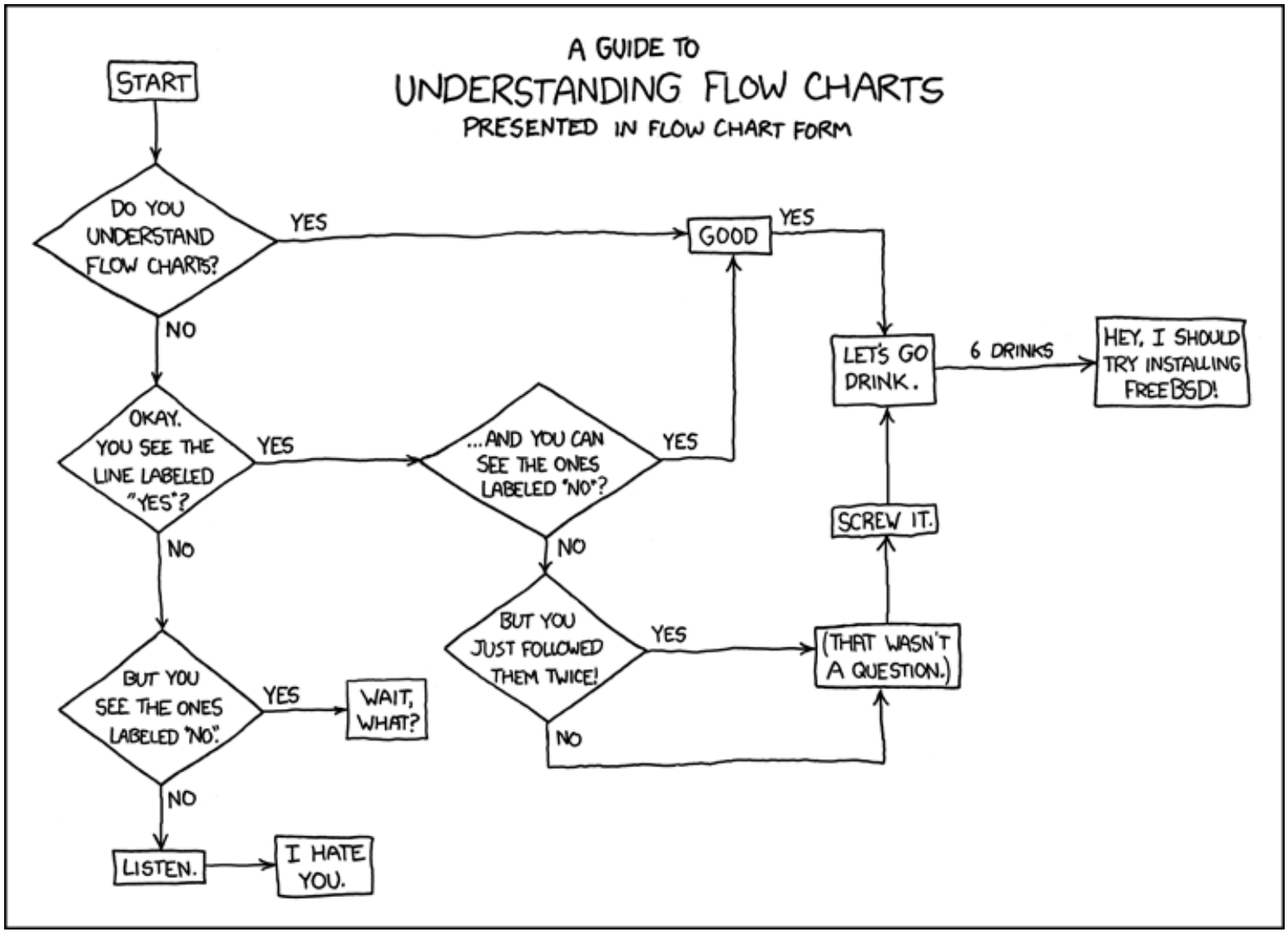


Fig: Operation of if...elif...else statement

(programiz)

Side Note: Reading Flow Charts



(xkcd/518)

