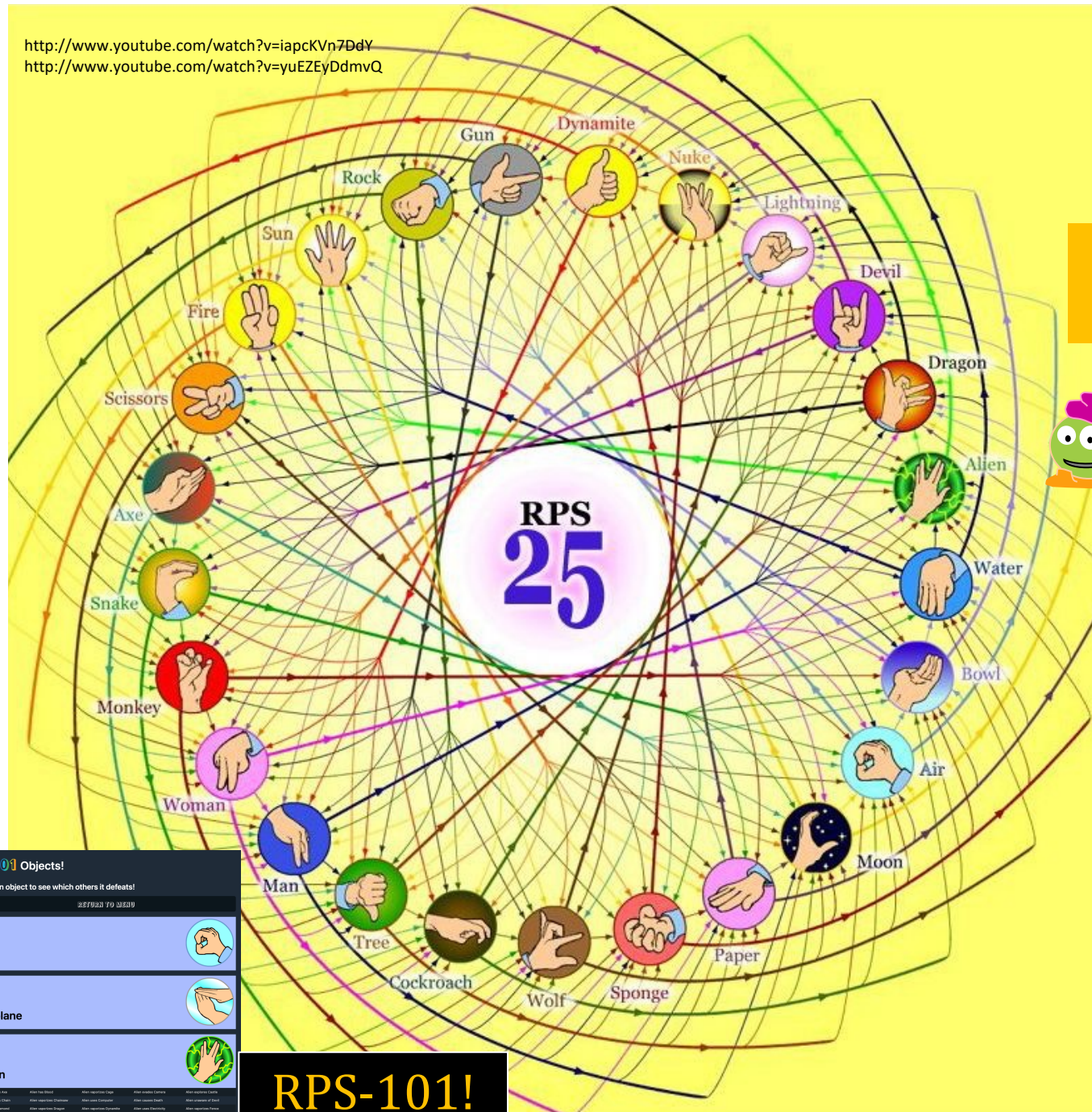


<http://www.youtube.com/watch?v=iapcKVn7DdY>
<http://www.youtube.com/watch?v=yuEZEyDdmvQ>



RPS-25 ?!

They call *that* an alien?



Spock *mind-melds* three-eyed aliens!



Provably.

All 101 Objects!

Click an object to see which others it defeats!

RETURN TO MENU

Air	
Airplane	
Alien	

RPS-101!

You've Got Mail!

I'm looking to make contact!



Class Survey!
GradeScope!

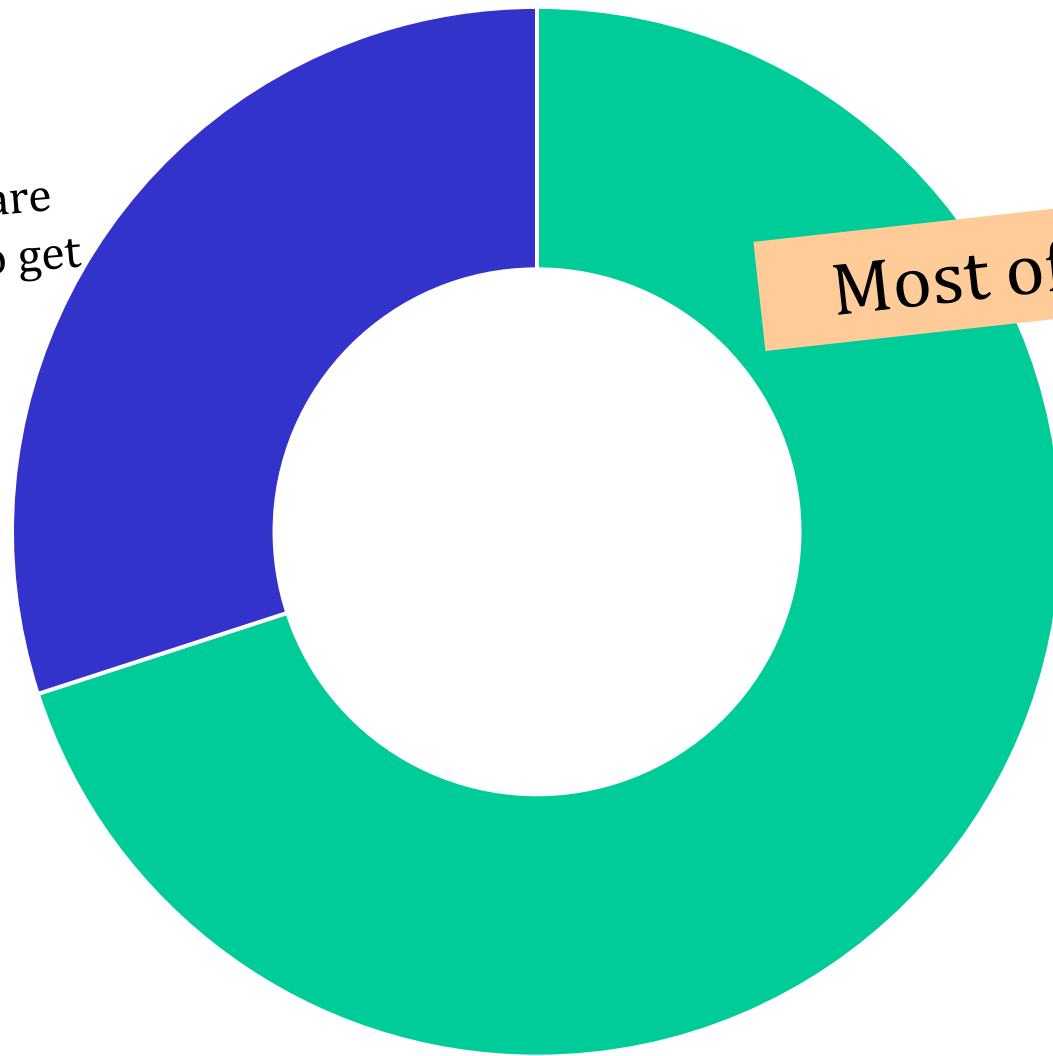
Piazza!

