This is CS50

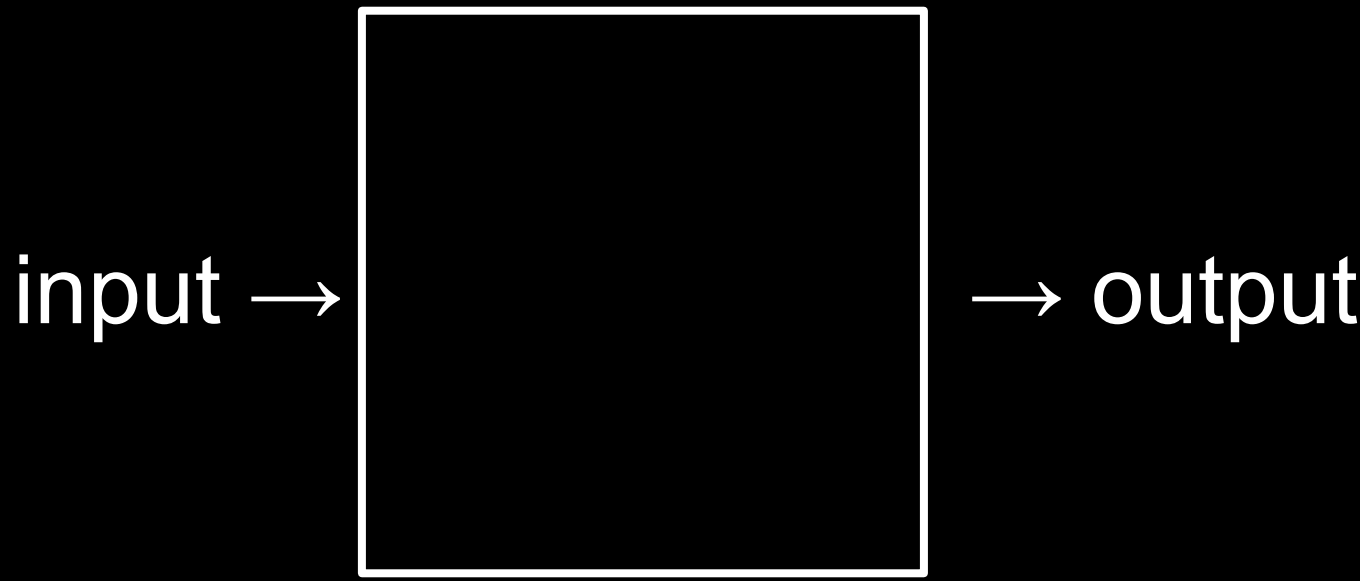
- Hi!
- See cs50.harvard.edu for course's website.
  - See cs50.harvard.edu/syllabus for syllabus.
  - See cs50.harvard.edu/faqs for FAQs.
- If you have trouble seeing screen on stage,
  see live.cs50.io/screen on your laptop.
- Today's lecture will be 3pm–4:15pm.
  Future lectures will be Mondays, 3pm–5pm.
- Problem Set 0 due on Sunday 9/8, 11:59pm. See website.
- Orientation meetings next week. See website.
- CS50 Puzzle Day (a tradition) is this Saturday 9/7, 12pm–3:30pm.
  Register at cs50.harvard.edu/register. Friends welcome.
- Cake (a tradition) will be served in transept after class!

This is CS50

2/3

of CS50 students have never taken CS before

what ultimately matters in this course is not so much where you end up relative to your classmates but where you end up relative to yourself when you began


input →
→ output

representation

0 1 2 3 4 5 6 7 8 9

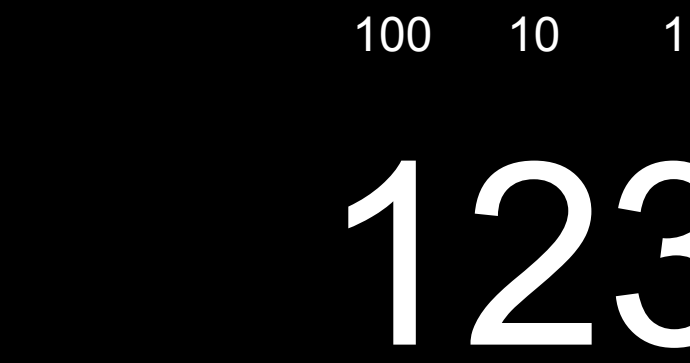
01

123

123

10 1

123


100 10 1
123

100 10 1

123

100 × 1

100 10 1

123

100 × 1 +

100 10 1

123

100 × 1 + 10 × 2

100 10 1

123

100 × 1 + 10 × 2 +

100 10 1

123

100 × 1 + 10 × 2 + 1 × 3

100 10 1

123

100 + 20 + 3

123

100 10 1

000

100 10 1

001

100 10 1

002

100 10 1

003

100 10 1

004

100 10 1

005

100 10 1

006

100 10 1

007

100 10 1

008

100 10 1

009

100 10 1

010

100 10 1

000

10^2 10^1 10^0

000

2^2 2^1 2^0

000

4 2 1

000

4 2 1

001

4 2 1

010

4 2 1

011

4 2 1

100

4 2 1

101

4 2 1

110

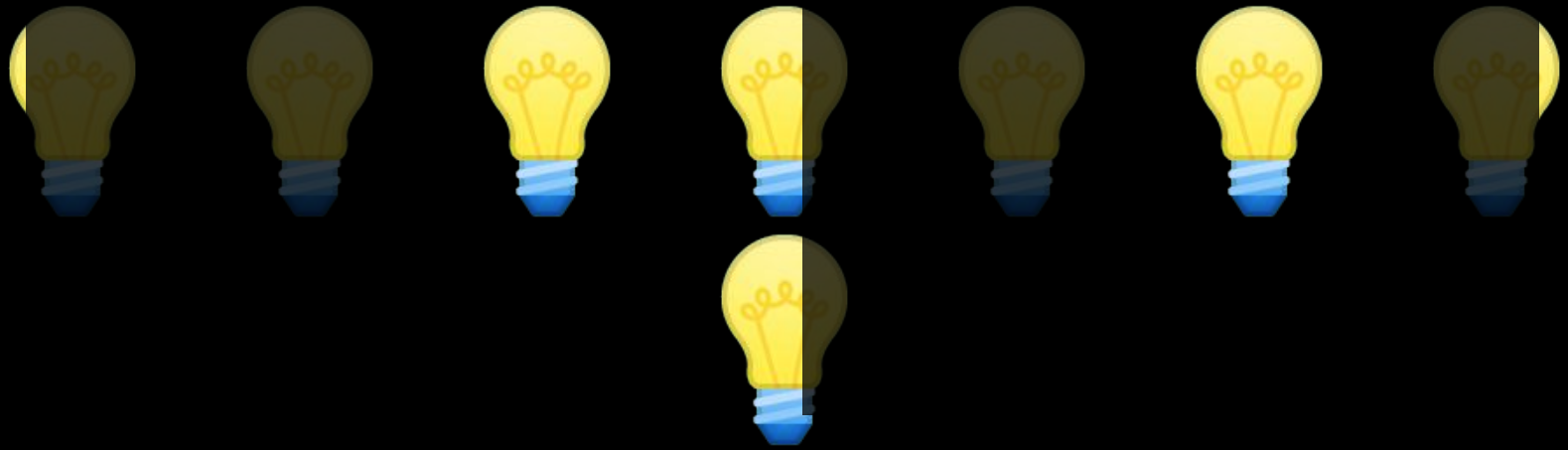
4 2 1

111

bit

bit bit bit bit bit bit bit bit

byte



A

65

01000001

65

ASCII

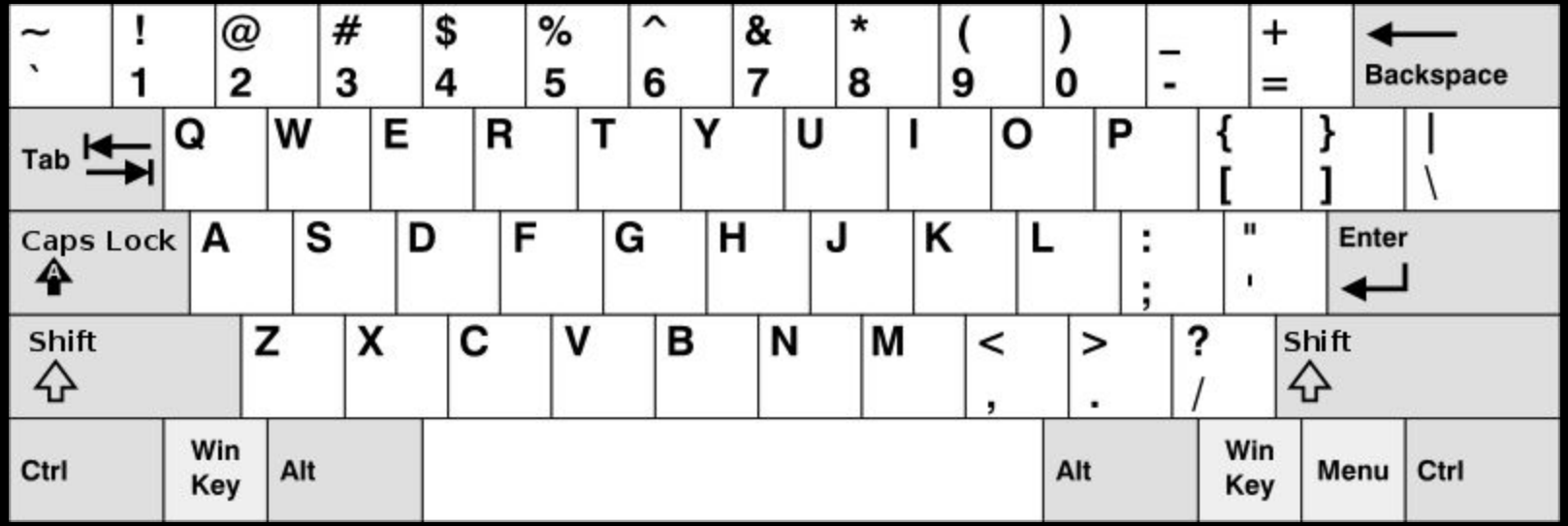
...	A	B	C	D	E	F	G	H	I	...
...	65	66	67	68	69	70	71	72	73	...

72 73 33

H I

72 73 33

H	I	!
72	73	33


~ `
! 1
@ 2
# 3
$ 4
% 5
^ 6
& 7
* 8
(9
) 0
_ -
+ =
Backspace
Tab
Q
W
E
R
T
Y
U
I
O
P
{ [
}]
| \
Caps Lock
A
S
D
F
G
H
J
K
L
: ;
" '
Enter
Shift
Z
X
C
V
B
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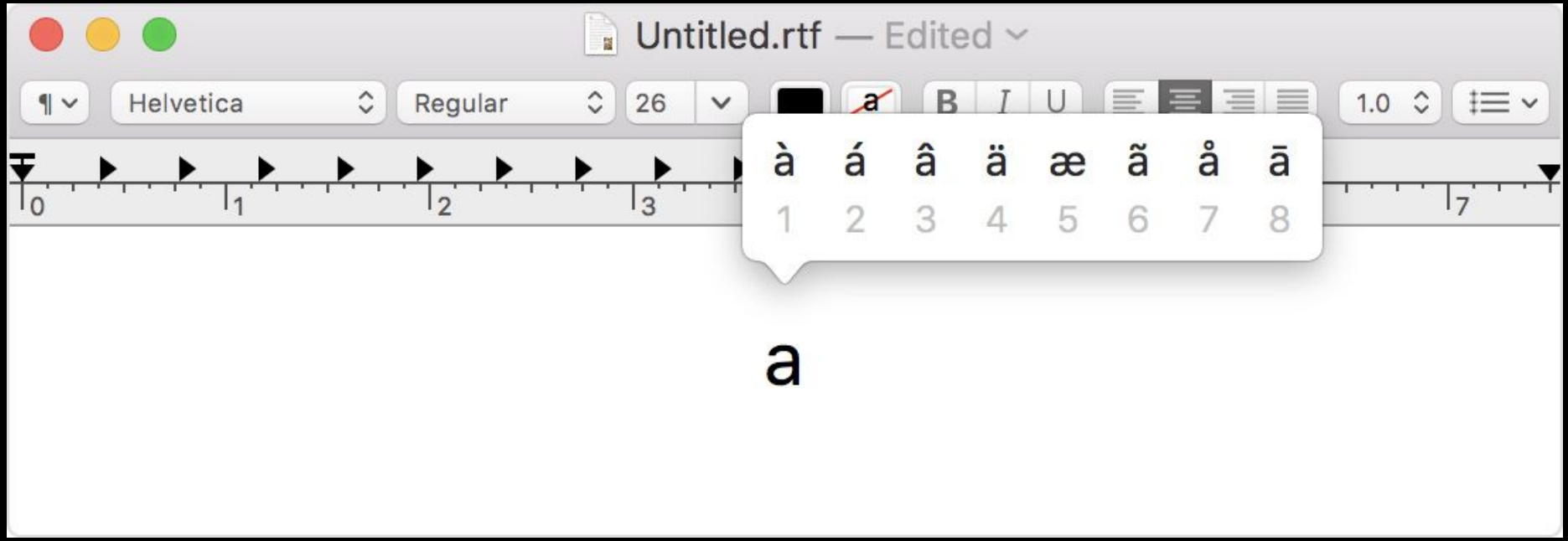
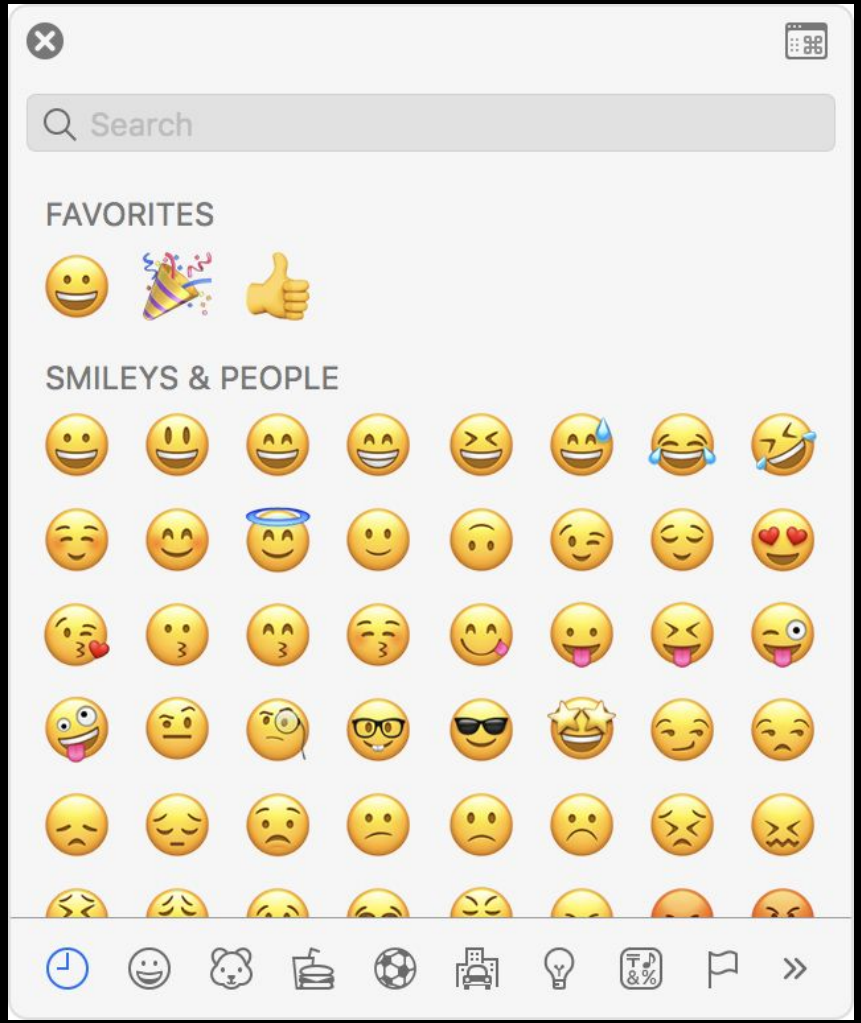
> .
? /
Shift
Ctrl
Win Key
Alt
Alt
Win Key
Menu
Ctrl