Today's Topics

- Recap: Decisions
- **Logical Expressions**
- Circuits
- Binary Numbers

Challenge

Predict what the code will do:

```
origin = "Indian Ocean"
winds = 100
if (winds > 74):
    print("Major storm, called a ", end="")
    if origin == "Indian Ocean" or origin == "South Pacific":
        print("cyclone.")
    elif origin == "North Pacific":
        print("typhoon.")
    else:
        print("hurricane.")

visibility = 0.2
winds = 40
conditions = "blowing snow"
if (winds > 35) and (visibility < 0.25) and \
      (conditions == "blowing snow" or conditions == "heavy snow"):
    print("Blizzard!")
```

Python Tutor

```
origin = "Indian Ocean"
winds = 100
if (winds > 74):
    print("Major storm, called a ", end="")
    if origin == "Indian Ocean" or origin == "South Pacific":
        print("cyclone.")
    elif origin == "North Pacific":
        print("typhoon.")
    else:
        print("hurricane.")

visibility = 0.2
winds = 40
conditions = "blowing snow"
if (winds > 35) and (visibility < 0.25) and \
     (conditions == "blowing snow" or conditions == "heavy snow"):
    print("Blizzard!")
```

(Demo with `pythonTutor`)

Logical Operators

and

in1		in2	*returns:*
`False`	`and`	`False`	`False`
`False`	`and`	`True`	`False`
`True`	`and`	`False`	`False`
`True`	`and`	`True`	`True`

Logical Operators

and

in1		in2	*returns:*
`False`	`and`	`False`	`False`
`False`	`and`	`True`	`False`
`True`	`and`	`False`	`False`
`True`	`and`	`True`	`True`

or

in1		in2	*returns:*
`False`	`or`	`False`	`False`
`False`	`or`	`True`	`True`
`True`	`or`	`False`	`True`
`True`	`or`	`True`	`True`

Logical Operators

and

in1		in2	*returns:*
`False`	`and`	`False`	`False`
`False`	`and`	`True`	`False`
`True`	`and`	`False`	`False`
`True`	`and`	`True`	`True`

or

in1		in2	*returns:*
`False`	`or`	`False`	`False`
`False`	`or`	`True`	`True`
`True`	`or`	`False`	`True`
`True`	`or`	`True`	`True`

not

	in1	*returns:*
`not`	`False`	`True`
`not`	`True`	`False`

Challenge

Predict what the code will do:

```
semHours = 18
reqHours = 120
if semHours >= 12:
     print('Full Time')
else:
     print('Part Time')

pace = reqHours // semHours
if reqHours % semHours != 0:
     pace = pace + 1
print('At this pace, you will graduate in', pace, 'semesters,')
yrs = pace / 2
print('(or', yrs, 'years).')


for i in range(1,20):
     if (i > 10) and (i % 2 == 1):
          print('oddly large')
     else:
          print(i)
```

Python Tutor

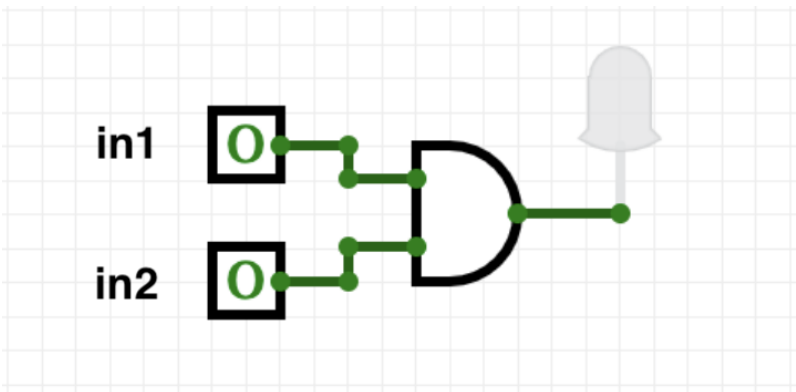
```
semHours = 18
reqHours = 120
if semHours >= 12:
     print('Full Time')
else:
     print('Part Time')

pace = reqHours // semHours
if reqHours % semHours != 0:
     pace = pace + 1
print('At this pace, you will graduate in', pace, 'semesters,')
yrs = pace / 2
print('(or', yrs, 'years).')


for i in range(1,20):
     if (i > 10) and (i % 2 == 1):
          print('oddly large')
     else:
          print(i)
```

