

# CS50 for MBAs

Programming Languages

# Office Hours

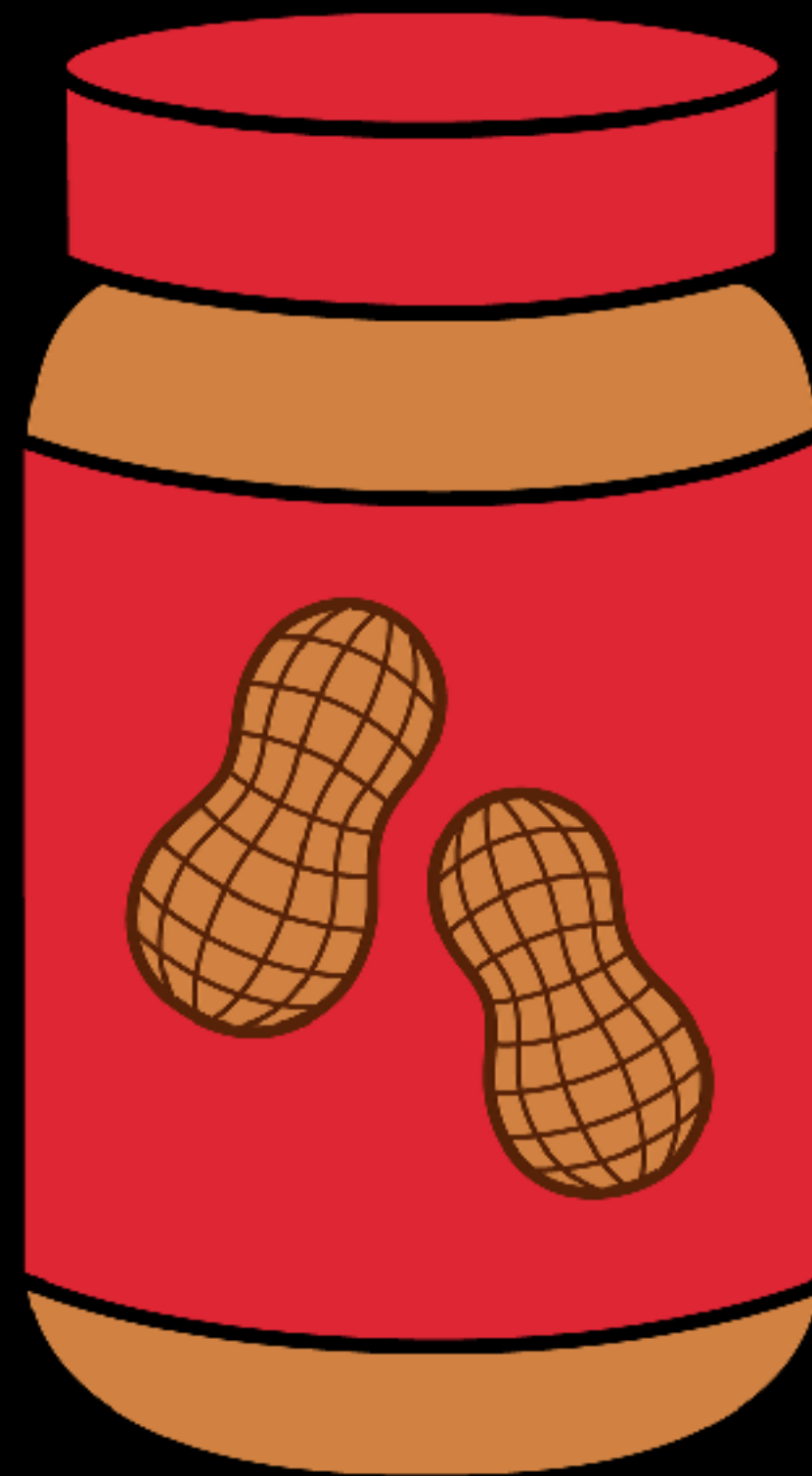