Untitled.rtf — Edited
Helvetica
Regular
26
1.0
à á â ä æ ã å ā
1 2 3 4 5 6 7 8
a

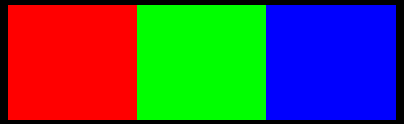

Search
FAVORITES
SMILEYS & PEOPLE

Unicode

128514

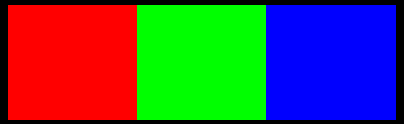
1111110110000000010

RGB



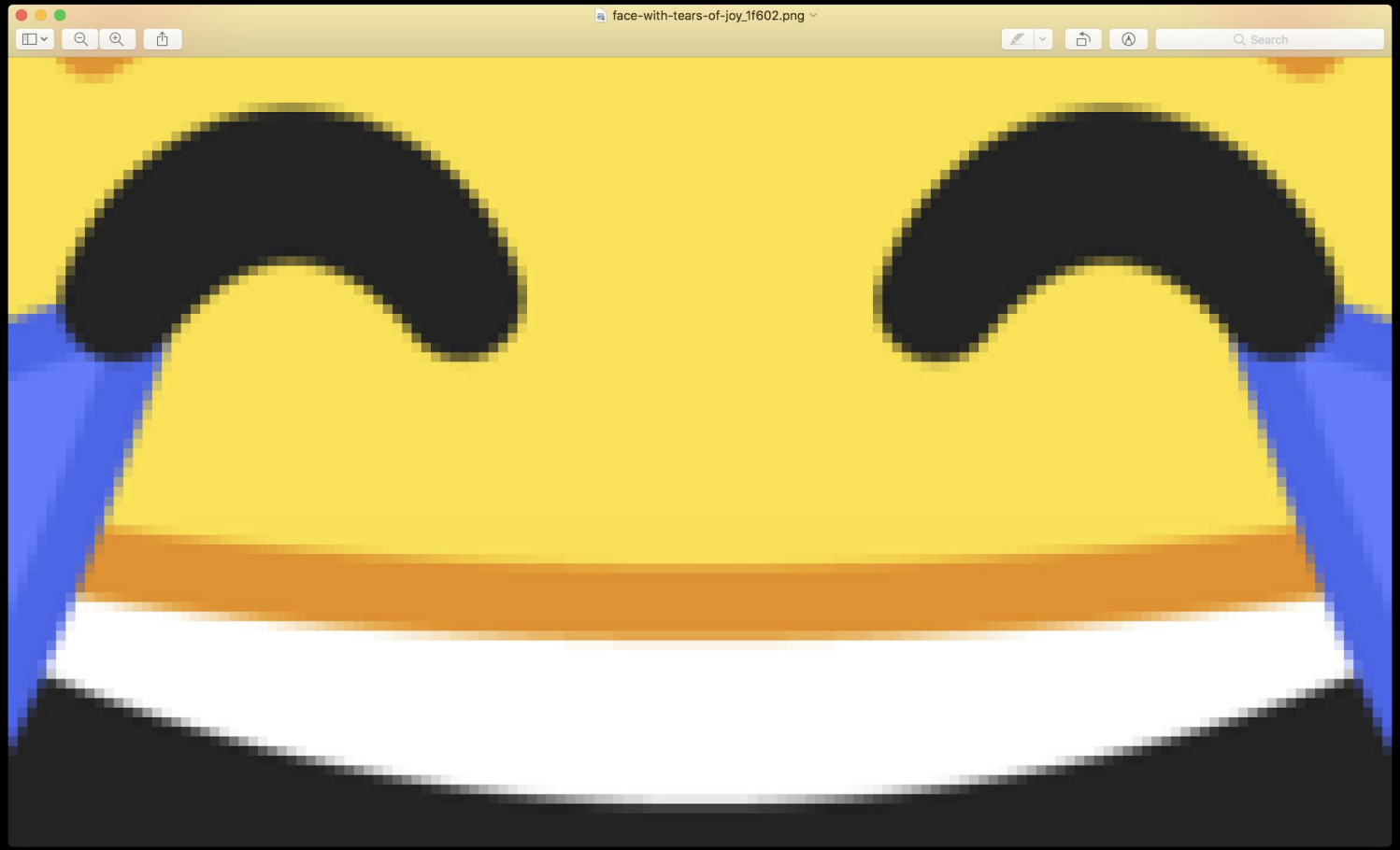
72 73 33

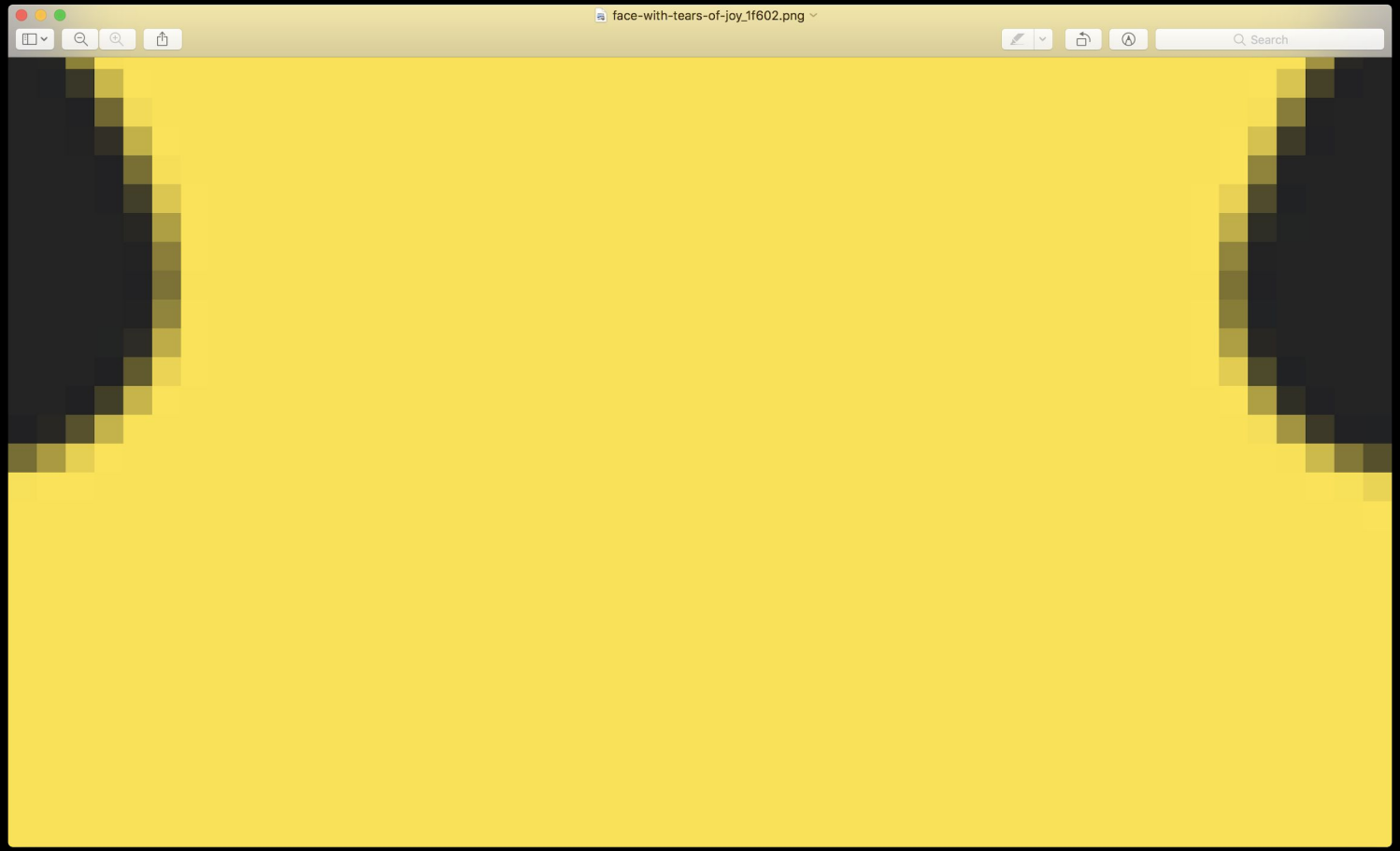

72
73
33

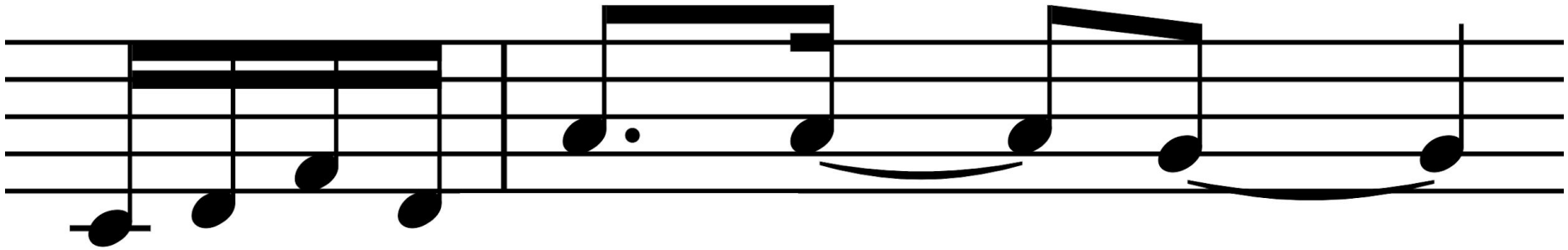


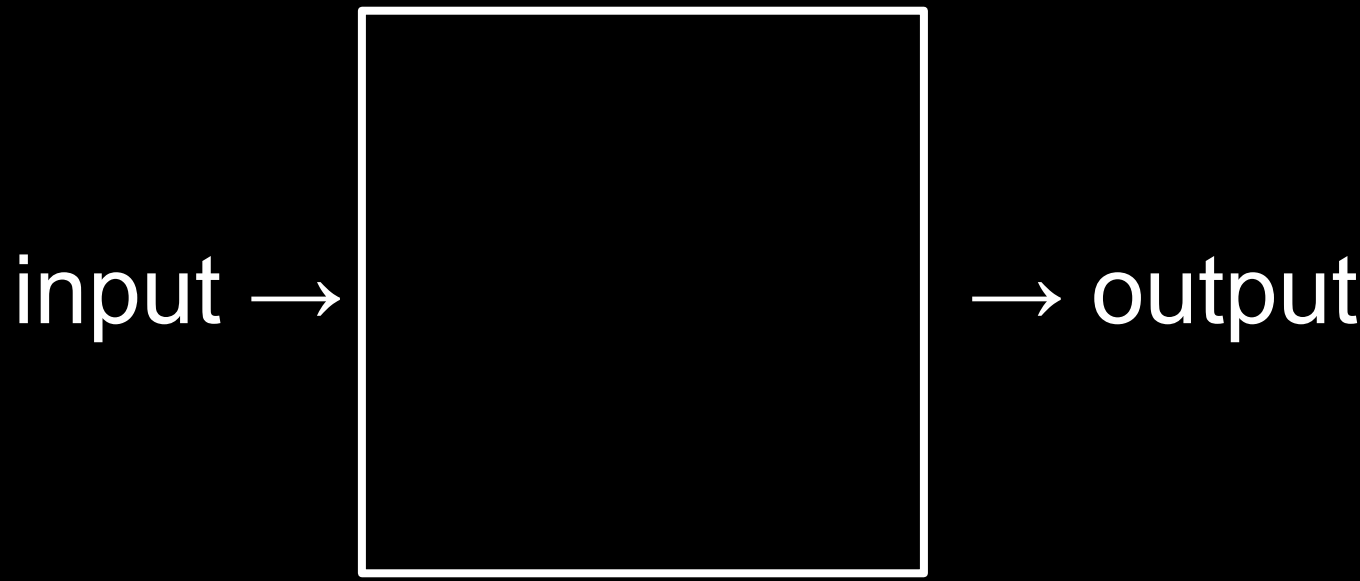
face-with-tears-of-joy_1f602.png