No message?
It was sent! Check
your SPAM folder!!



How Much Prior CS Experience?

If you do have experience there are still lots of ways to get a ton out of this course!



Most of you, None!

■ No Experience ■ Some Experience

Friday == Lab!

It's an experience!



plus, lots of other grutoring hours... (see page)

Lab lookback...

Lab's goal: Get things working
 Complete 25-50% of the hw

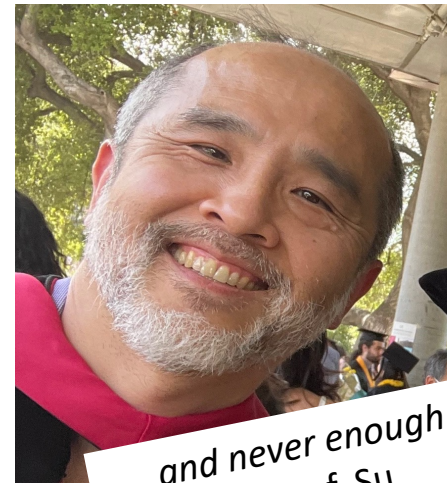
Nick's rule...

Finished with lab? OK! No *need* to stay longer

Watch
out!

```
print("And thirty is", int(factorial(4)+sqrt(4*4)+sqrt(4)), "!")
```

Four fours is ~
sometimes too many...
other times too few...



and never enough!
-- Prof. Su

"Online" help: *Piazza*...

CS 5: *Welcome!*

Administration

Using Python

Class Resources

Midterm

Final

GradeScope

CS5 Piazza

Grutoring!

Homework Assignments

for many questions,
Piazza is a great resource:

The screenshot shows the Piazza Q&A interface for CS5. The top navigation bar includes links for CS 5, Q & A, Resources, Statistics, and Manage Class. The user's name, Zachary Dodds, is displayed in the top right. The left sidebar shows a list of folders (polls, hw1, hw2, hw3, hw4) and a search bar. The main content area displays a post titled "Welcome to CS5's piazza site..." with a summary and details. The details section includes a rich text editor with various formatting options (bold, italic, list, link, image, code, etc.) and the following text: "Welcome, everyone! Piazza's discussion board allows _all_ of the (~70) tutors and graders and the (~280) students in cs5 to answer questions... . If you have a general question, post the question to the whole group (public) If you are asking about code that is your _solution_ to a problem, post it to the "Instructors" above (private) And - detailed coding questions are usually better handled in-person with the grutors!". A red arrow points to the "Q & A" link in the top navigation bar, and another red arrow points to the "this Q&A page" text overlay.

CS 5 Q & A Resources Statistics Manage Class

polls hw1 hw2 hw3 hw4

Unread Updated Unresolved Following

New Post Search or add a post...

DRAFTS

Welcome to CS5's piazza site...
<p>Welcome, everyone!</p> <p></p> <p>Piazza's discussion board allows _all_ of the (~70) tutors and graders and the (~280) students in cs5 to answer questions...

YESTERDAY

Private unzip/extract files 5:08PM
How to extract files from ConEmu folder? For Windows. I right clicked, and there is no "extract" option.. But.

Post to ☒ Entire Class ☐ Individual Student(s) / Instructor(s)

Select Folder(s) hw1 hw2 hw3 hw4 hw5 hw6 hw7 hw8 hw9 hw10 project exam logistics other

Your class is currently set to use default folders. Edit these folders via Manage Class page.

Summary (100 characters or less)
Welcome to CS5's piazza site...

Details
[use plain text editor](#)

Edit Insert View Format Table

B I [List Icons] [Link Icon] [Image Icon] [Code Icon] [Help]

code tt

Welcome, everyone!

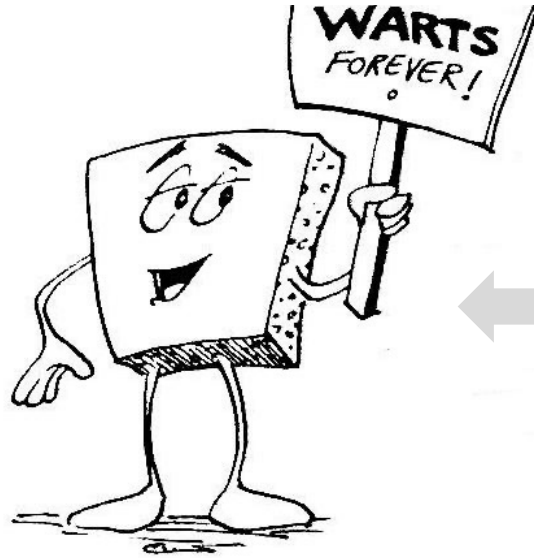
Piazza's discussion board allows _all_ of the (~70) tutors and graders and the (~280) students in cs5 to answer questions... .

If you have a general question, post the question to the whole group (public)

If you are asking about code that is your _solution_ to a problem, post it to the "Instructors" above (private)

And - detailed coding questions are usually better handled in-person with the grutors!

Welcome back to CS 5 !



Wally

Average of
these two?