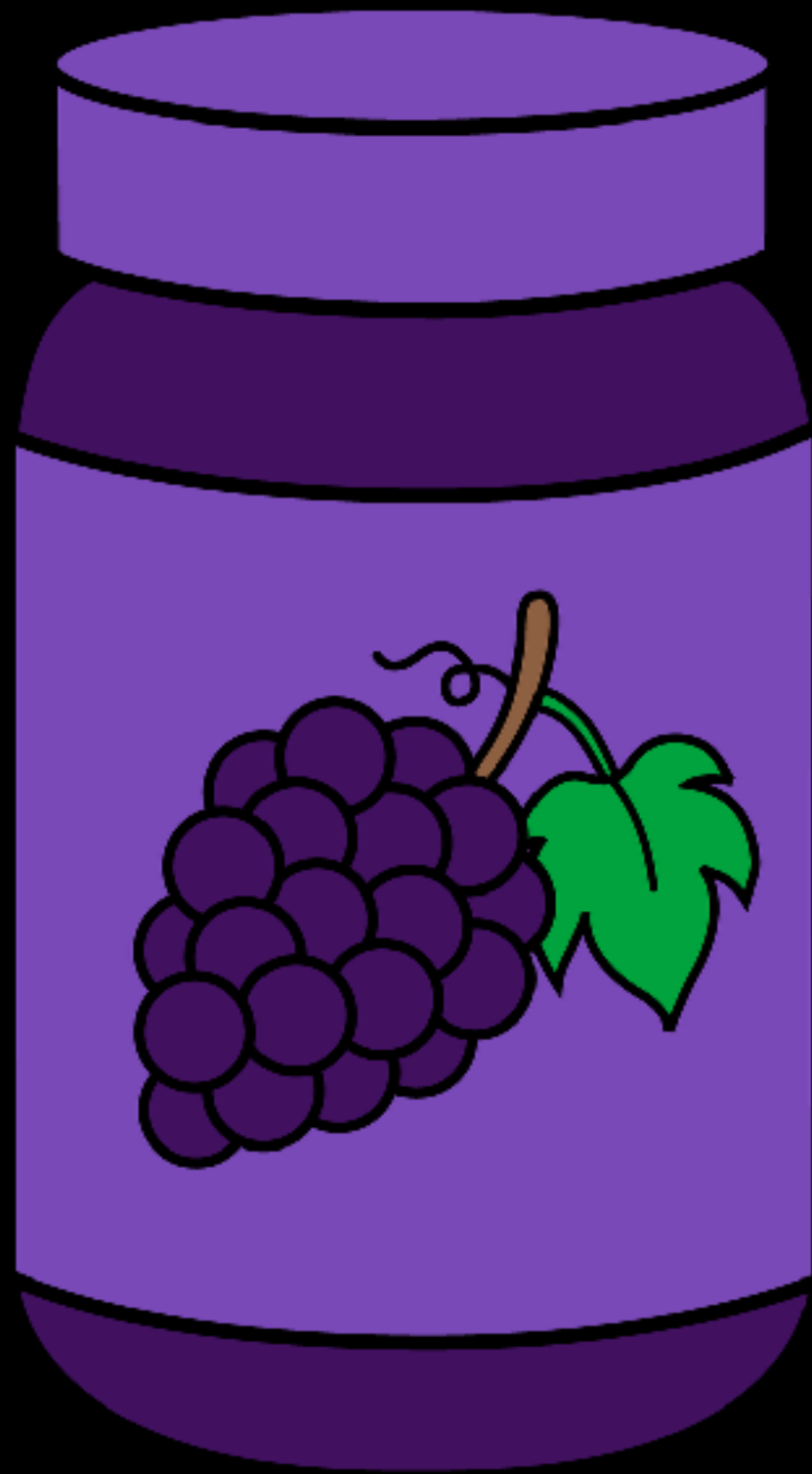
[cs50.github.io/hbs/hours](https://cs50.github.io/hbs/hours)