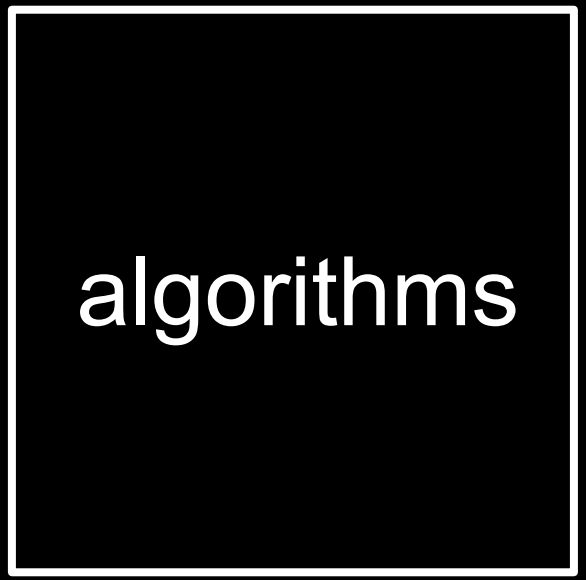
face-with-tears-of-joy_1f602.png


face-with-tears-of-joy_1f602.png
Search


face-with-tears-of-joy_1f602.png
Search



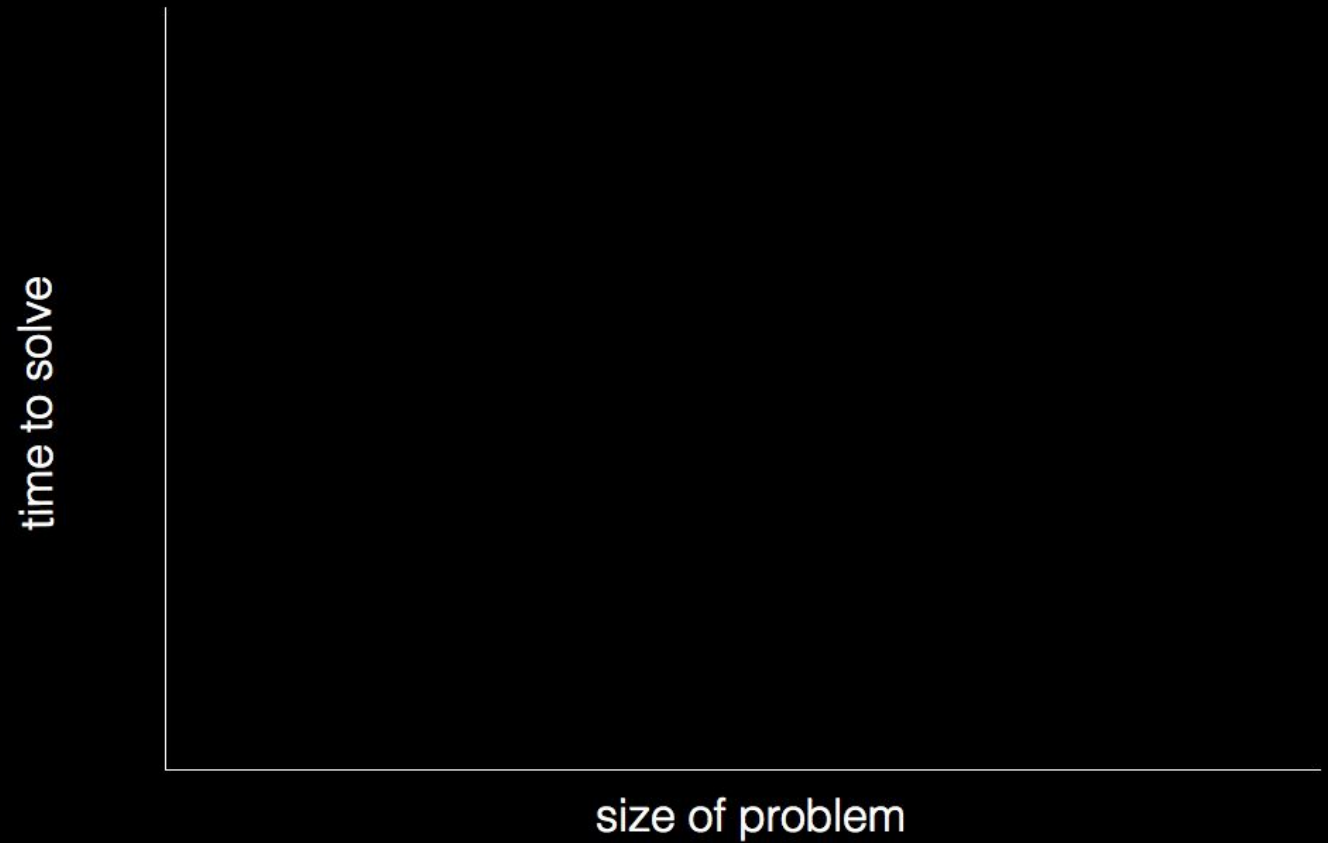

input →
→ output

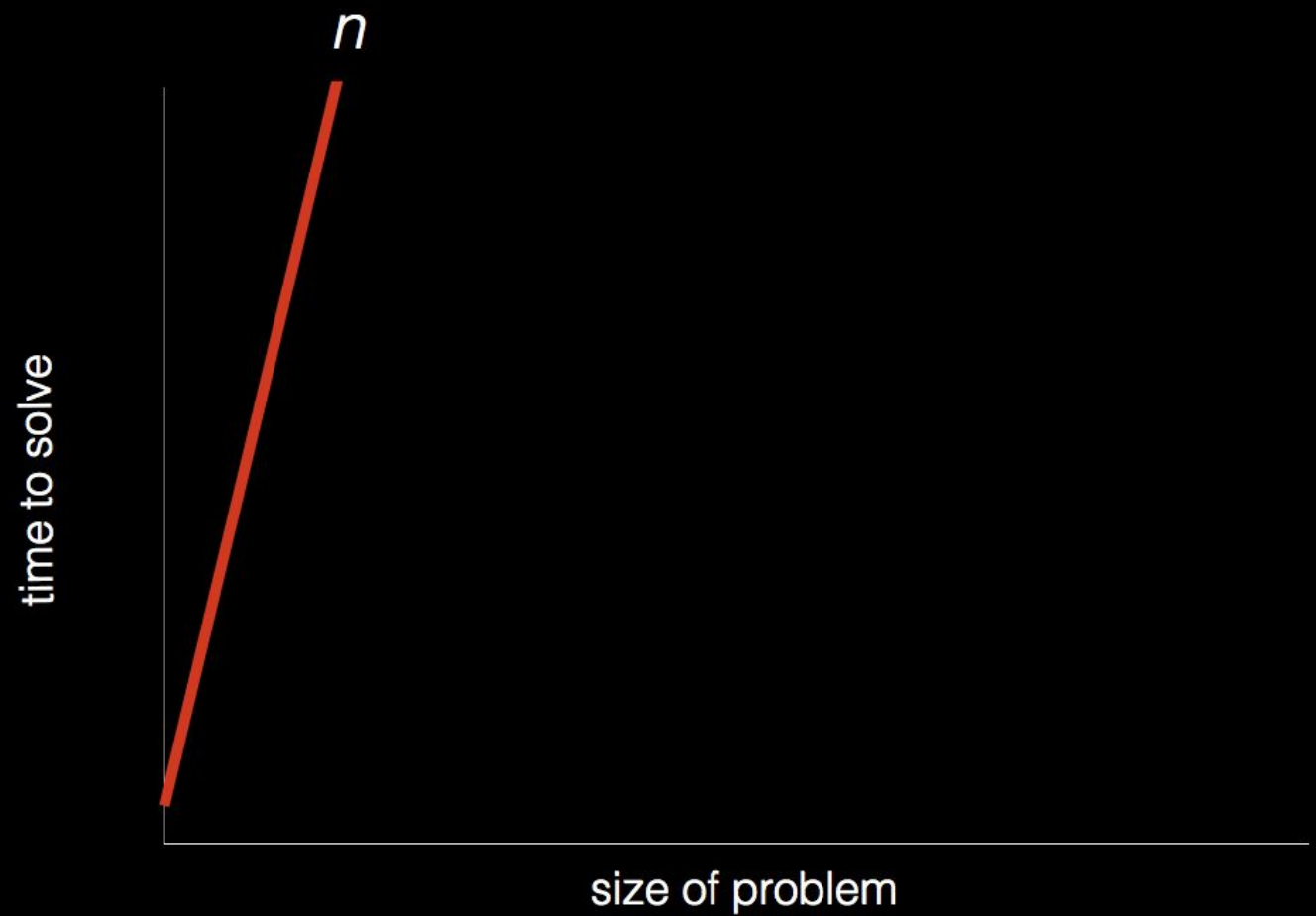

algorithms

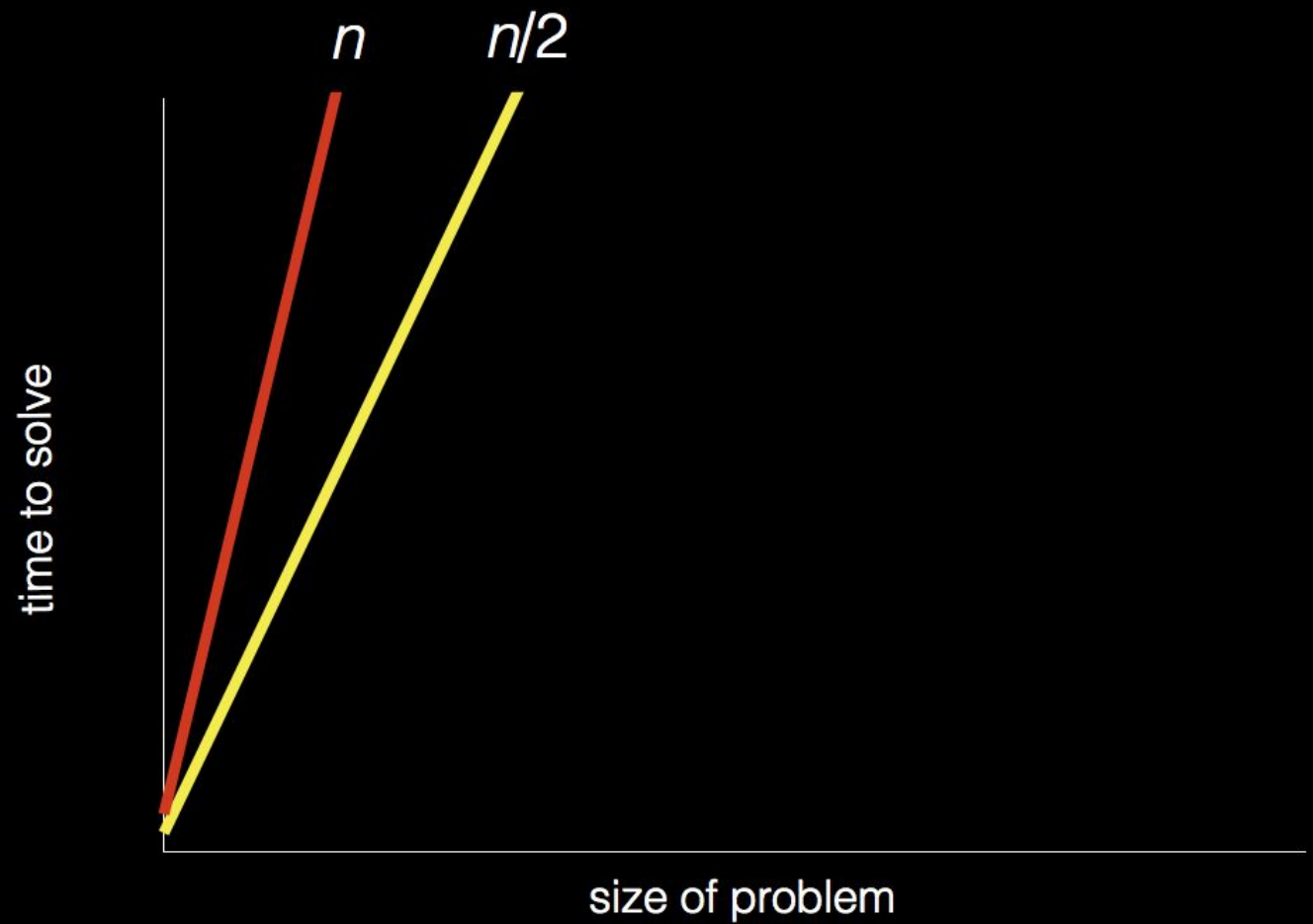
1024
1023
1022
1021
1020
1019
1018
1017
1016
1015
1014
...

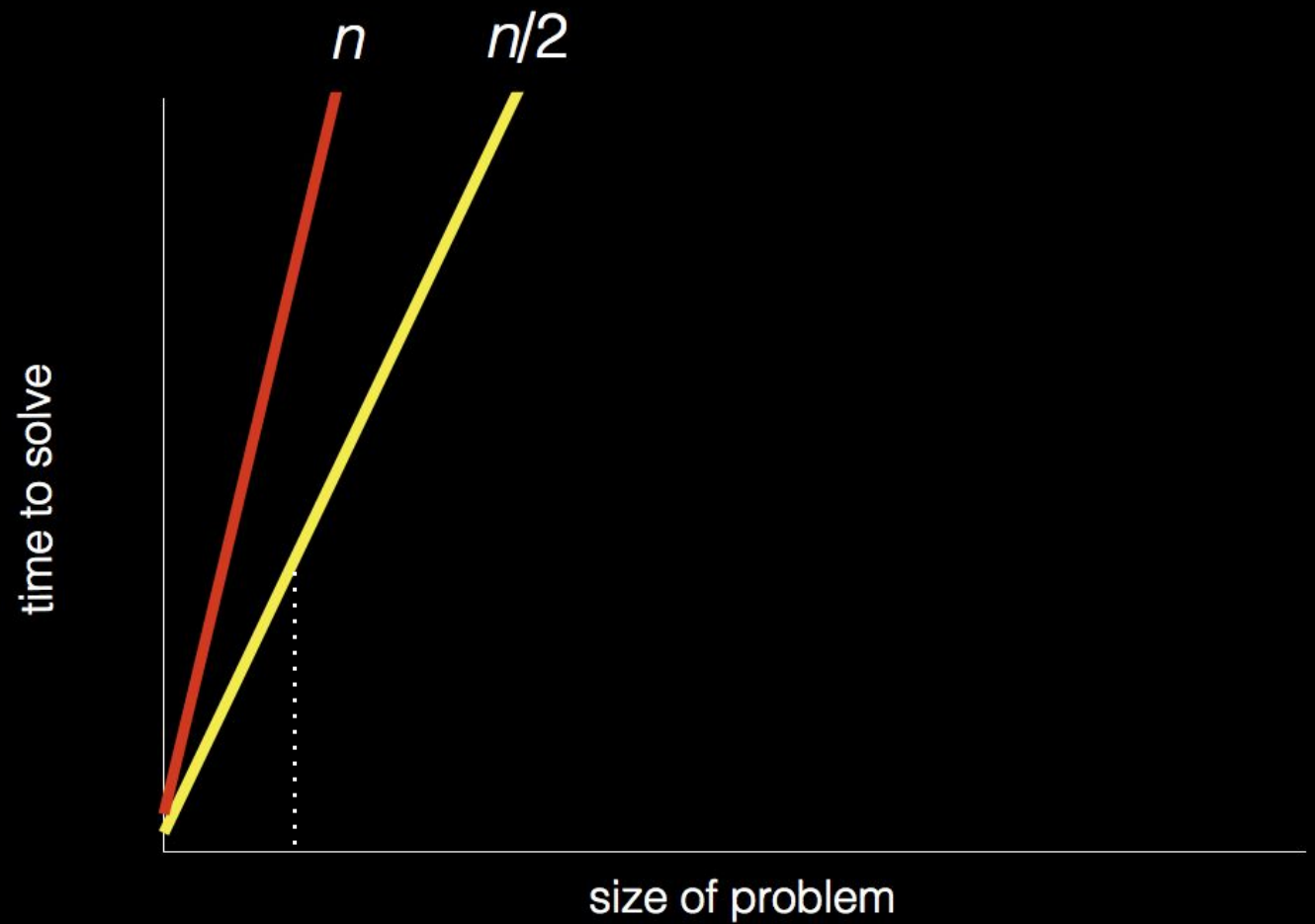
1024
1022
1020
1018
1016
1014
1012
1010
1008
1006
1004
...