Alien

Homework 0

due Tues. night (22:22:22)

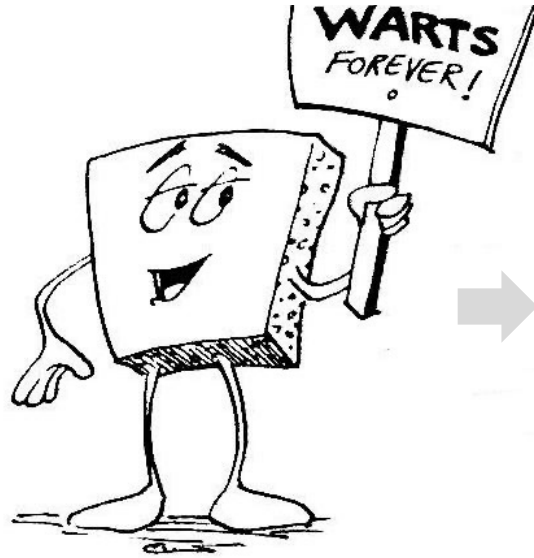
Problem 0: Reading + response...

Problem 1: Four-fours program: Can be done for lab...

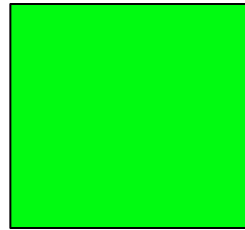
Problem 2: Rock-paper-scissors program (*Maybe* done already!)

Problems 3-4: Picobot! empty room (3) maze (4)

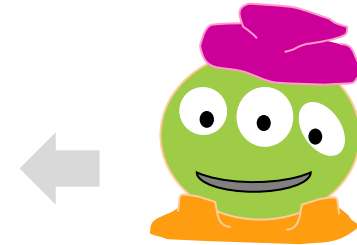
Welcome back to CS 5 !



Wally



Picobot!



Yes! I see the
resemblance

Alien

Homework 0

due Mon. night (10:42pm)

Problem 0: Reading + response...

Problem 1: Four-fours program: Can be done for lab...

Problem 2: Rock-paper-scissors program (*Maybe* done already!)

Problems 3-4: Picobot! empty room (3) maze (4)

Problem 0 ?

Typically, an article on CS or an application...

Submit a one-paragraph response { A few sentences that raise or address questions, using the article as a guide.

Small part (5 pts) {
5 – insightful, careful
4 – thoughtful
3 – complete, on topic
0-2 – less than complete

Does Your Language Shape How You Think?



This week's article might not seem like CS at first...

The New York Times

Magazine

Search All NYTimes.com

Go

ING DIRECT

[WORLD](#) [U.S.](#) [N.Y. / REGION](#) [BUSINESS](#) [TECHNOLOGY](#) [SCIENCE](#) [HEALTH](#) [SPORTS](#) [OPINION](#) [ARTS](#) [STYLE](#) [TRAVEL](#) [JOBS](#) [REAL ESTATE](#) [AUTOS](#)

and I thought my
language was *alien*!

Does Your Language Shape How You Think?



Seventy years ago, in 1940, a popular science magazine published a short article that set in motion one of the trendiest intellectual fads of the 20th century. At first glance, there seemed little about the article to augur its subsequent celebrity. Neither the title, “Science and Linguistics,” nor the magazine, M.I.T.’s Technology Review, was most people’s idea of glamour. And the author, a chemical engineer who worked for an insurance company and moonlighted as an anthropology lecturer at Yale University, was an unlikely candidate for international superstardom. And yet Benjamin Lee Whorf let loose an alluring idea about language’s power over the mind, and his stirring prose seduced a whole generation into believing that our mother tongue restricts what we are able to think.

The New York Times

Magazine

Search All NYTimes.com

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WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION ARTS STYLE TRAVEL JOBS REAL ESTATE AUTOS

Seventy years ago, in 1940, a popular

But then a remote Australian aboriginal tongue, Guugu Yimithirr, from north Queensland, turned up, and with it came the astounding realization that not all languages conform to what we have always taken as simply “natural.” In fact, Guugu Yimithirr doesn’t make any use of egocentric coordinates at all. The anthropologist John Haviland and later the linguist Stephen Levinson have shown that Guugu Yimithirr does not use words like “left” or “right,” “in front of” or “behind,” to describe the position of objects. Whenever we would use the egocentric system, the Guugu Yimithirr rely on cardinal directions. If they want you to move over on the car seat to make room, they’ll say “move a bit to the east.” To tell you where exactly they left something in your house, they’ll say, “I left it on the southern edge of the western table.” Or they would warn you to “look out for that big ant just north of your foot.” Even when shown a film on television, they gave descriptions of it based on the orientation of the screen. If the television was facing north, and a man on the screen was approaching, they said that he was “coming northward.”



believing that our mother tongue restricts what we are able to think.