# Seminars

[cs50.github.io/hbs/seminars](https://cs50.github.io/hbs/seminars)

# Last Last Time

Computational Thinking



0 PUT ON THE TABLE loaf of bread, a jar of peanut butter, a jar of jelly, a plate and a knife

1 OPEN jar of peanut butter, jar of jelly

2 GET knife

3 CUT the loaf of bread in half

4 PUT two halves of the bread on a plate

5 PASS knife on the peanut butter

6 PASS knife on the two halves of the bread

7 PASS knife on the jelly

8 PASS knife on the two halves of the bread

9 EAT

Step 0 Get loaf of bread, jar of peanut butter, jar of jelly, plate, knife

Step 1 Place loaf of bread, jar of peanut butter, jar of jelly, plate, knife on a flat surface

Step 2 If loaf of bread has a cover, untie/ open cover  
else, nothing

Step 3 If loaf of bread is pre-sliced, take two slices of bread

else place loaf of bread in front of you such that the shorter side is to your left and the longer side is parallel to your chest AND take your knife and cut off two slices of bread from loaf of bread, cutting straight down from the left side, and place knife back on the flat surface

Step 4 If loaf of bread has cover, close/ tie cover

Step 5 Place two slices of bread on plate, unstacked, lying next to each other so that the sides with most surface area is against the plate, with no overlap with the slice next to it

Step 6 Open the jar of peanut butter

Step 7 Take your knife and place it into the jar of peanut butter to scoop out peanut butter

Step 8 Use your knife to spread peanut butter on ONE side of one slice of loaf of bread, the side of the slice of loaf of bread not against the plate

Step 9 If one side of selected slice of loaf of bread is completely full of peanut butter

then wipe excess peanut butter off the knife by scraping the knife against the side of the plate

Else repeat steps 7-9

Step 10 Open the jar of jelly

Step 11 Take your knife and place it into the jar of jelly to scoop out jelly

Step 12 Use your knife to spread jelly on the side of the slice of loaf of bread that does not have peanut butter, the side of the slice of loaf of bread not against the plate

Step 13 If that side of slice of loaf of bread is completely full of jelly

then wipe excess jelly off knife by scraping the knife against the side of the plate

Else repeat steps 11-13

Step 14 Put the knife down on the surface

Step 15 Close the peanut butter jar

Step 16 Close the jelly jar

Step 17 Take slice of bread with peanut butter off the plate, turn it over, and place it on the other slice of bread with jelly such that the peanut butter exactly touches aligns with the jelly sides of the slices of loaf of bread"



## THE PROBLEM ABOUT BEING A PROGRAMMER

My mom said:



"Honey, please go to the market and buy 1 bottle of milk. If they have eggs, bring 6"

I came back with 6 bottles of milk.

She said: "Why the hell did you buy 6 bottles of milk?"

I said: "BECAUSE THEY HAD EGGS!!!!"



 **Harvard Alert** <7169a844-0005-3000-80c0-fceb5!  
to malan 

11:50 PM (13 hours ago)



Harvard Alert- Camb Police continue to invest a shooting near Mt Auburn Hospital. Avoid area.  
This is last message, unless new info develops.

- Seminars
- Office Hours



integer overflow

128

64

32

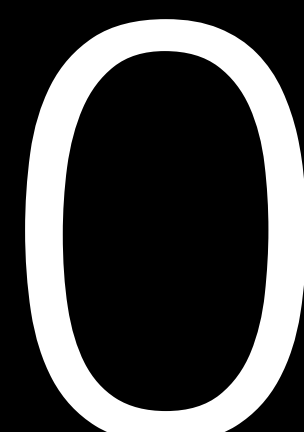
16

8

4

2

1



128

64

32

16

8

4

2

1



128

64

32

16

8

4

2

1

0

0

0

0

0

0

0

0









B **Beats**

A **Buy**

4,000,000,000







Greetings from M.Gandhi, ruler  
and King of the Indians...  
Our words are backed  
with NUCLEAR WEAPONS!