(Demo with pythonTutor)

Today's Topics

- Recap: Decisions
- Logical Expressions
- **Circuits**
- Binary Numbers

Circuit Demo

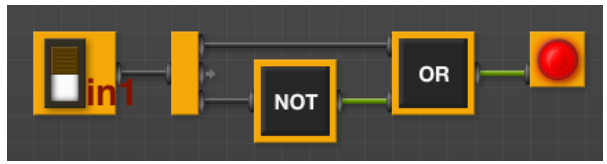


(Demo with `circuitverse`)

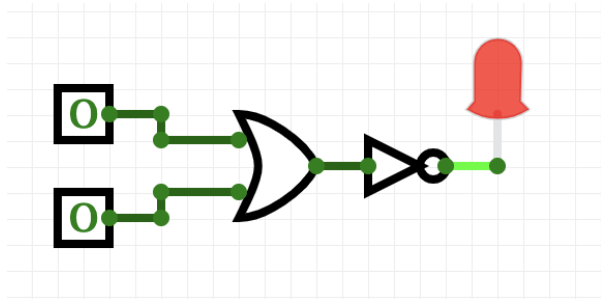
Challenge

Predict when these expressions are true:

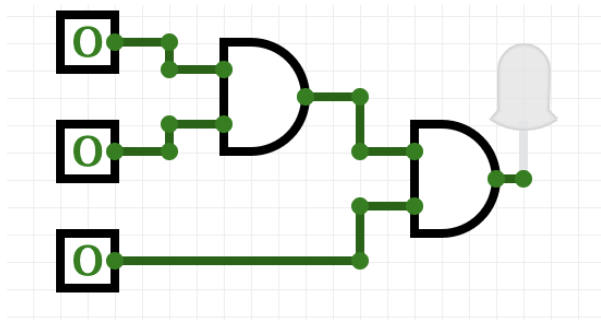
- `in1 or not in1`:



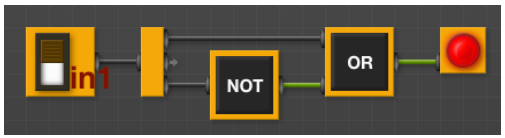
- `not(in1 or in2)`:

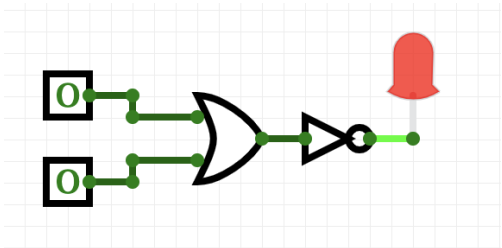


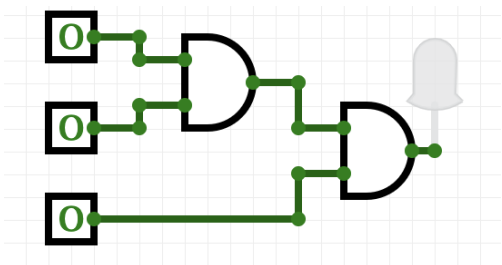
- `(in1 and in2) and in3`:



Circuit Demo

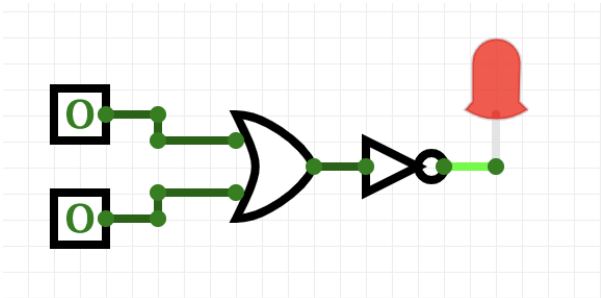






(Demo with `circuitverse`)