The New York Times

Magazine

Search All NYTimes.com

ING DIRECT

WORLD U.S. NY

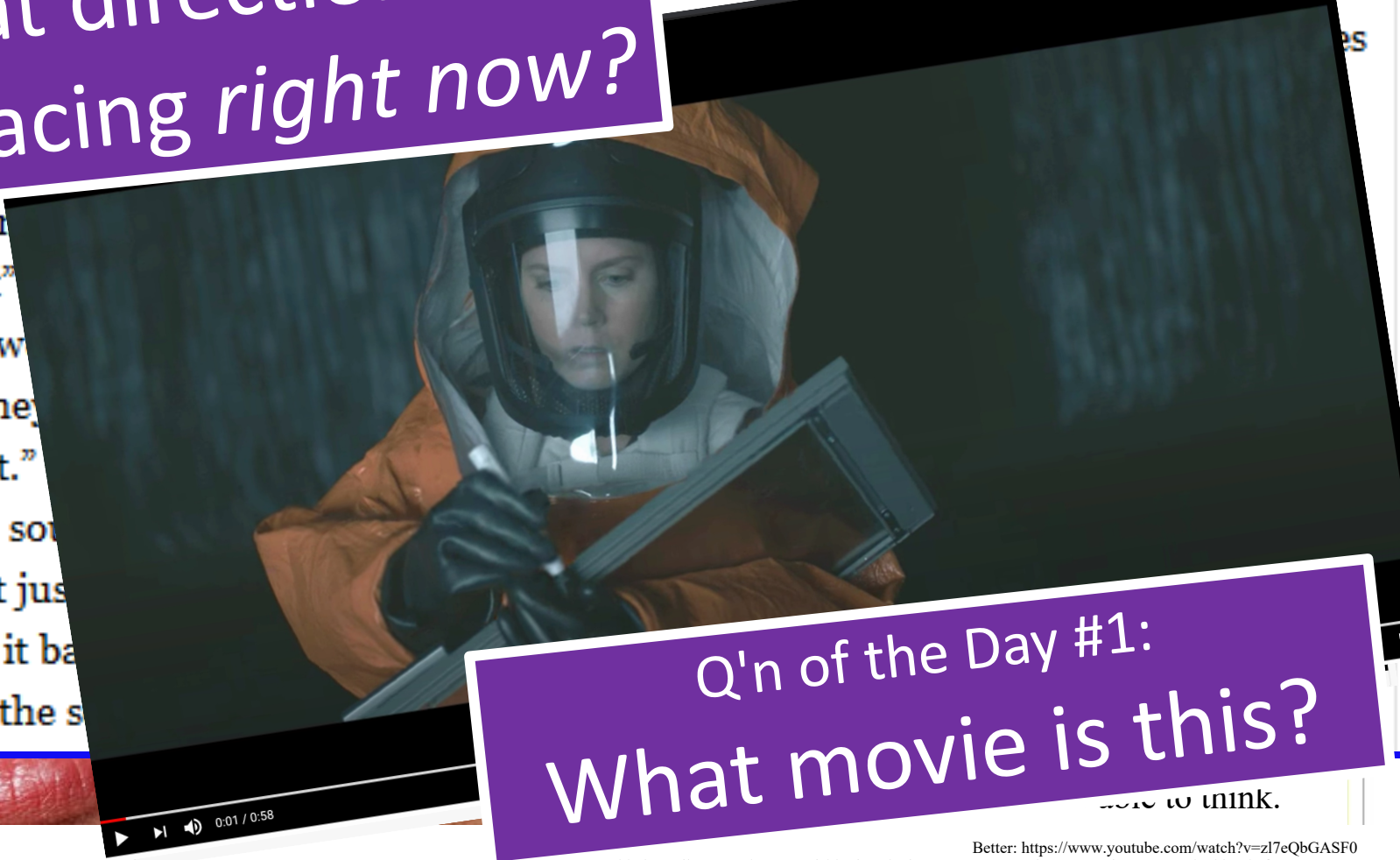
OPINION ARTS STYLE TRAVEL JOBS REAL ESTATE AUTOS

Seventy years ago, in 1940, a popular

Guugu Yimithim

Q'n of the Day #0:
What direction are
you facing *right now*?

and later the li
words like "left"
Whenever we w
directions. If the
a bit to the east."
"I left it on the so
for that big ant jus
descriptions of it ba
and a man on the s



Q'n of the Day #1:
What movie is this?

more to think.

The New York Times

Magazine

Search All NYTimes.com

Go

ING DIRECT

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION ARTS STYLE TRAVEL JOBS REAL ESTATE AUTOS

Seventy years ago, in 1940, a popular

But then a remote Australian aboriginal tongue, Guugu Yimithin, from Queensland, offers a different perspective on the world. It does not have words for "left" or "right." Whenever we would use these directions, if they were Guugu Yimithin, they would be "a bit to the east." To the Guugu Yimithin, "I left it on the south" for that big ant just described it based on descriptions of it based on a man on the screen.

Alien languages offer a lot of opportunity!!



...leaving that our mother tongue restricts what we are able to think.

Last time...

CS != Programming

What is CS?

CS is the study of **complexity**

How can **it** be done?

How well can **it** be done?

Can **it** be done at all?

CS's 6 big questions are here.

But only one is **programming**.
Do you see which?

Can you solve this problem? **CS**

Can you create a process to solve such problems?
programming + CS

How quickly can you find solutions? **CS**

Do you have the "best" solution? **CS**

Is every problem solvable? **CS**

Is there a way to tell?
There isn't always! **CS**

Last time...

A Big Idea

Information ^(simple)
+ Rules

Composition
Complexity

What *is* programming ?

Programming as recipe-writing

VS.

Programming as learning a foreign language

1) Expect it to be different!

Baggage!

2) Practice, not memorization!

3) Immerse == Experiment!

**What about the *Python*
programming language ?**

The *foreign language* of python...

syntax

How it looks

semantics

What it does

intent

What it should do



The *foreign language* of python...

syntax

How it looks

semantics

What it does

intent

What it should do



```
user = input("Choose your weapon: ")
comp = random.choice(['rock', 'paper', 'scissors'])
print()

print('The user (you) chose', user)
print('The computer (I) chose', comp)
print()

if user == 'rock' and comp == 'scissors':
    print('Ha! I actually chose paper, which annihilates your rock.')

elif user == 'rock' and comp == 'paper':
    print('I won! Your rock is d

print("Better luck ne.
```

This program should play RPS "appropriately."

The *foreign language* of python...

syntax

How it looks

semantics

What it does

intent

What it should do

```
user = input("Choose your weapon: ")
comp = random.choice(['rock', 'paper', 'scissors'])
print()

print('The user (you)   chose', user)
print('The computer (I) chose', comp)
print()

if user == 'rock' and comp == 'scissors':
    print('Ha! I actually chose paper, which annihilates your rock.')

elif user == 'rock' and comp == 'paper':
    print('I won! Your rock is d

print("Better luck ne.
```

*human-
desired
result*

**This program should play
RPS "appropriately."**

The *foreign language* of python...

syntax

How it looks

semantics

What it does

intent

What it should do



```
In [12]: cd Desktop
/Users/summer22/Desktop

In [13]: run hw0pr2rps.py

In [14]: rps()
Choose your weapon: rock
```

```
The user (you)   chose rock
The computer (I) chose scissors
```