floating-point imprecision

**$\frac{1}{3}$**

**.33333333333333333333**

# Last Time

Scratch

<https://scratch.mit.edu/studios/3841693/>

when



clicked

say

hello, world



say

hello, world



```
print("hello, world")
```

forever

say

hello, world





```
while True:  
    print("hello, world")
```





```
for i in range(50):  
    print("hello, world")
```

set **i** to 0



`i == 0`







$i < 50$





$x < y$

if  $x < y$  then

say x is less than y

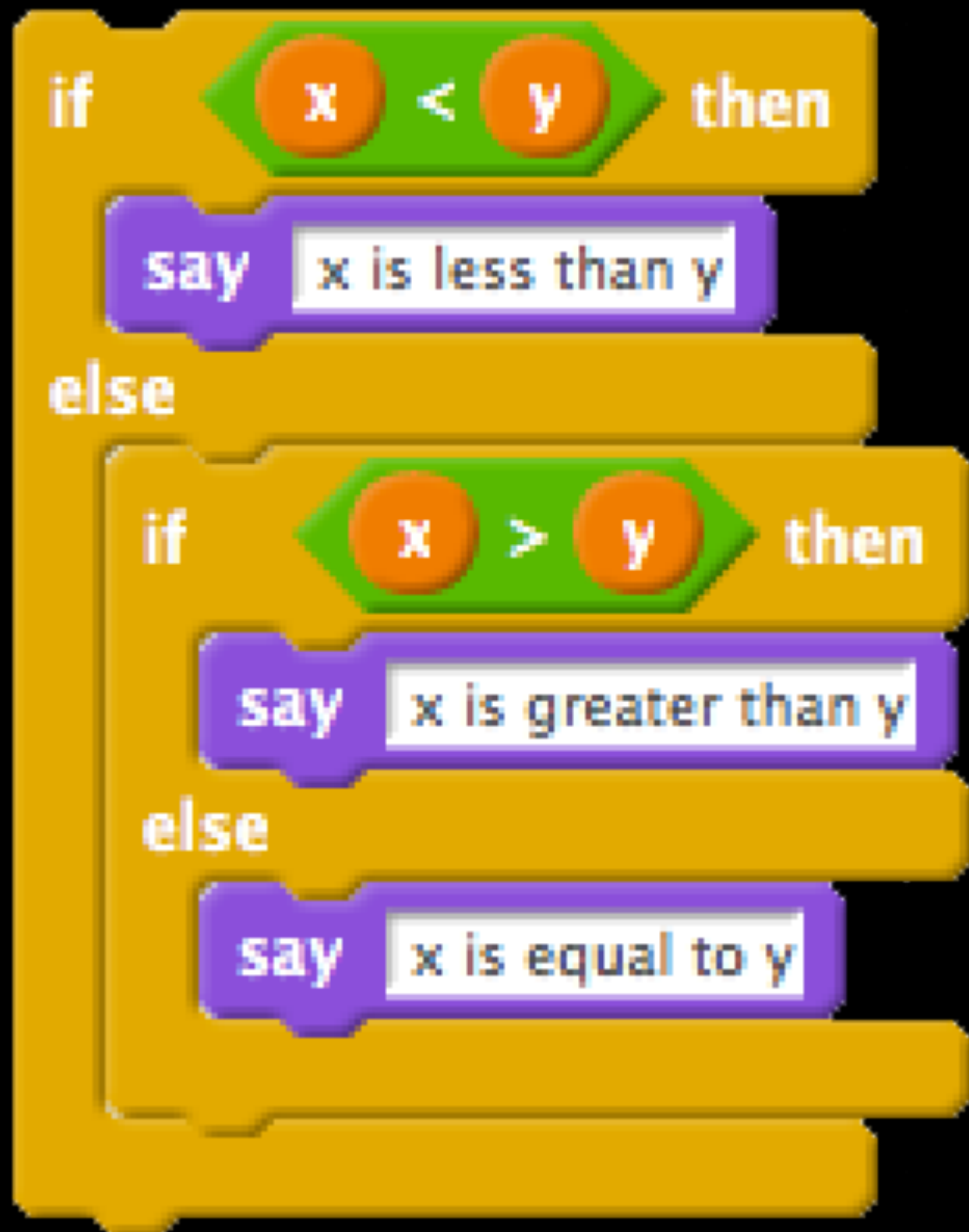
else

if  $x > y$  then