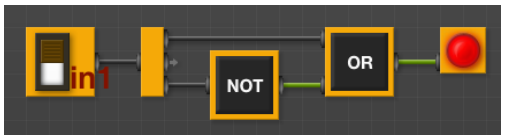
Challenge

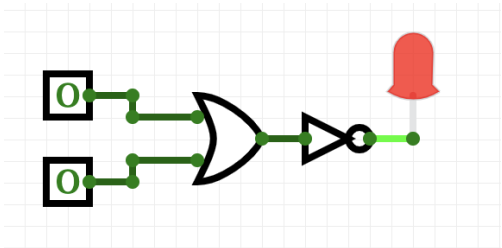


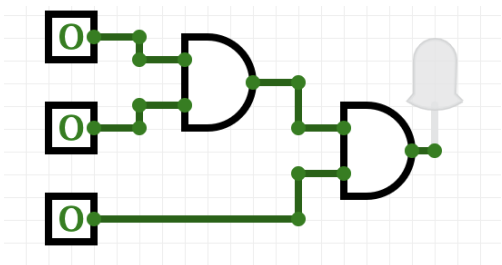
Draw a circuit that corresponds to each logical expression:

- `in1 or in2`
- `(in1 or in2) and (in1 or in3)`
- `(not(in1 and not in2)) or (in1 and (in2 and in3))`

Circuit Demo







(Demo with `circuitverse`)

Today's Topics

- Recap: Decisions
- Logical Expressions
- Circuits
- **Binary Numbers**

Binary Numbers

- Logic $\rightarrow$ Circuits $\rightarrow$ Numbers

Binary Numbers

- Logic $\rightarrow$ Circuits $\rightarrow$ Numbers
- Digital logic design allows for two states:

Binary Numbers

- Logic $\rightarrow$ Circuits $\rightarrow$ Numbers
- Digital logic design allows for two states:
  - True / False

Binary Numbers

- Logic $\rightarrow$ Circuits $\rightarrow$ Numbers
- Digital logic design allows for two states:
  - True / False
  - On / Off (two voltage levels)

Binary Numbers

- Logic $\rightarrow$ Circuits $\rightarrow$ Numbers
- Digital logic design allows for two states:
  - True / False
  - On / Off (two voltage levels)
  - 1 / 0

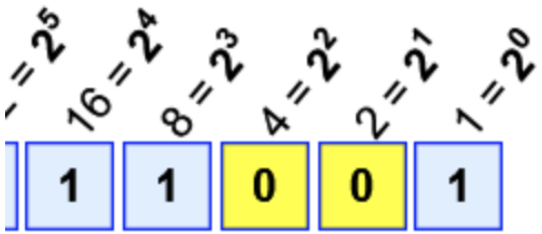
Binary Numbers

- Logic $\rightarrow$ Circuits $\rightarrow$ Numbers
- Digital logic design allows for two states:
  - True / False
  - On / Off (two voltage levels)
  - 1 / 0
- Computers store numbers using the Binary system (base 2)

Binary Numbers

- Logic $\rightarrow$ Circuits $\rightarrow$ Numbers
- Digital logic design allows for two states:
  - True / False
  - On / Off (two voltage levels)
  - 1 / 0
- Computers store numbers using the Binary system (base 2)
- A **bit** (binary digit) being 1 (on) or 0 (off)

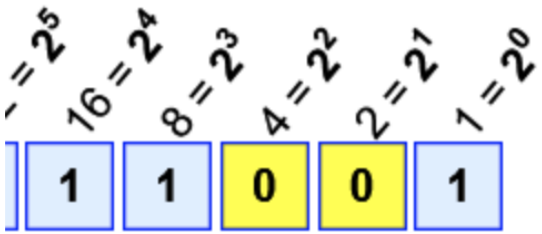
Binary Numbers



Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Two digits: **0** and **1**

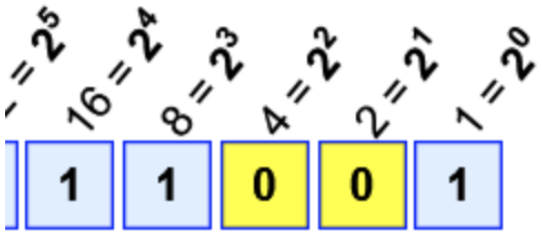
Binary Numbers



Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Two digits: **0** and **1**
- Each position is a power of two