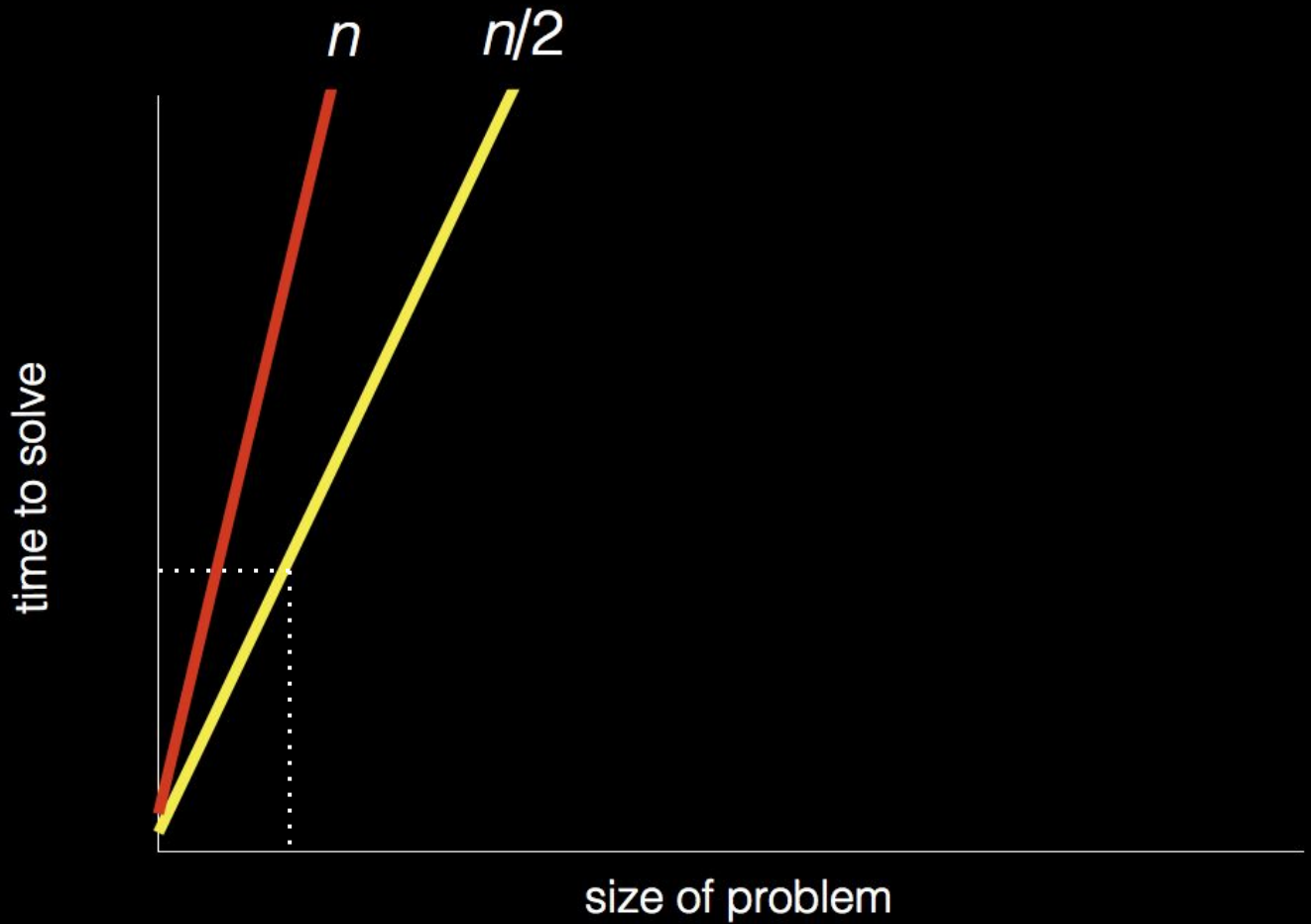
1024
512
256
128
64
32
16
8
4
2
1

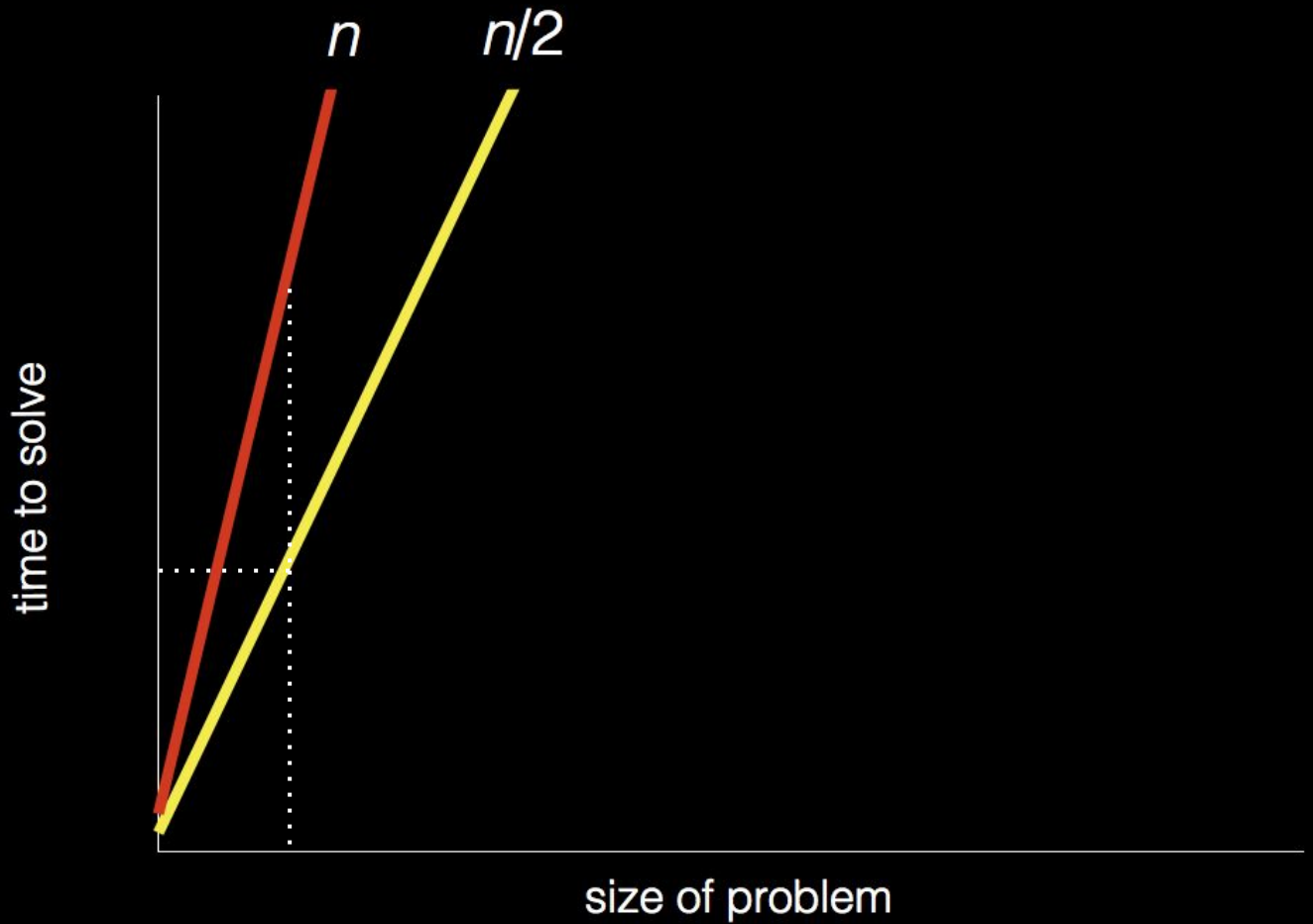

time to solve
size of problem

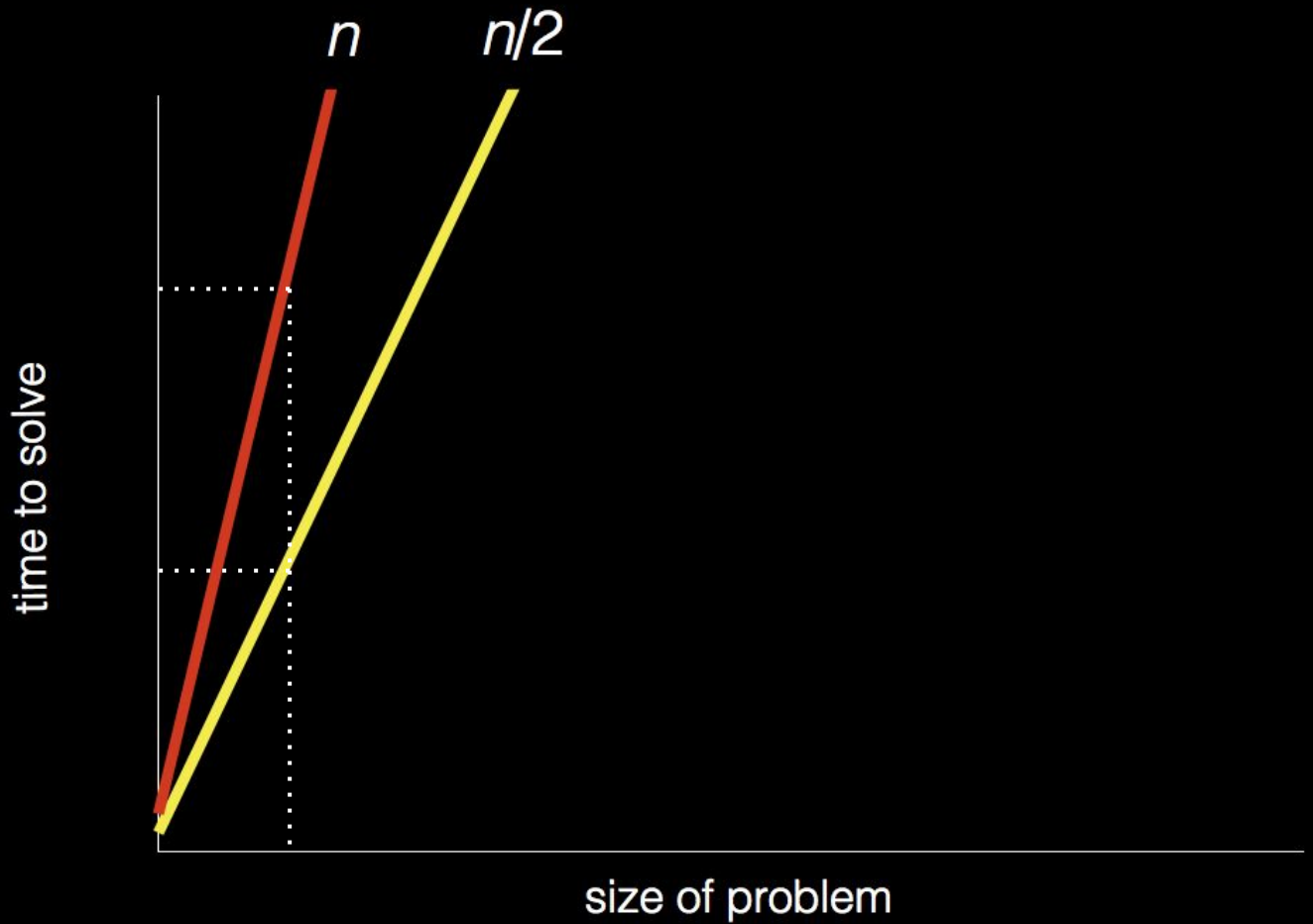

n
time to solve
size of problem

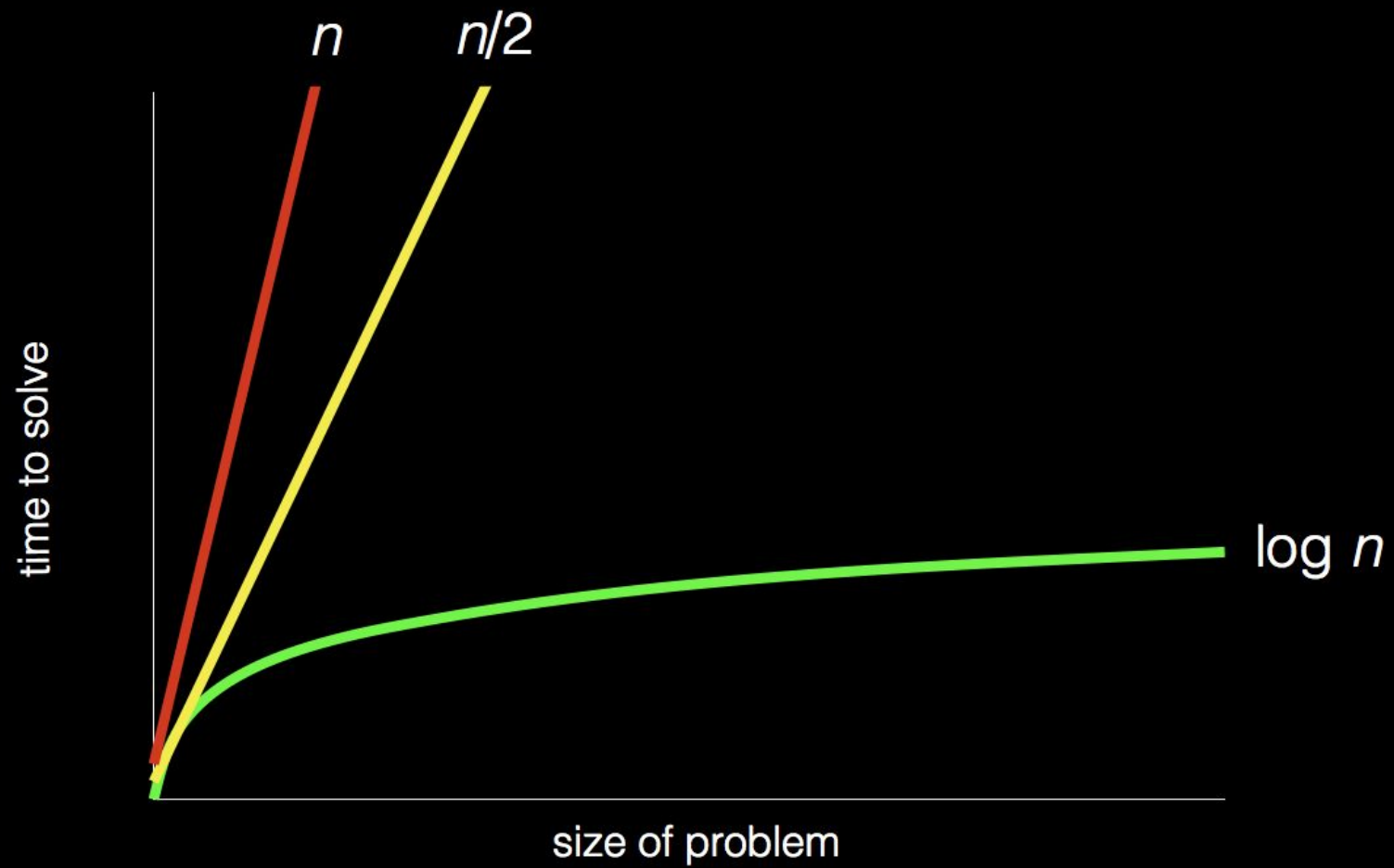

n
n/2
time to solve
size of problem


n
n/2
time to solve
size of problem


n
n/2
time to solve
size of problem


n
n/2
time to solve
size of problem


n
n/2
time to solve
size of problem


n
n/2
log n
time to solve
size of problem

pseudocode

```
1   Pick up phone book
2   Open to middle of phone book
3   Look at page
4   If Smith is on page
5       Call Mike
6   Else if Smith is earlier in book
7       Open to middle of left half of book
8       Go back to line 3
9   Else if Smith is later in book
10      Open to middle of right half of book
11      Go back to line 3
12  Else
13      Quit
```

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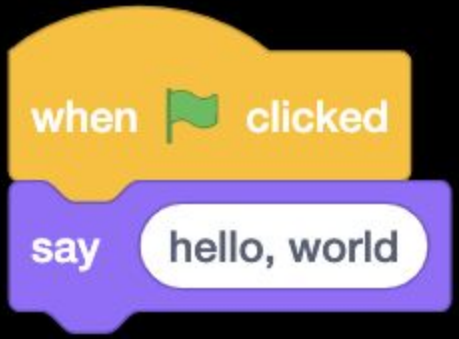
```

- functions
- conditions
- Boolean expressions
- loops

- functions
- conditions
- Boolean expressions
- loops
- variables
- threads
- events
- ...