say x is greater than y

else

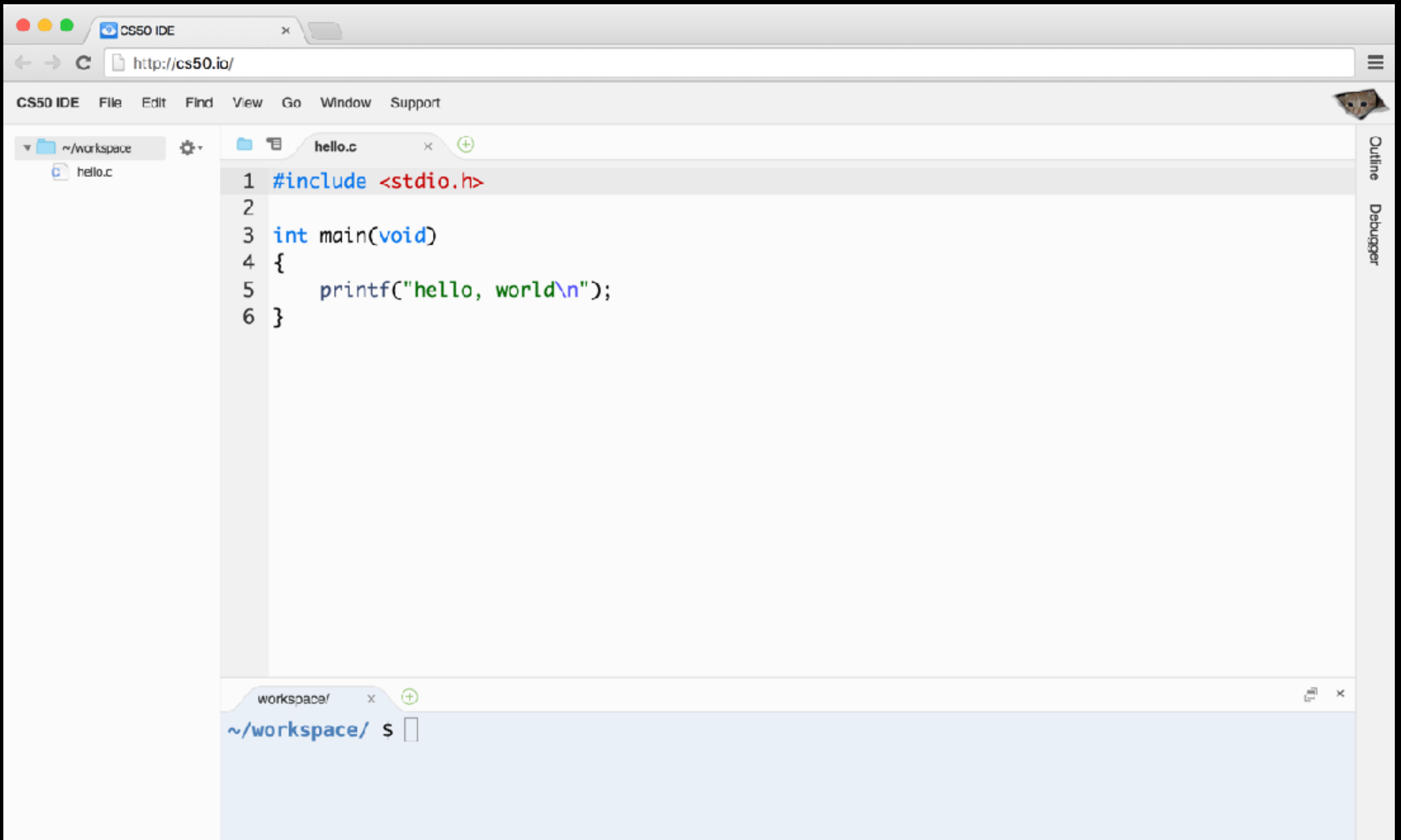
say x is equal to y



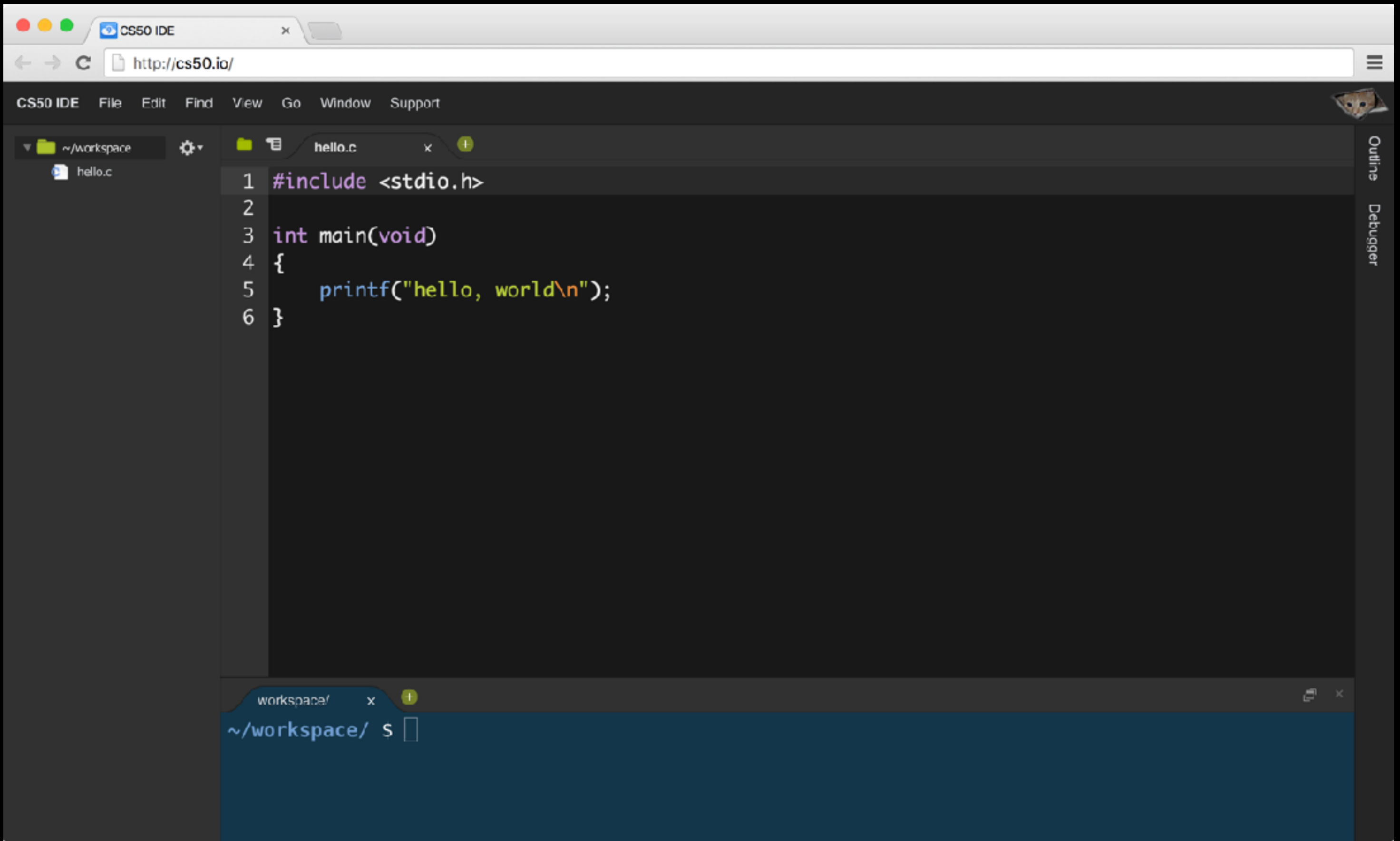
```
if x < y:  
    print("x is less than y")  
elif x > y:  
    print("x is greater than y")  
else:  
    print("x is equal to y")
```