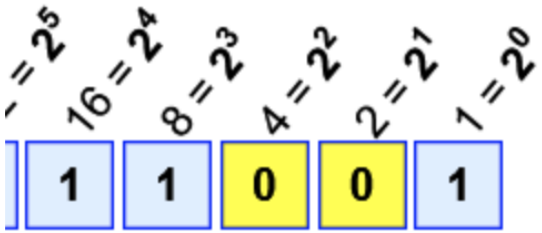
Binary Numbers



Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Two digits: **0** and **1**
- Each position is a power of two
  - Decimal: the "ones", "tens", "hundreds" and so on (powers of 10)

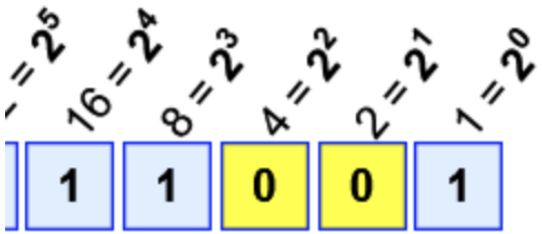
Binary Numbers



Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Two digits: **0** and **1**
- Each position is a power of two
  - Decimal: the "ones", "tens", "hundreds" and so on (powers of 10)
  - Binary: the "ones", "twos", "fours", "sixteens" and so on (powers of 2)

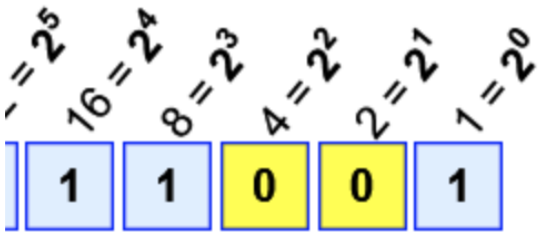
Binary Numbers



Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Two digits: **0** and **1**
- Each position is a power of two
  - Decimal: the "ones", "tens", "hundreds" and so on (powers of 10)
  - Binary: the "ones", "twos", "fours", "sixteens" and so on (powers of 2)
- In each position the digit is either 0 or 1, so given a binary number we can obtain the decimal equivalent as follows:

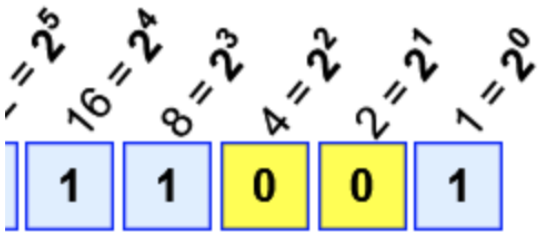
Binary Numbers



Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Two digits: **0** and **1**
- Each position is a power of two
  - Decimal: the "ones", "tens", "hundreds" and so on (powers of 10)
  - Binary: the "ones", "twos", "fours", "sixteens" and so on (powers of 2)
- In each position the digit is either 0 or 1, so given a binary number we can obtain the decimal equivalent as follows:
  - In the "ones" position we either have a 1 or not

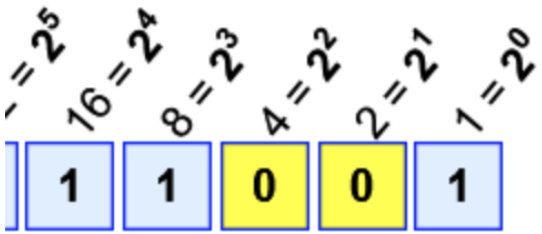
Binary Numbers



Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Two digits: **0** and **1**
- Each position is a power of two
  - Decimal: the "ones", "tens", "hundreds" and so on (powers of 10)
  - Binary: the "ones", "twos", "fours", "sixteens" and so on (powers of 2)
- In each position the digit is either 0 or 1, so given a binary number we can obtain the decimal equivalent as follows:
  - In the "ones" position we either have a 1 or not
  - In the "twos" position we either have a 2 or not