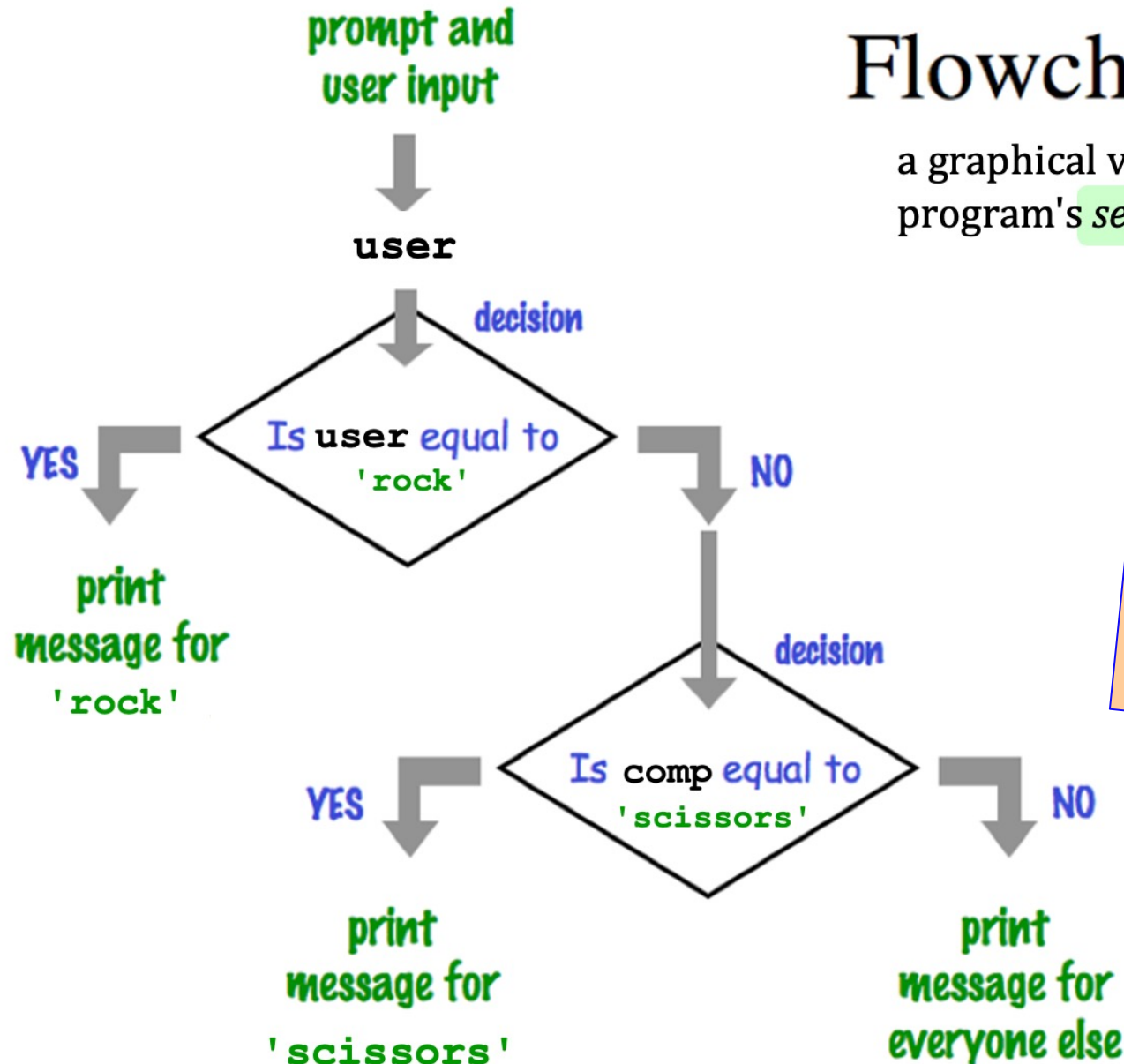
```
Ha! I actually chose paper, which annihilates your rock.
Better luck next time...
```

```
In [15]: █
```

**machine-
produced
output**

Flowchart...

a graphical view of a program's *semantics*



machine-produced output



The *foreign language* of python...

syntax

How it looks



semantics

What it does

intent

What it should do



How
Python
looks!

- how punctuation is used
- the language keywords used
- use of whitespace
- peculiarities of formatting
- how behavior is affected ...

The *foreign language* of python...

syntax

How it looks



**human-
typed
input**

semantics

does

intent

What it should do



How
Python
looks!

- how punctuation is used
- the language keywords used
- use of whitespace
- peculiarities of formatting
- how behavior is affected ...

The *challenge* of programming...

Look deep into my eyes...



syntax

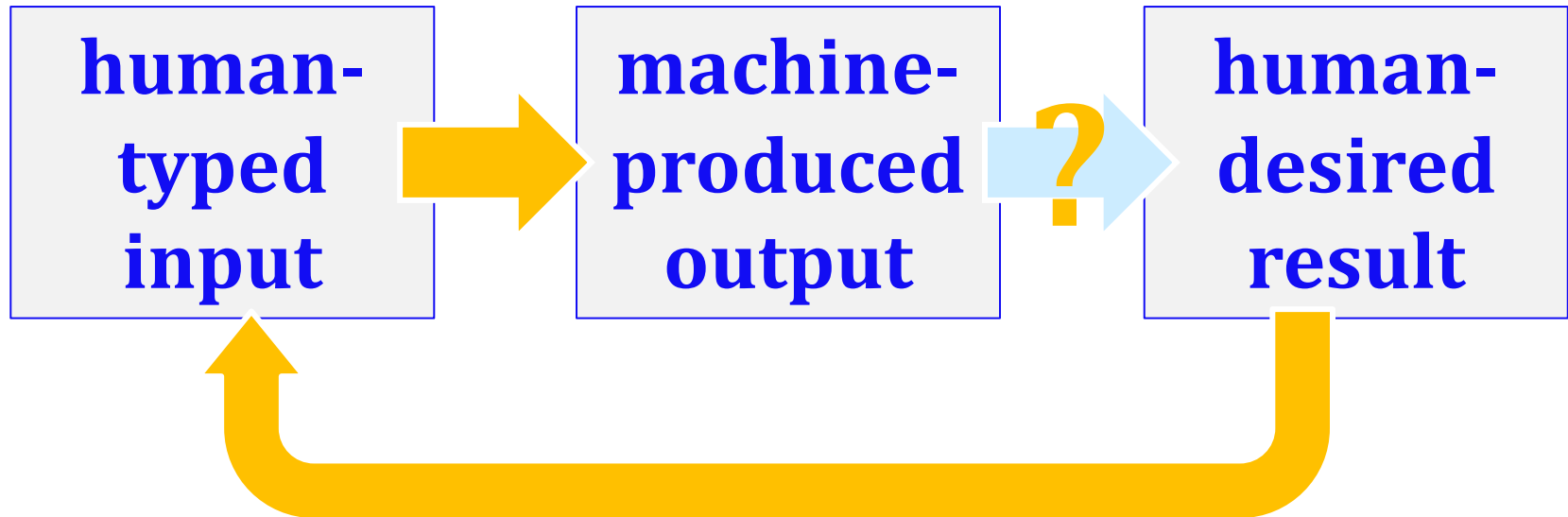
How it looks

semantics

What it does

intent

What it should do



How we learn...