```c
#include <stdio.h>

int main(void)
{
    printf("hello, world\n");
}
```


when clicked
say
hello, world

Code Costumes Sounds

Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks

Motion

move 10 steps
turn 15 degrees
turn 15 degrees

go to random position
go to x: 0 y: 0
glide 1 secs to random position
glide 1 secs to x: 0 y: 0

point in direction 90
point towards mouse-pointer

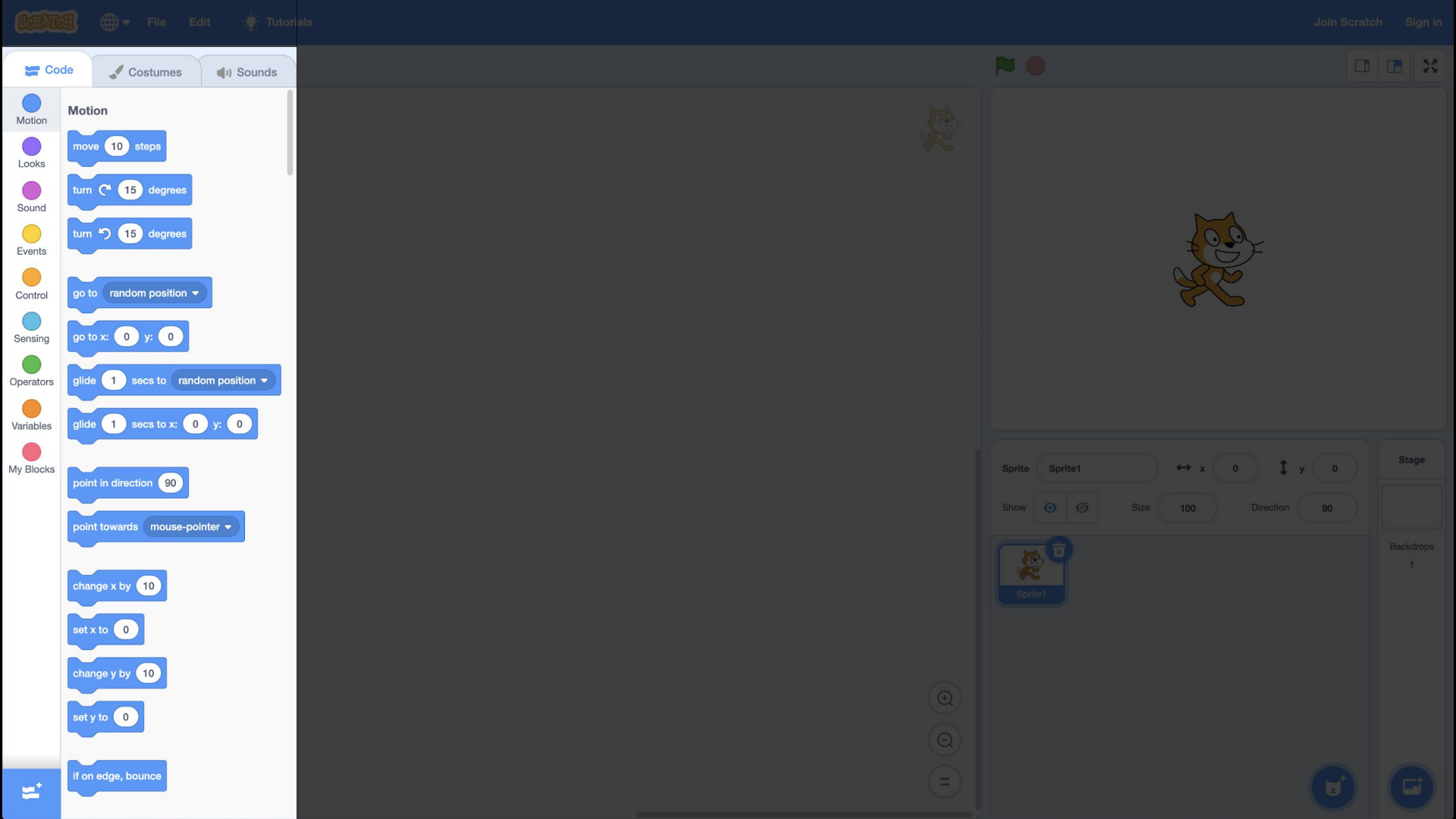
change x by 10
set x to 0
change y by 10
set y to 0

if on edge, bounce

Sprite Sprite1 x 0 y 0
Show Size 100 Direction 90


Sprite1

Stage
Backdrops 1


File
Edit
Tutorials
Join Scratch
Sign in
Code
Costumes
Sounds
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
Motion
move 10 steps
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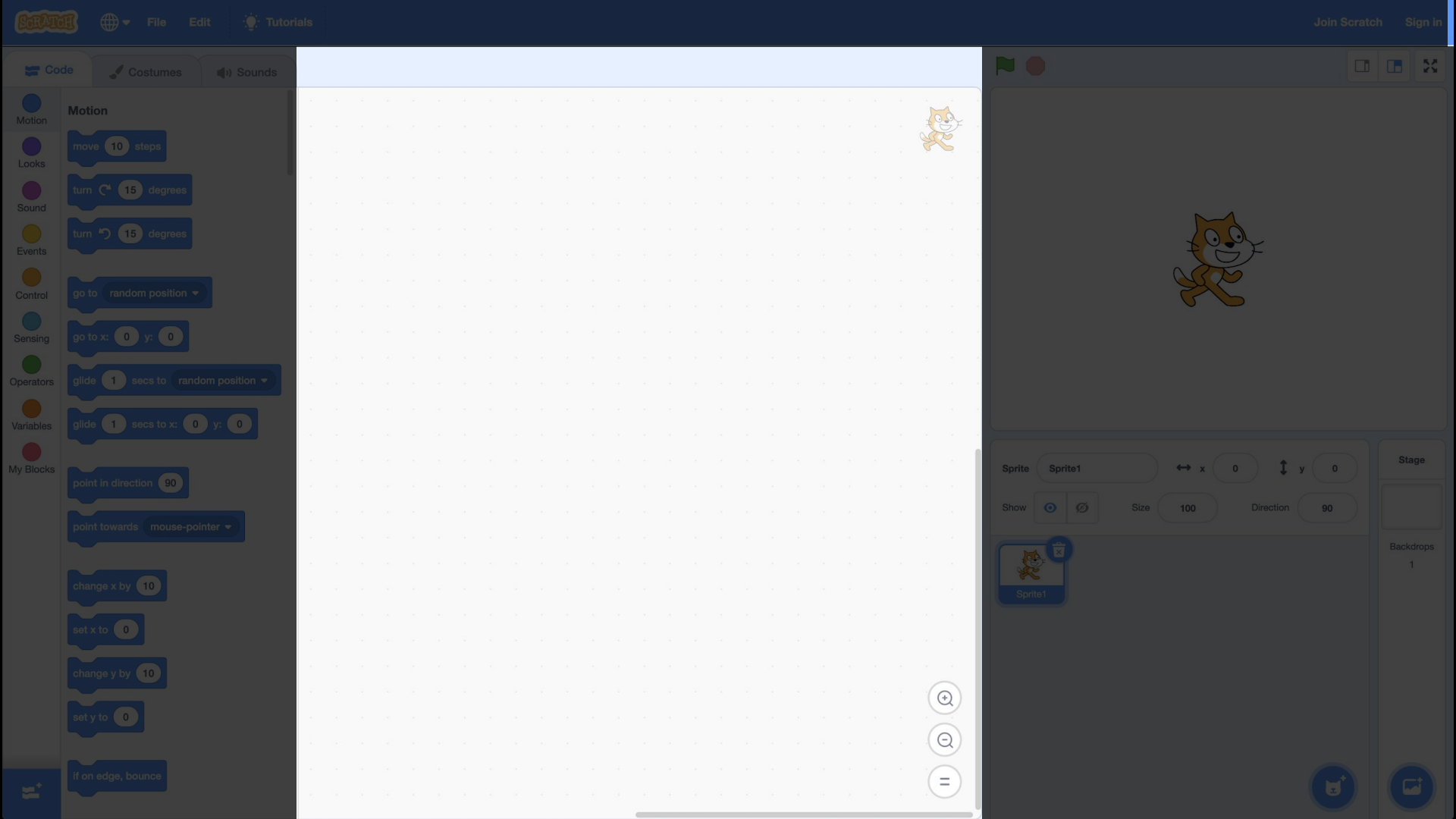
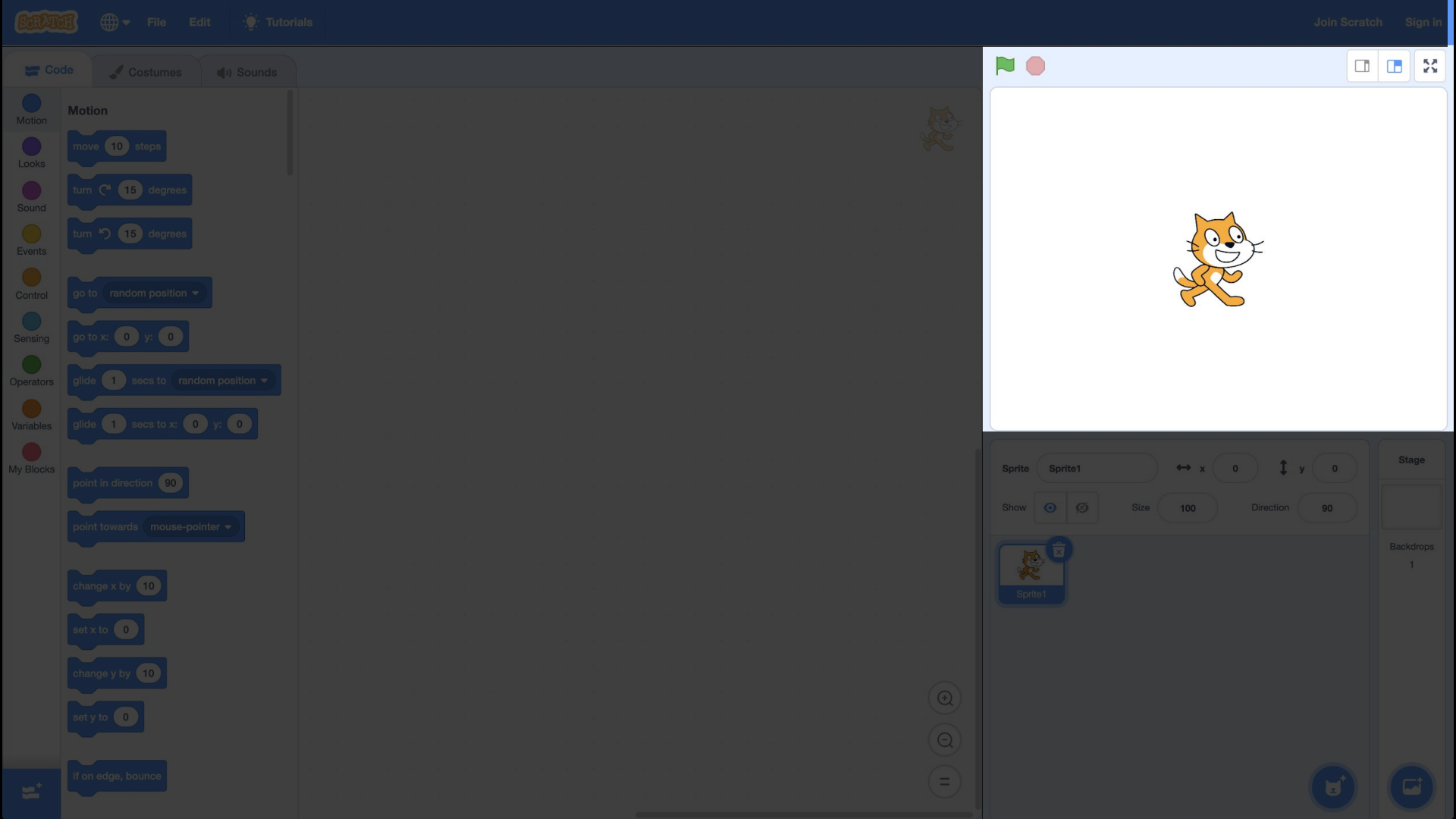
if on edge, bounce