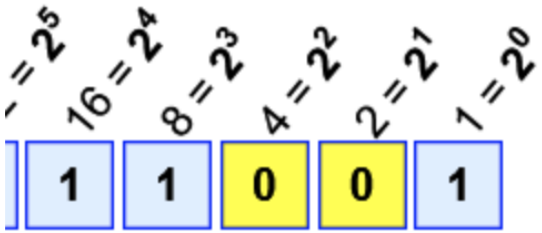
Binary Numbers



Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Two digits: **0** and **1**
- Each position is a power of two
  - Decimal: the "ones", "tens", "hundreds" and so on (powers of 10)
  - Binary: the "ones", "twos", "fours", "sixteens" and so on (powers of 2)
- In each position the digit is either 0 or 1, so given a binary number we can obtain the decimal equivalent as follows:
  - In the "ones" position we either have a 1 or not
  - In the "twos" position we either have a 2 or not
  - In the "fours" position we either have a 4 or not ...

Binary Numbers



Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Two digits: **0** and **1**
- Each position is a power of two
  - Decimal: the "ones", "tens", "hundreds" and so on (powers of 10)
  - Binary: the "ones", "twos", "fours", "sixteens" and so on (powers of 2)
- In each position the digit is either 0 or 1, so given a binary number we can obtain the decimal equivalent as follows:
  - In the "ones" position we either have a 1 or not
  - In the "twos" position we either have a 2 or not
  - In the "fours" position we either have a 4 or not ...
- **Example:**

$$11001_{base2} = 16 + 8 + 1 = 25_{base10}$$

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- Write down the output to see the pattern:

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- Write down the output to see the pattern:
  1

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- Write down the output to see the pattern:
  1
  2

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- Write down the output to see the pattern:
  1
  2
  Fizz

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- Write down the output to see the pattern:
  1
  2
  Fizz
  4

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- Write down the output to see the pattern:
  1
  2
  Fizz
  4
  Buzz

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- Write down the output to see the pattern:
  1
  2
  Fizz
  4
  Buzz
  Fizz

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- Write down the output to see the pattern:
  1
  2
  Fizz
  4
  Buzz
  Fizz
  7

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- Write down the output to see the pattern:
  1
  2
  Fizz
  4
  Buzz
  Fizz
  7
  ...
  14

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- Write down the output to see the pattern:
  1
  2
  Fizz
  4
  Buzz
  Fizz
  7
  ...
  14
  FizzBuzz

Challenge: Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- Write down the output to see the pattern:
  1
  2
  Fizz
  4
  Buzz
  Fizz
  7
  ...
  14
  FizzBuzz
- Write the **algorithm** then, if time, write the code.

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- To Do List:

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- To Do List:
  - Create a loop that goes from 1 to 100.

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- To Do List:
  - Create a loop that goes from 1 to 100.
  - If the number is divisible by 3, print “Fizz”.

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- To Do List:
  - Create a loop that goes from 1 to 100.
  - If the number is divisible by 3, print “Fizz”.
  - If the number is divisible by 5, print “Buzz”.

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- To Do List:
  - Create a loop that goes from 1 to 100.
  - If the number is divisible by 3, print “Fizz”.
  - If the number is divisible by 5, print “Buzz”.
  - **If divisible by both, print “FizzBuzz”.**

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- To Do List:
  - Create a loop that goes from 1 to 100.
  - If the number is divisible by 3, print “Fizz”.
  - If the number is divisible by 5, print “Buzz”.
  - **If divisible by both, print “FizzBuzz”.**
  - Otherwise print the number.

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- To Do List:
  - Create a loop that goes from 1 to 100.
  - If the number is divisible by 3, print "Fizz".
  - If the number is divisible by 5, print "Buzz".
  - **If divisible by both, print "FizzBuzz".**
  - Otherwise print the number.
    Order matters!!! To print FizzBuzz when i is divisible by both it should be checked first, otherwise it will never get to this case!

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”.
- To Do List (**Reordered**):

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- To Do List (**Reordered**):
  - Create a loop that goes from 1 to 100.
  - **If divisible by both 3 and 5, print "FizzBuzz".**

Tech Interview Classic

- Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- To Do List (**Reordered**):
  - Create a loop that goes from 1 to 100.
  - **If divisible by both 3 and 5, print "FizzBuzz".**
  - If the number is divisible by 3, print "Fizz".
  - If the number is divisible by 5, print "Buzz".
  - Otherwise print the number.
  - Also should print a new line (so each entry is on its own line).