~~High Level Principles?~~

Concrete Examples!

hw0pr2rps: *RPS...*

Solarized Light
Abyss
Beautiful Dracula Darker

A function!

```
1  #
2  # hw0pr2rps.py
3  #
4
5  import random          # imports the library named random
6
7  def rps():
8      """This plays a game of rock-paper-scissors
9          (or a variant of that game)
10         Arguments: none      (prompted text doesn't count as an argument)
11         Results: none       (printing doesn't count as a result)
12         """
13         user = input("Choose your weapon: ")
14         comp = random.choice(['rock', 'paper', 'scissors'])
15         print()
16
17         print('The user (you) chose', user)
18         print('The computer (I) chose', comp)
19         print()
20
21         if user == 'rock' and comp == 'scissors':
22             print('Ha! I actually chose paper, which annihilates your rock.')
23
24         elif user == 'rock' and comp == 'paper':
25             print('I won! Your rock is dust!')
26
27         print("Better luck next time...")
```

human choices!

random choices!

all the syntax that creates the
semantics (that you intend!)

"Quiz!"

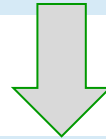
Name(s) _____

(we need to find your name on the roster!)

(1) Find and correct as many errors as you can in this code:

```
import random
```

(2) This one line does *three* things... what are they?



```
user = input( "Choose your weapon! " )
```

```
comp = random.choice( ['rock', 'paper', 'scissors'] )
```

```
print('user (you) chose:', user)
```

```
print('comp (me!) chose:', comp)
```

```
if user == 'rock' and comp == 'paper':
```

```
    print('The result is, YOU LOSE.')
```

```
    print('unless you're a CS5 grader, then YOU WIN :)')
```

try to use one word for each step!

(a) Prints

(b) Red text

(c) Stores / sets

JD

python list

index
is green

Syntax challenge!

(1) Find and correct as many errors as you can here...

(2) This line is doing **three** things... what are they?

import random

set-equals always uses
ONE equals sign

user = **input**("Choose your weapon! ")

comp = **random.choice**(['rock', 'paper', 'scissors'])

print('user (you) chose:', **user**)

print('comp (me!) chose:', **comp**)

if **user** == 'rock' **and** **comp** == 'paper':

test-equals uses
TWO equals signs

'rock' is a string,
not a variable

test-equals

The comma prints a space and
does NOT go to the next line.

a colon starts a new block

print('The result is, YOU LOSE.')

matching parenthesis!

print('unless you're a CS5 grader, then YOU WIN! :)')

flattering - or flouting -
graders is encouraged!

there's one more left...

every block of code must line up!

every
block of
code must
line up!

using one
word for
each step!

(a) prints!

(b) gets!!

(c) sets!!!

(a) prints the "weapon" prompt
(b) gets user's input from the kbd
(c) assigns that input to the variable user

match brackets, parens and
single/double quotes !

Syntax challenge!

(1) Find and correct as many errors as you can here...

(2) This line is doing **three** things... what are they?

import random

set-equals always uses
ONE equals sign

user = **input**("Choose your weapon! ")

comp = **random.choice**(['rock', 'paper', 'scissors'])

print('user (you) chose:', **user**)

user is a
variable, not
a string!

print('comp (me!) chose:', **comp**)

match brackets, parens and
single/double quotes !

test-equals uses
TWO equals signs

'rock' is a string,
not a variable

test-equals

The comma prints a space and
does NOT go to the next line.

if **user** == 'rock' **and** **comp** == 'paper':

a colon starts a new block

print('The result is, YOU LOSE.')

matching parenthesis!

print('unless you\'re a CS5 grader, then YOU WIN! :)')

a backslash handles special characters

flattering - or flouting -
graders is encouraged!

every block of code must line up!

every
block of
code must
line up!

using one
word for
each step!

(a) prints!

(b) gets!!

(c) sets!!!

(a) prints the "weapon" prompt
(b) gets user's input from the kbd
(c) assigns that input to the variable user

`print("how we'd print a single quote!")`

Syntax challenge!

(1) Find and correct as many
errors as you can...

they?

' prompt
the kbd
ble user

ns and
notes !

:) ')

attering - or flouting -
graders is encouraged!

Pass 'em to your right!
(take a photo, if you'd like!)

"End of the line>" if you can grab, stack and pass forward: Thank you!!!

every block of code must line up!

every
block of
code must
line up!

```
print("how we'd print a single quote!")
```

hw0pr2if: Interactive Fiction ☺

Create a short text-adventure in Python...

Use at least five control structures with decisions: (if/elif/else)

Use lists, strings, and dictionaries as you like ... not required ...

We look forward to adventuring!

hw0pr2if.py ×

hw0pr2if.py > ...

```
13 import time
14
15 def adventure():
16     """This function runs one session of interactive fiction.
17     It's a digital journey in search of the Algorithmic Artifact.
18     Arguments: no arguments (prompted text doesn't count as an argument)
19     Results: no results (printing doesn't count as a result)
20     """
21     delay = 0.0 # change to 0.0 for testing or speed runs, larger for dramatic effect!
22
23     user_name = input("What shall I call you, brave code seeker? ")
24
25     print()
26     print("Welcome,", user_name, "to the Virtual Realm, a domain")
27     print("of bytes and bits, algorithms and AI!")
28     print()
29
30     print("Your quest: To locate and secure the Algorithmic Artifact, a code")
31     print("said to enhance AI understanding beyond our wildest dreams!")
32     print()
33     ai_choice = input("Which AI model do you admire most? ")
```

PROBLEMS TERMINAL PORTS DEBUG CONSOLE OUTPUT

```
○ [melissa@yuki ...into-lectures/Lectures/temp]$ ipython
Python 3.12.1 (main, Dec 8 2023, 18:57:37) [Clang 14.0.3 (clang-1403.0.22.14.1)]
Type 'copyright', 'credits' or 'license' for more information
IPython 8.20.0 -- An enhanced Interactive Python. Type '?' for help.
```

```
In [1]: run hw0pr2if.py
```

```
In [2]: adventure()
What shall I call you, brave code seeker? Melissa
```

```
Welcome, Melissa to the Virtual Realm, a domain
of bytes and bits, algorithms and AI!
```

```
Your quest: To locate and secure the Algorithmic Artifact, a code
said to enhance AI understanding beyond our wildest dreams!
```

```
Which AI model do you admire most? gpt
Ah, a choice showing deep insight into language models!
```

```
Onward to the quest!
```

What *is* programming ?



It's an adventure!

Another language!

Let's ***not only*** add another language...

... ***but also*** make it ***half the hw!***



*Even with three eyes, I
must be misreading this!*

Last time...

A Big Idea

Information ^(simple)
+ Rules

Composition
Complexity

Another language *already*?