# CS50 IDE

[cs50.io](https://cs50.io)







source code

```
#include <stdio.h>
```

```
int main(void)
```

```
{
```

```
    printf("hello, world\n");
```

```
}
```

compiler

machine code

01111111	01000101	01001100	01000110	00000010	00000001	00000001	00000000
00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
00000010	00000000	00111110	00000000	00000001	00000000	00000000	00000000
10110000	00000101	01000000	00000000	00000000	00000000	00000000	00000000
01000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
11010000	00010011	00000000	00000000	00000000	00000000	00000000	00000000
00000000	00000000	00000000	00000000	01000000	00000000	00111000	00000000
00001001	00000000	01000000	00000000	00100100	00000000	00100001	00000000
00000110	00000000	00000000	00000000	00000101	00000000	00000000	00000000
01000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
01000000	00000000	01000000	00000000	00000000	00000000	00000000	00000000
01000000	00000000	01000000	00000000	00000000	00000000	00000000	00000000
11111000	00000001	00000000	00000000	00000000	00000000	00000000	00000000
11111000	00000001	00000000	00000000	00000000	00000000	00000000	00000000
00001000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
00000011	00000000	00000000	00000000	00000100	00000000	00000000	00000000
00111000	00000010	00000000	00000000	00000000	00000000	00000000	00000000
00111000	00000010	01000000	00000000	00000000	00000000	00000000	00000000
00111000	00000010	01000000	00000000	00000000	00000000	00000000	00000000
00011100	00000000	00000000	00000000	00000000	00000000	00000000	00000000

. . .

```
clang hello.c
```

```
./a.out
```

source code



```
def main():  
    print("hello, world")
```

compiler

bytecode

2	0	LOAD_GLOBAL	0	(print)
	3	LOAD_CONST	1	('hello, world')
	6	CALL_FUNCTION	1	(1 positional, 0 keyword pair)
	9	POP_TOP		
	10	LOAD_CONST	0	(None)
	13	RETURN_VALUE		

interpreter

```
python hello.py
```

```
#include <iostream>
```

```
int main()
```

```
{
```

```
    std::cout << "hello, world" << std::endl;
```

```
}
```

```
class Hello
{
    public static void main(String [] args)
    {
        System.out.println("hello, world");
    }
}
```



```
put "hello, world"
```

```
(print "hello, world")
```

```
console.log("hello, world")
```

<https://helloworldcollection.github.io/>

- Bash
- C
- C++
- C#
- Clojure
- Erlang
- F#
- Go
- Haskell
- Java
- JavaScript
- Objective-C

- OCaml
- PHP
- Python
- R
- Ruby
- Scala
- Scheme
- SQL
- Swift
- ...

[wikipedia.org/wiki/List\\_of\\_programming\\_languages](https://wikipedia.org/wiki/List_of_programming_languages)

# CS50 for MBAs

Algorithms, Data Structures

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Programming Languages