Sprite
Sprite1
x
0
y
0
Show
Size
100
Direction
90
Stage
Backdrops
1
Sprite1


File
Edit
Tutorials
Join Scratch
Sign in
Code
Costumes
Sounds
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
Motion
move 10 steps
turn 15 degrees
turn 15 degrees
go to random position
go to x: 0 y: 0
glide 1 secs to random position
glide 1 secs to x: 0 y: 0
point in direction 90
point towards mouse-pointer
change x by 10
set x to 0
change y by 10
set y to 0
if on edge, bounce
Sprite
Sprite1
x 0
y 0
Show
Size 100
Direction 90
Stage
Backdrops 1


File
Edit
Tutorials
Join Scratch
Sign in
Code
Costumes
Sounds
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
Motion
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go to random position
go to x: 0 y: 0
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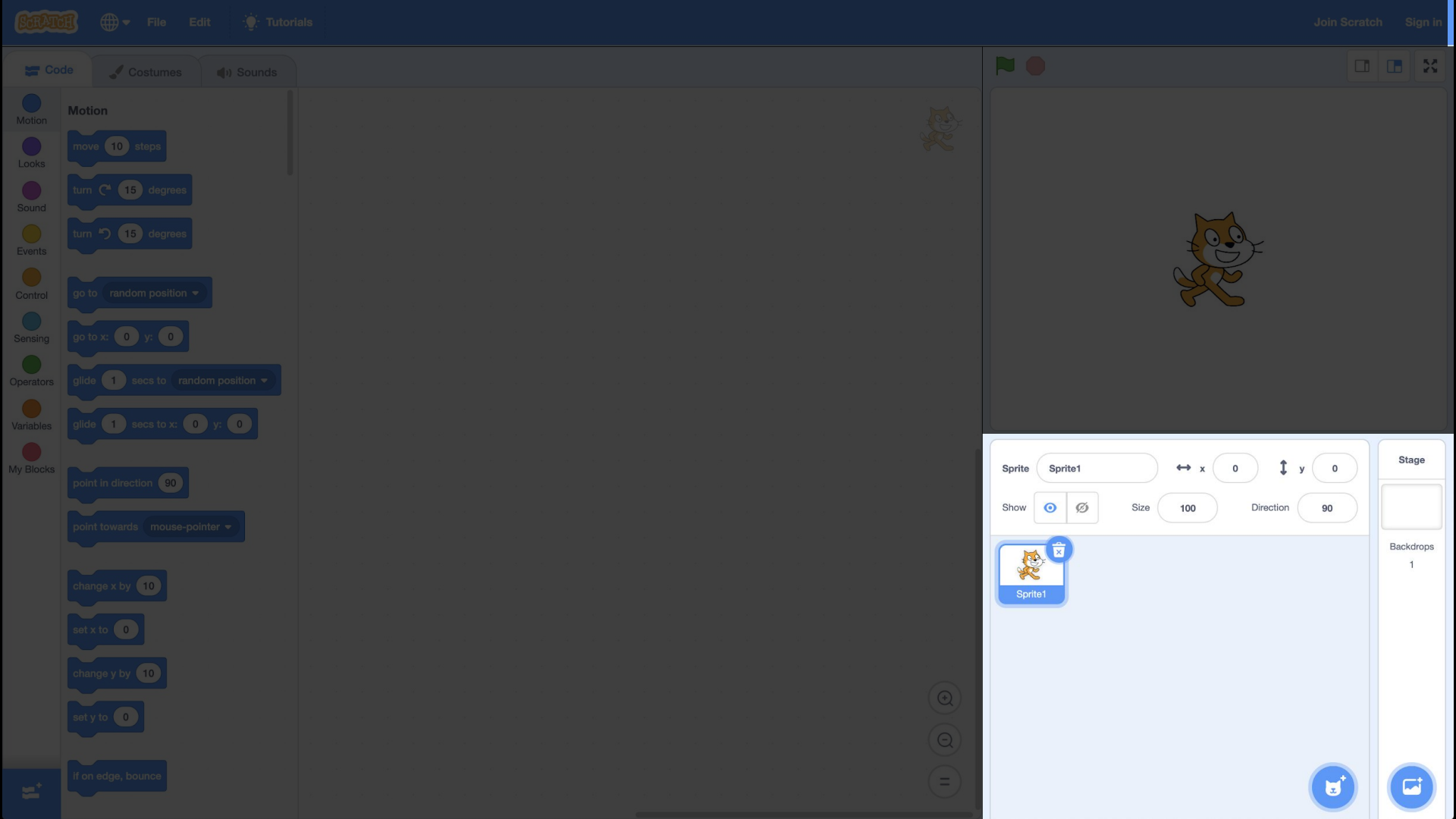
Sprite1
x
0
y
0
Show
Size
100
Direction