Python

General-purpose language

you might see
50% by the end
of the term

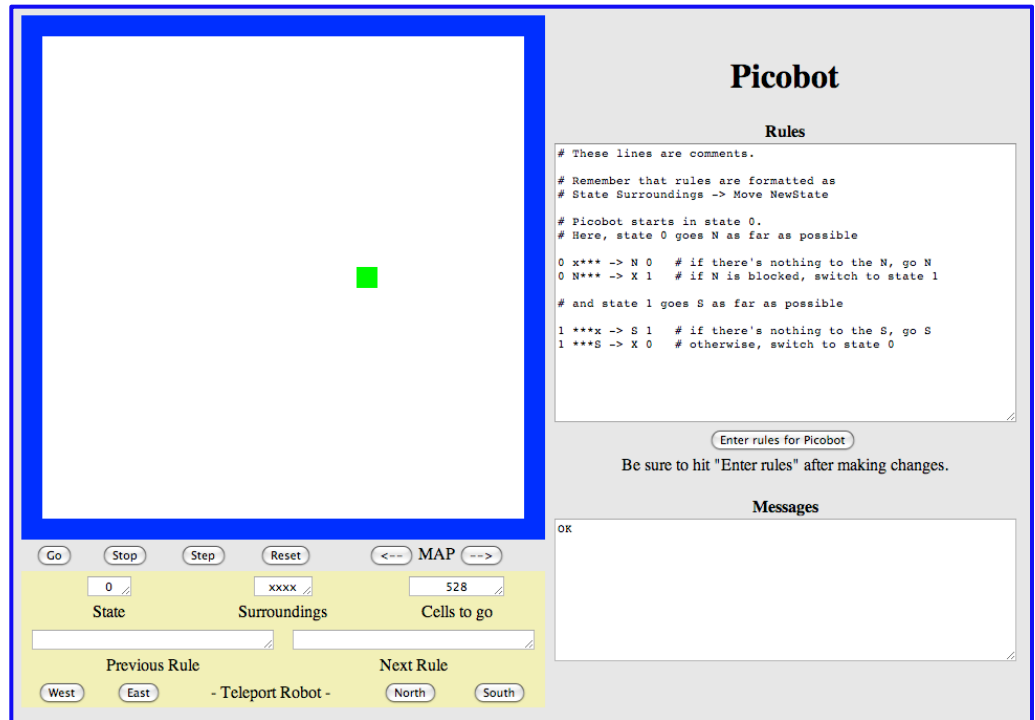
even then, <1% of its libraries!

Picobot

Special-purpose language

you'll see 100% in
the next 10 minutes

Picobot!



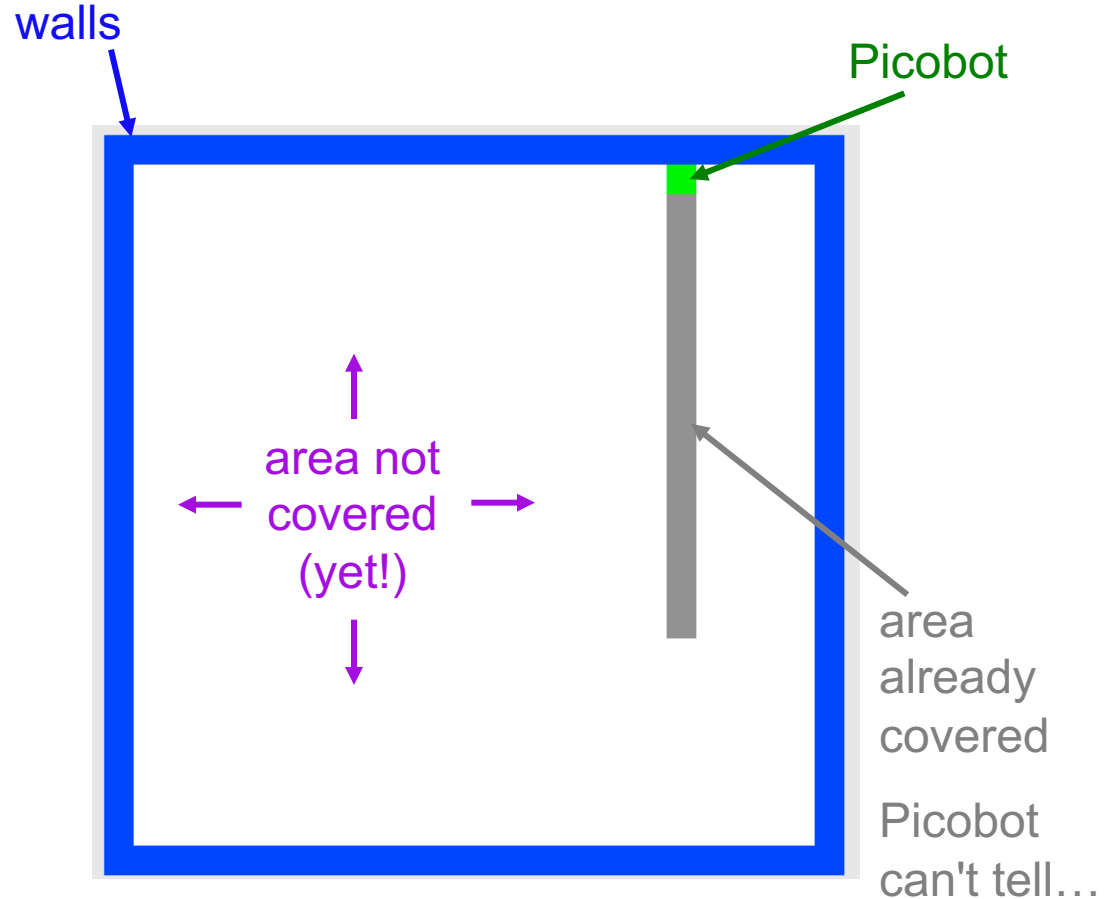
The Picobot simulator
www.cs.hmc.edu/picobot

Demo!

HW problems 3 and 4: Picobot!

Goal: full-room coverage with only *local sensing*...

Inspiration?