Tech Interview Classic

- To Do List:
  - Create a loop that goes from 1 to 100.
  - If divisible by both 3 and 5, print “FizzBuzz”.
  - If the number is divisible by 3, print “Fizz”.
  - If the number is divisible by 5, print “Buzz”.
  - Otherwise print the number.
  - Also should print a new line (so each entry is on its own line).

Tech Interview Classic

- To Do List:
  - Create a loop that goes from 1 to 100.
  - If divisible by both 3 and 5, print "FizzBuzz".
  - If the number is divisible by 3, print "Fizz".
  - If the number is divisible by 5, print "Buzz".
  - Otherwise print the number.
  - Also should print a new line (so each entry is on its own line).

```
for i in range(1,101):
```

Tech Interview Classic

- To Do List:
  - Create a loop that goes from 1 to 100.
  - If divisible by both 3 and 5, print "FizzBuzz".
  - If the number is divisible by 3, print "Fizz".
  - If the number is divisible by 5, print "Buzz".
  - Otherwise print the number.
  - Also should print a new line (so each entry is on its own line).

```
for i in range(1,101):
    if i%3 == 0 and i%5 == 0:
        print("FizzBuzz")
```

Tech Interview Classic

- To Do List:
  - Create a loop that goes from 1 to 100.
  - If divisible by both 3 and 5, print "FizzBuzz".
  - If the number is divisible by 3, print "Fizz".
  - If the number is divisible by 5, print "Buzz".
  - Otherwise print the number.
  - Also should print a new line (so each entry is on its own line).

```
for i in range(1,101):
    if i%3 == 0 and i%5 == 0:
        print("FizzBuzz")
    elif i%3 == 0:
        print("Fizz")
```

Tech Interview Classic

- To Do List:
  - Create a loop that goes from 1 to 100.
  - If divisible by both 3 and 5, print "FizzBuzz".
  - If the number is divisible by 3, print "Fizz".
  - If the number is divisible by 5, print "Buzz".
  - Otherwise print the number.
  - Also should print a new line (so each entry is on its own line).

```
for i in range(1,101):
    if i%3 == 0 and i%5 == 0:
        print("FizzBuzz")
    elif i%3 == 0:
        print("Fizz")
    elif i%5 == 0:
        print("Buzz")
```

Tech Interview Classic

- To Do List:
  - Create a loop that goes from 1 to 100.
  - If divisible by both 3 and 5, print "FizzBuzz".
  - If the number is divisible by 3, print "Fizz".
  - If the number is divisible by 5, print "Buzz".
  - Otherwise print the number.
  - Also should print a new line (so each entry is on its own line).

```
for i in range(1,101):
    if i%3 == 0 and i%5 == 0:
        print("FizzBuzz")
    elif i%3 == 0:
        print("Fizz")
    elif i%5 == 0:
        print("Buzz")
    else:
        print(i)
```

Recap

- In Python, we introduced:

Recap

- In Python, we introduced:
  - Decisions
  - Logical Expressions
  - Circuits
  - Binary Numbers

Practice Quiz & Final Questions

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.

Practice Quiz & Final Questions

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).

Practice Quiz & Final Questions

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:

Practice Quiz & Final Questions

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;

Practice Quiz & Final Questions

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;
  - followed by answer; and

Practice Quiz & Final Questions

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;
  - followed by answer; and
  - repeat.

Practice Quiz & Final Questions

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;
  - followed by answer; and
  - repeat.
- Past exams are on the webpage (under Final Exam Information).

Practice Quiz & Final Questions

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;
  - followed by answer; and
  - repeat.
- Past exams are on the webpage (under Final Exam Information).
- We're starting with Spring 2018, Version 1.

Weekly Reminders!

Before next lecture, don't forget to:

- Read and work through Lab 5!

Weekly Reminders!

Before next lecture, don't forget to:

- Read and work through Lab 5!
- Submit this week's programming assignments

Weekly Reminders!

Before next lecture, don't forget to:

- Read and work through Lab 5!
- Submit this week's programming assignments
- Tutoring and help is available through cscisummer23@gmail.com