90
Stage
Backdrops
1


File
Edit
Tutorials
Join Scratch
Sign in
Code
Costumes
Sounds
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
Motion
move 10 steps
turn 15 degrees
turn 15 degrees
go to random position
go to x: 0 y: 0
glide 1 secs to random position
glide 1 secs to x: 0 y: 0
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Sprite
Sprite1
x
0
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Show
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100
Direction
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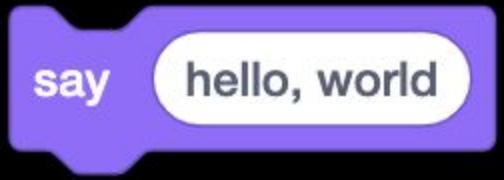
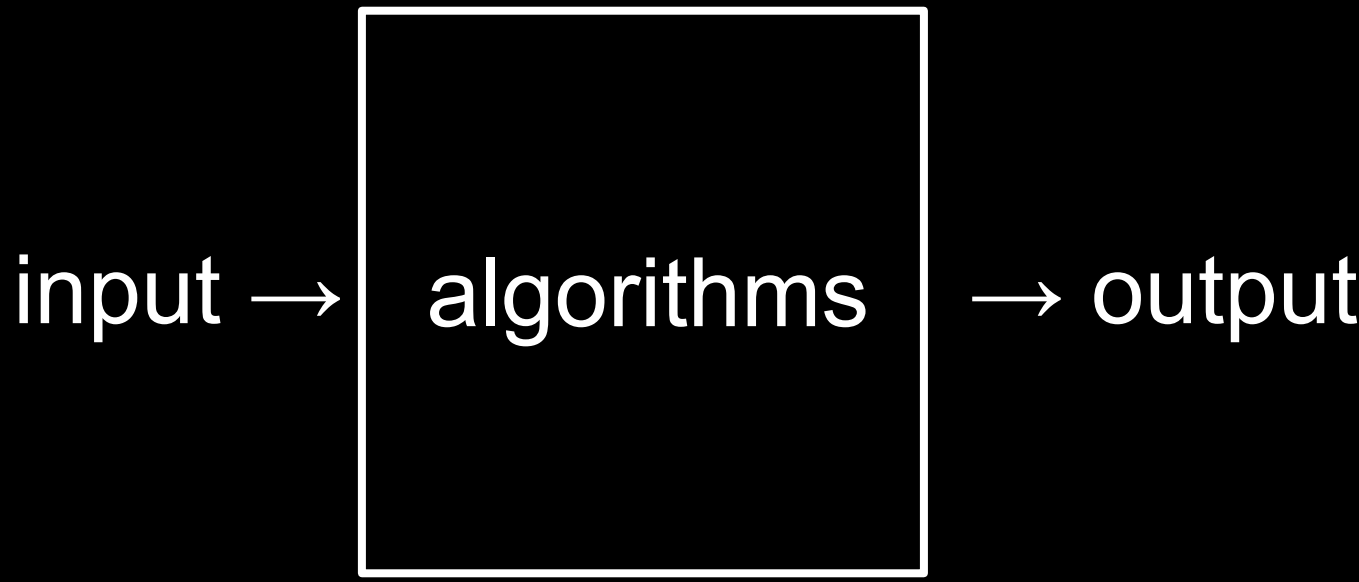
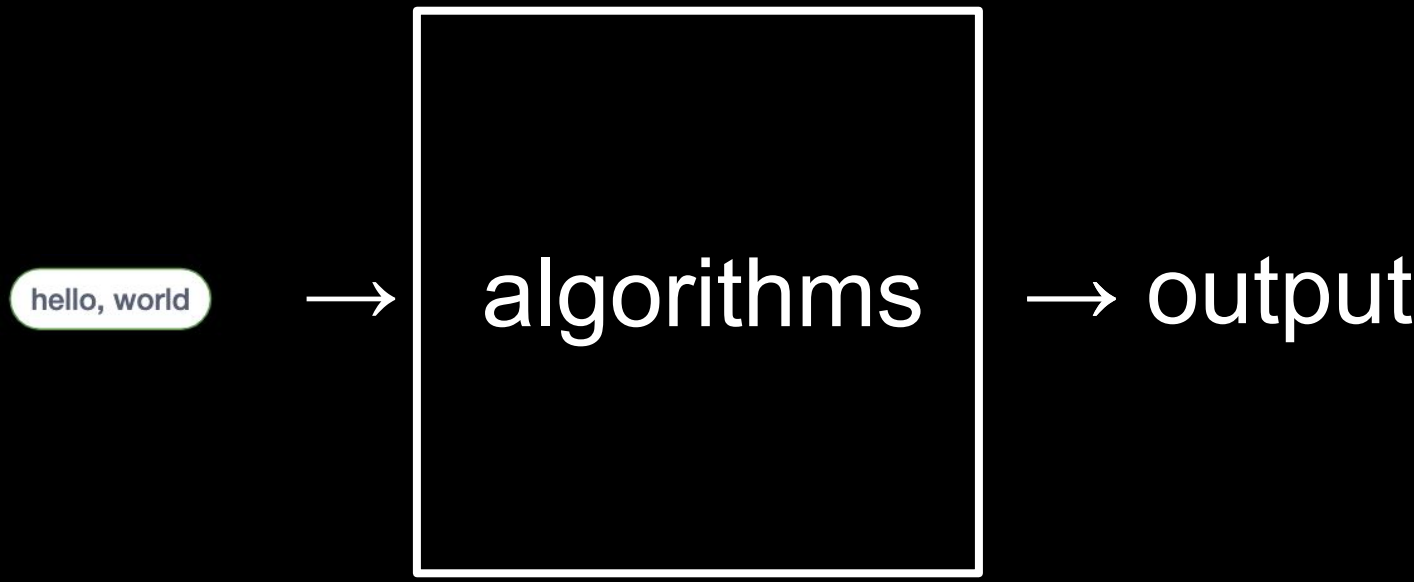
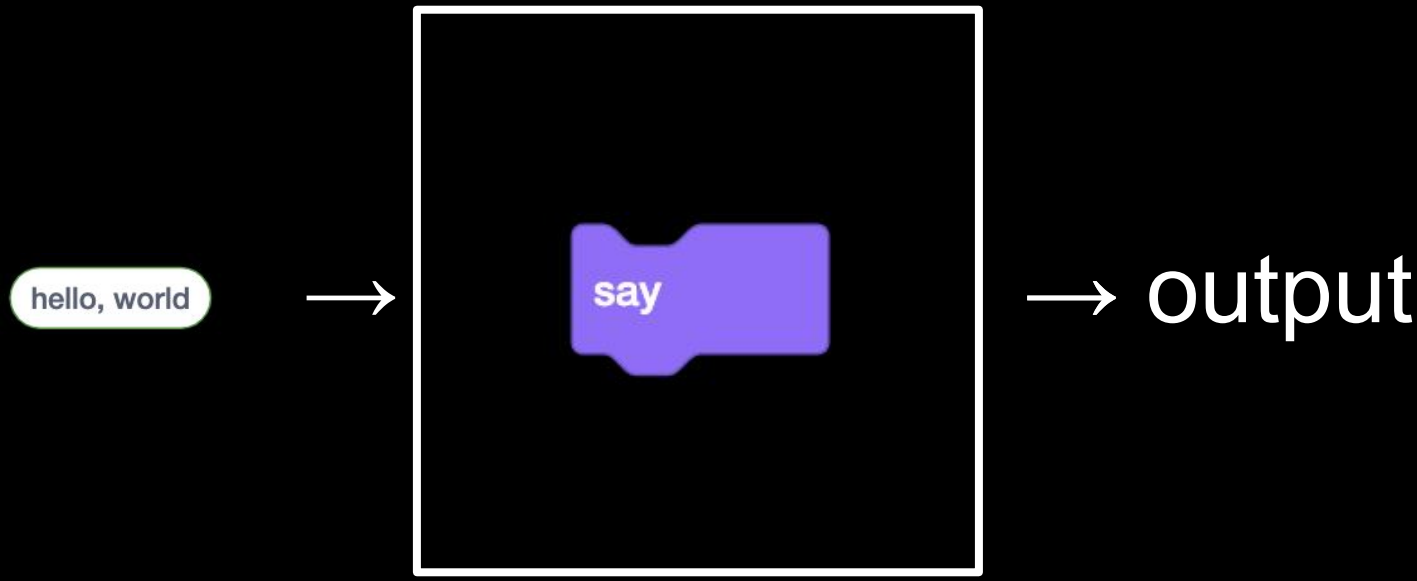
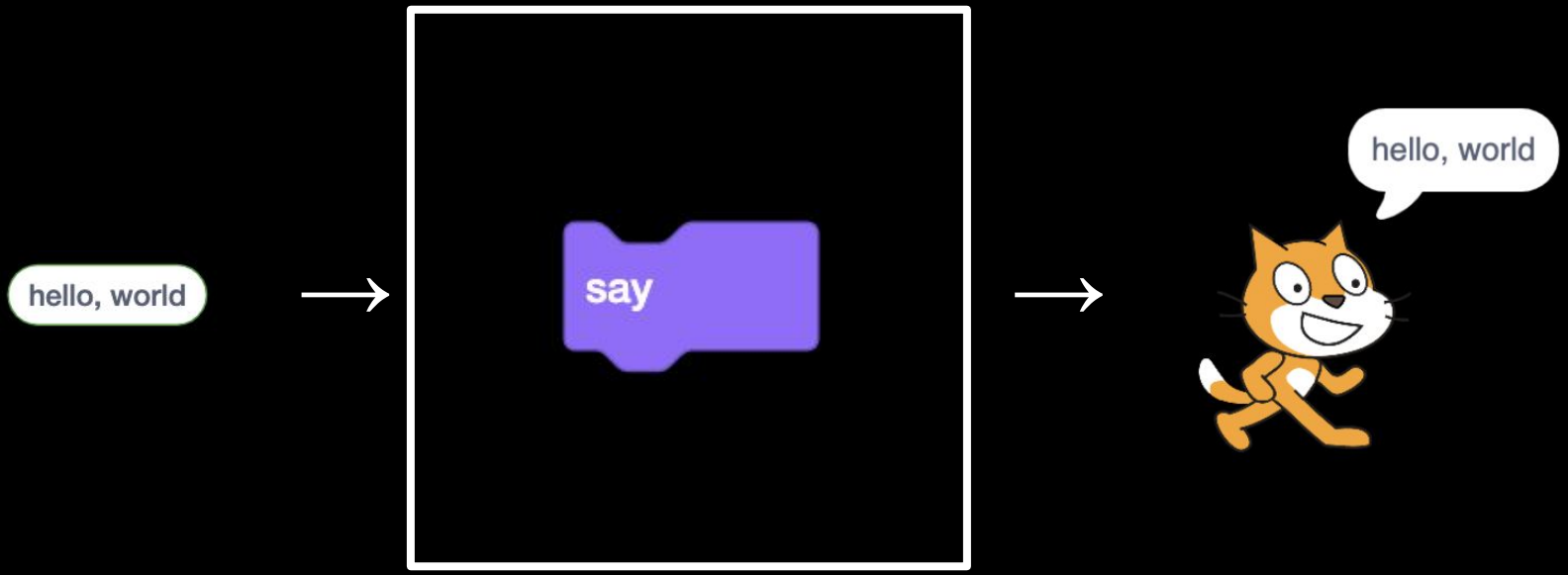
1

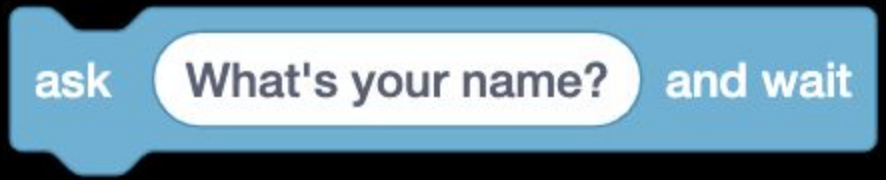

say
hello, world

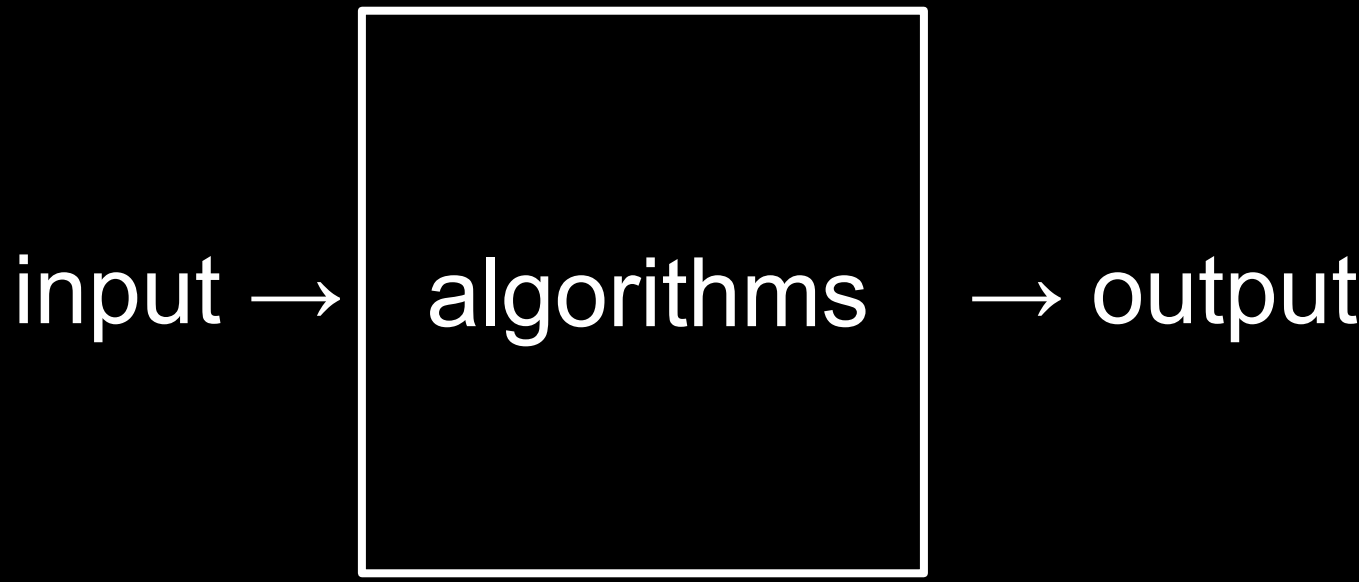

input →
algorithms
→ output

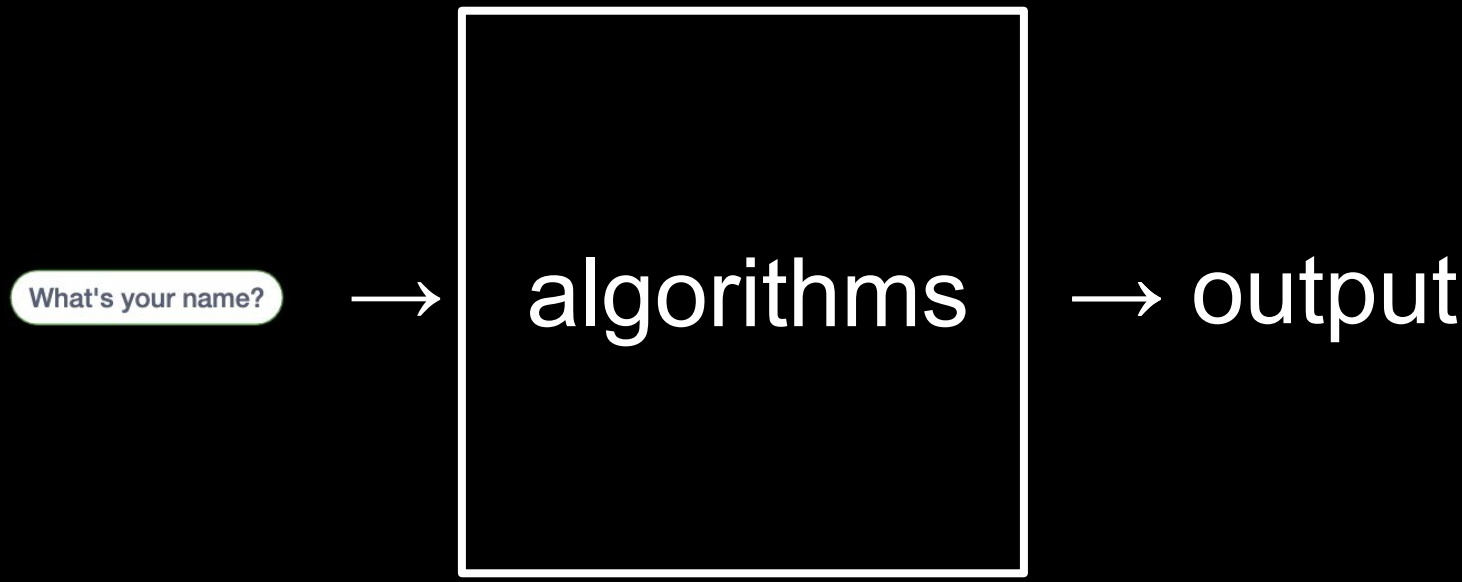

hello, world
algorithms
output

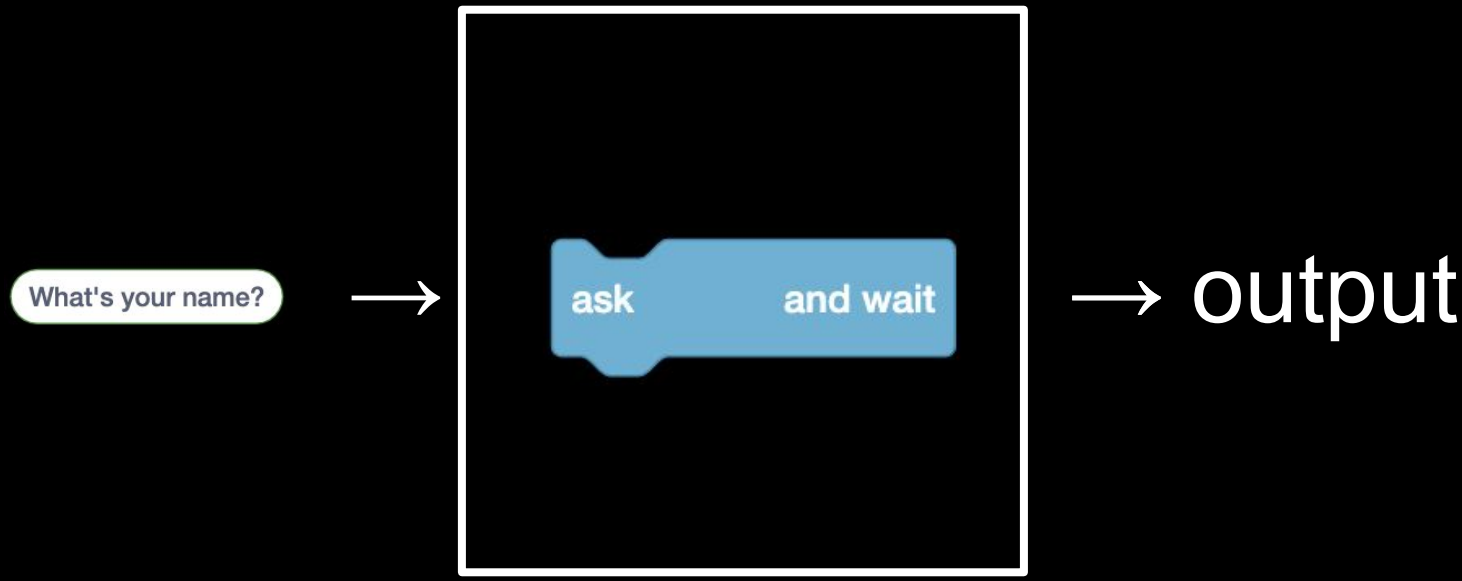

hello, world
say
output

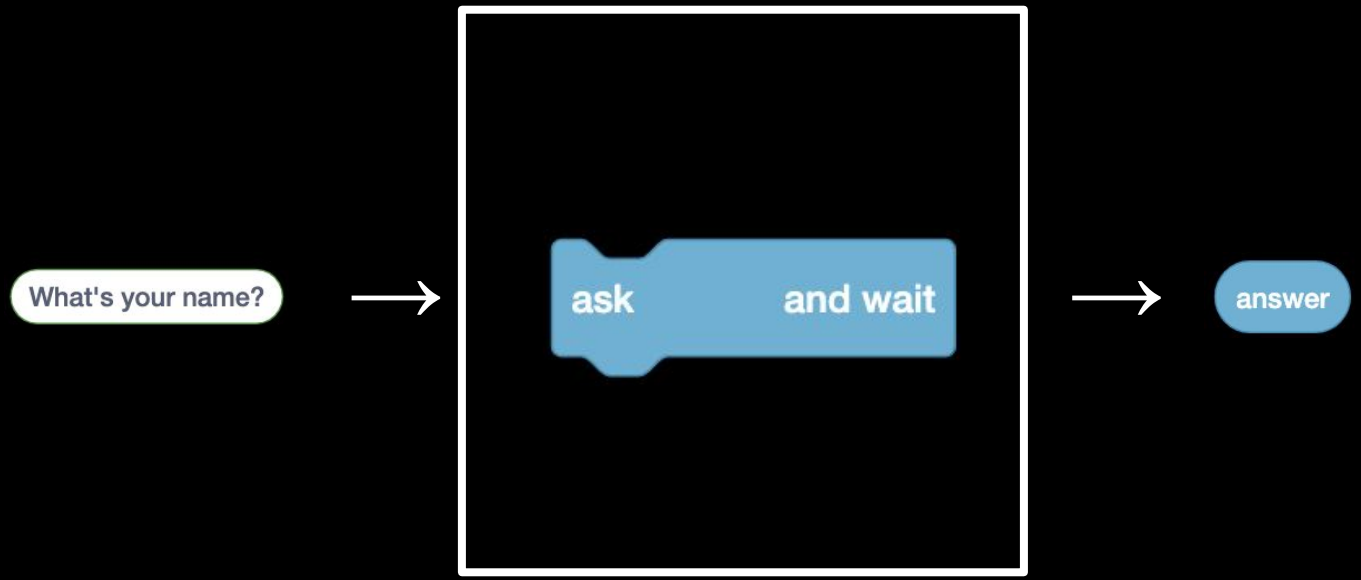

hello, world
say
hello, world

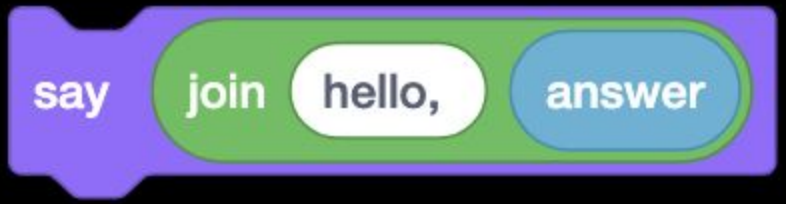

ask
What's your name?
and wait

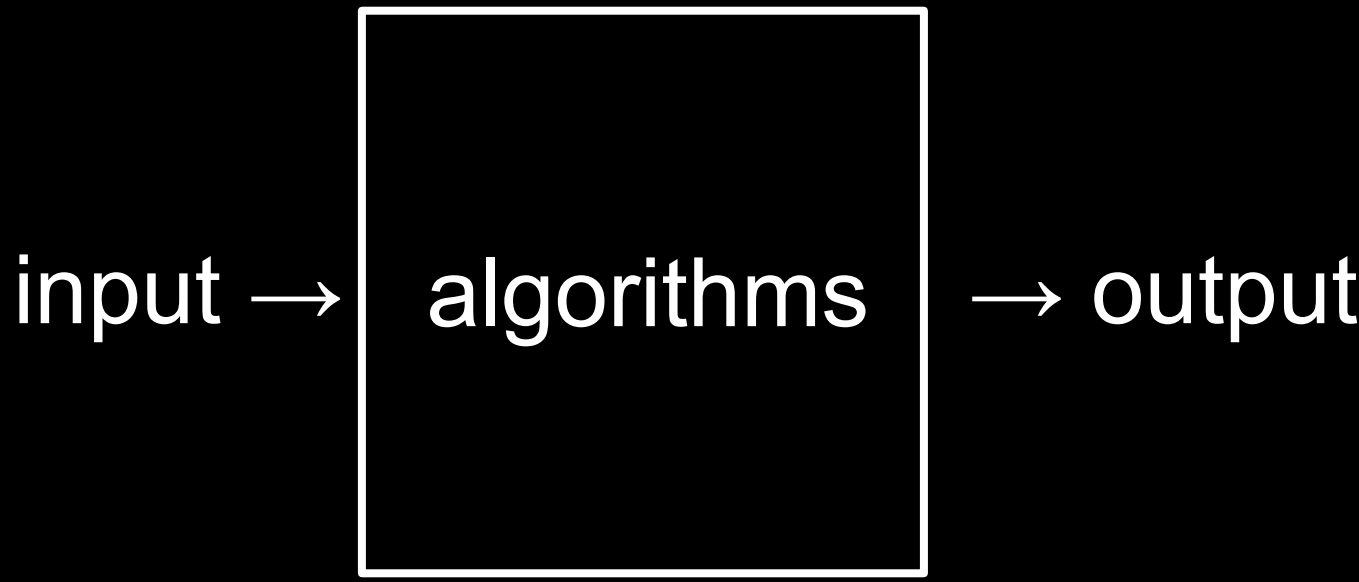

input →
algorithms
→ output

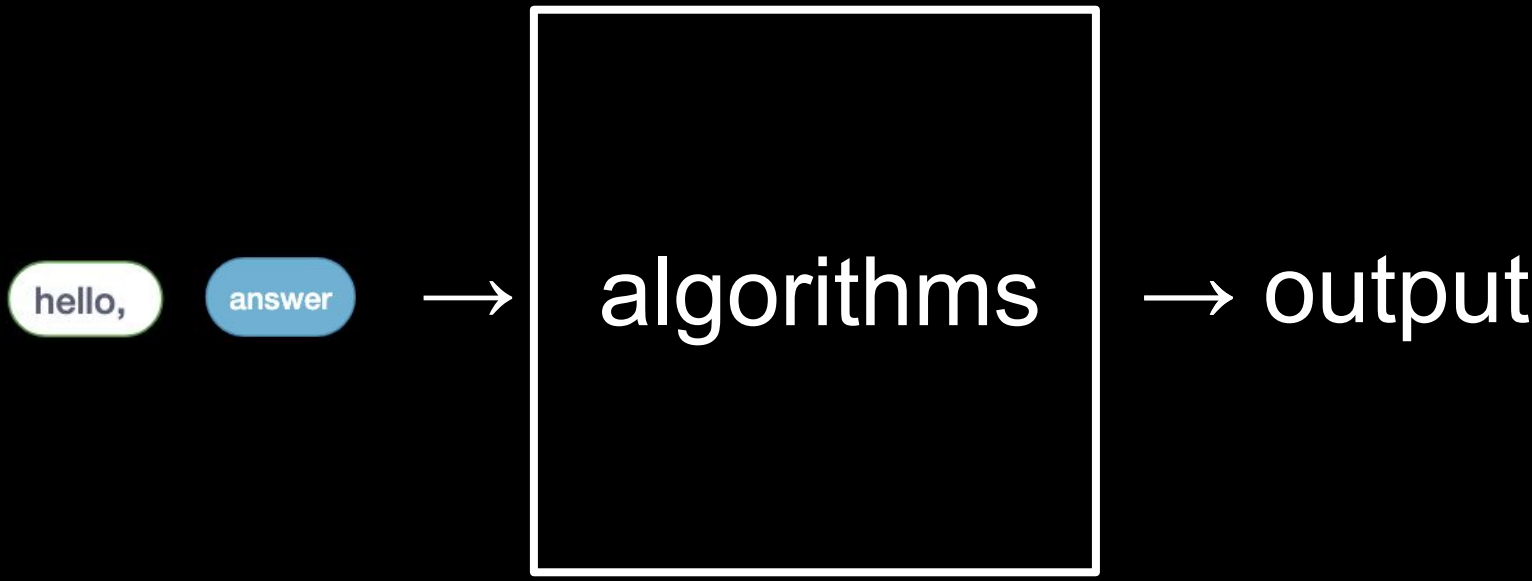

What's your name?
algorithms
output

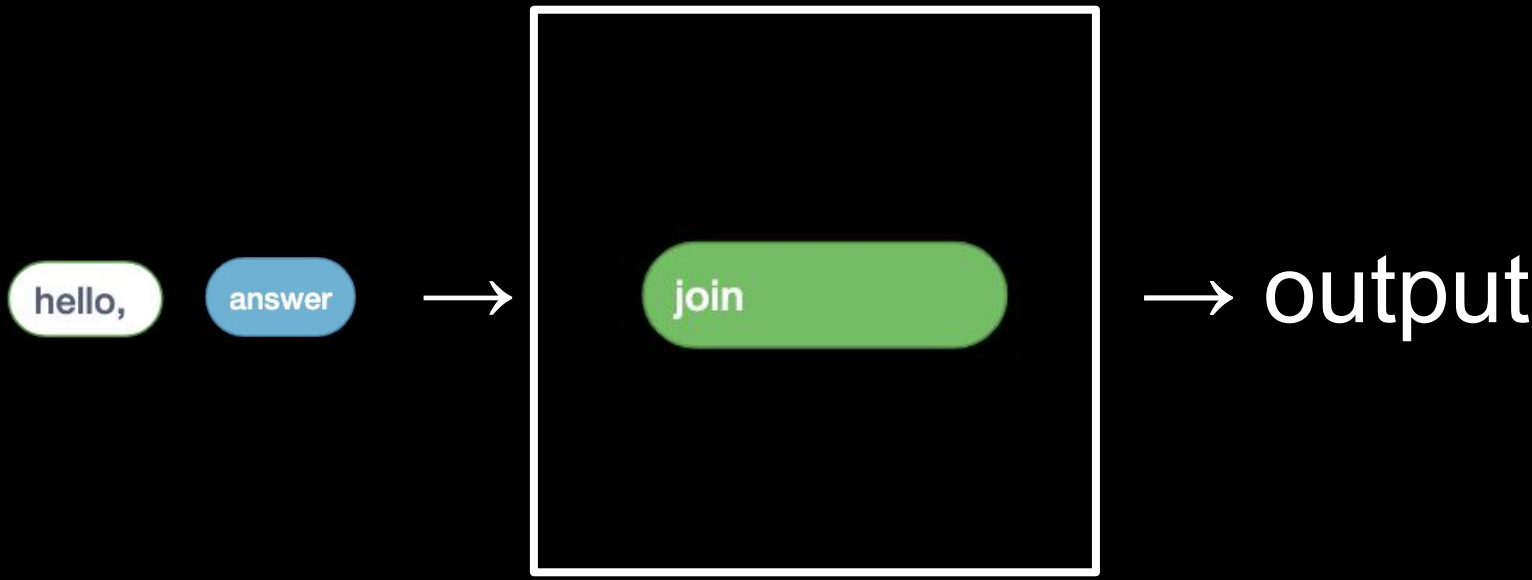

What's your name?
ask
and wait
output

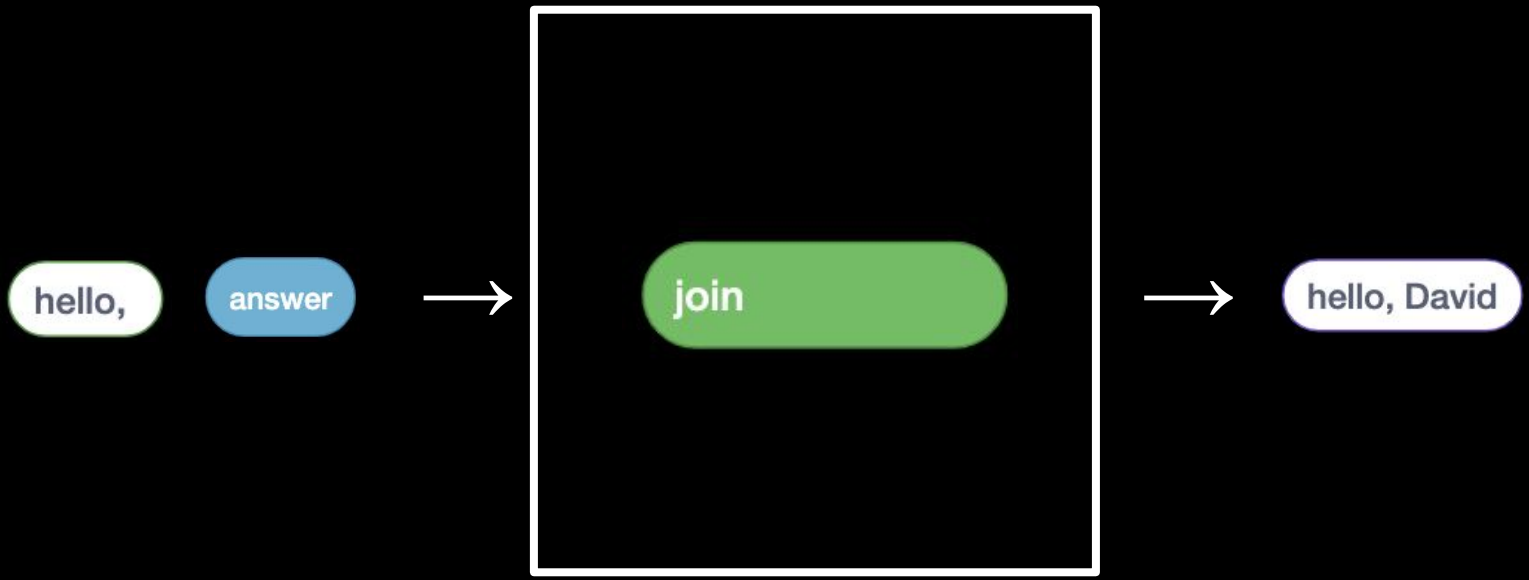

What's your name?
ask
and wait
answer


say
join
hello,
answer


input →
algorithms
→ output

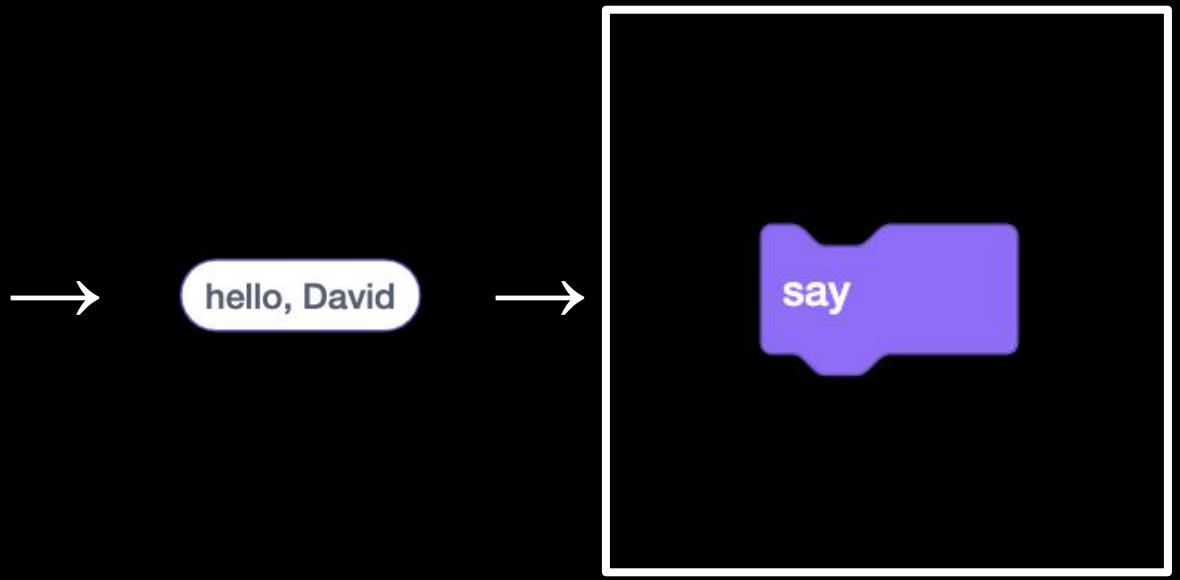

hello,
answer
algorithms
output


hello,
answer
join
output


hello,
answer
join
hello, David


hello, David


hello, David


hello, David
say


hello, David
say
hello, David

This is CS50