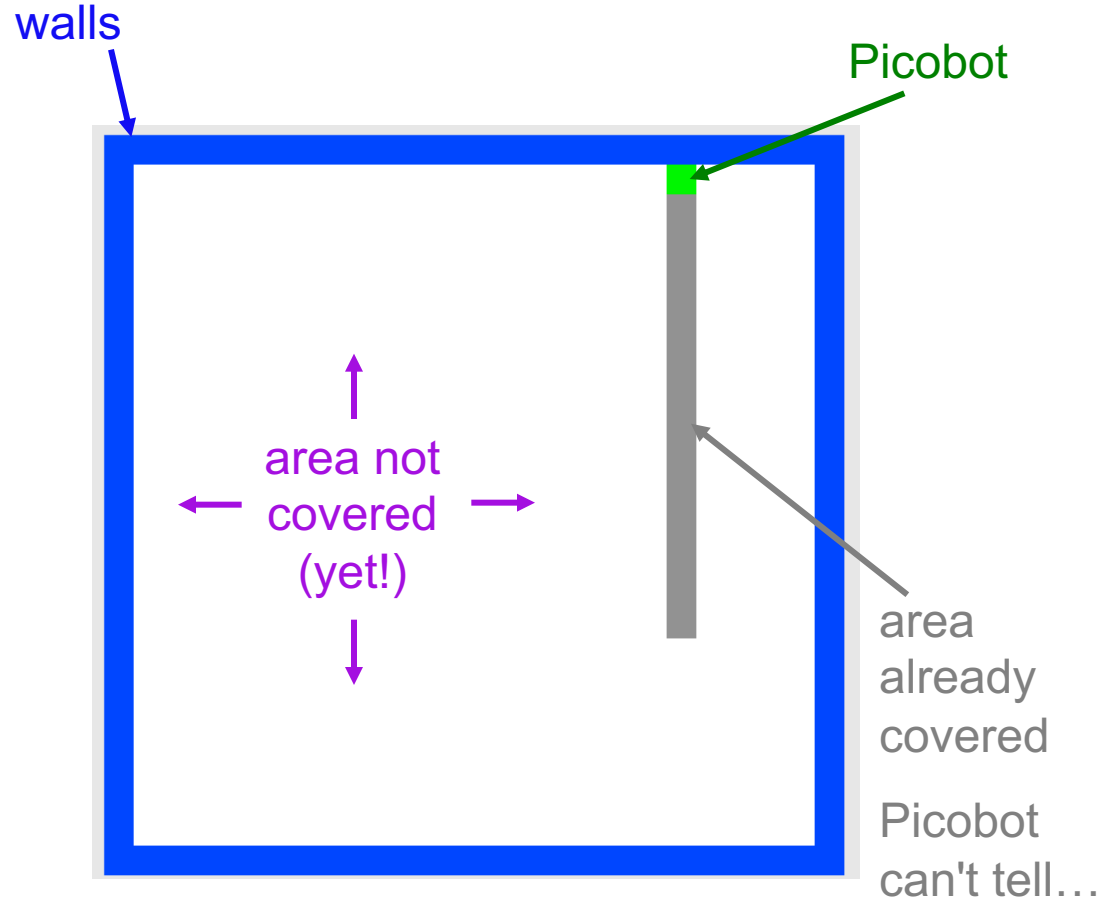


HW problems 3 and 4: Picobot!

Goal: full-room coverage with only *local sensing*...

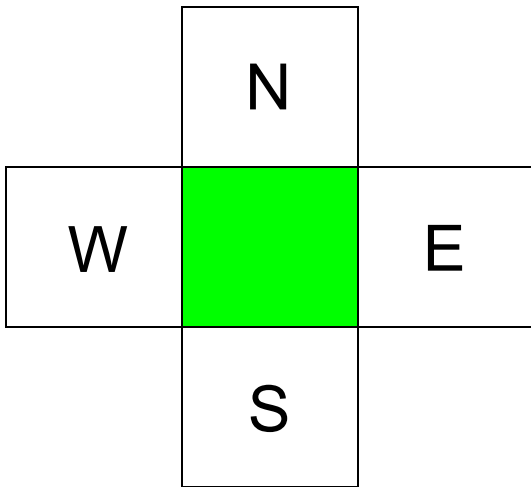


The Roomba!
can't tell "vacuumed"
from "unvacuumed" area



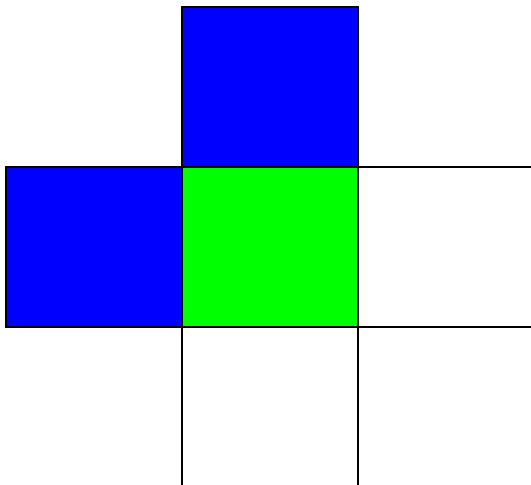
Let's see it!

Surroundings



Picobot can only sense things directly to the N, E, W, and S

For example, here its surroundings are

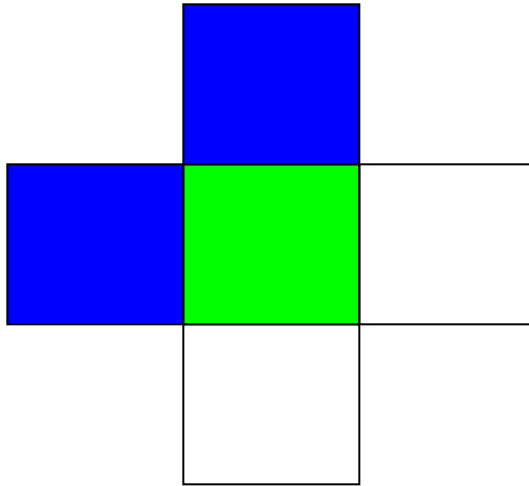


NxWx
N E W S

Surroundings are
always in **NEWS** order.

What are these surroundings?

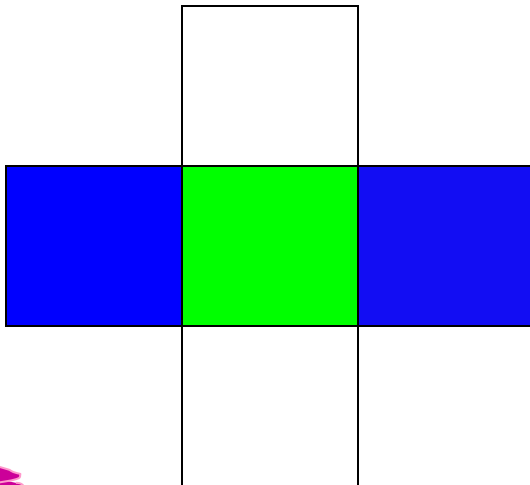
How many
surroundings are
there, total?



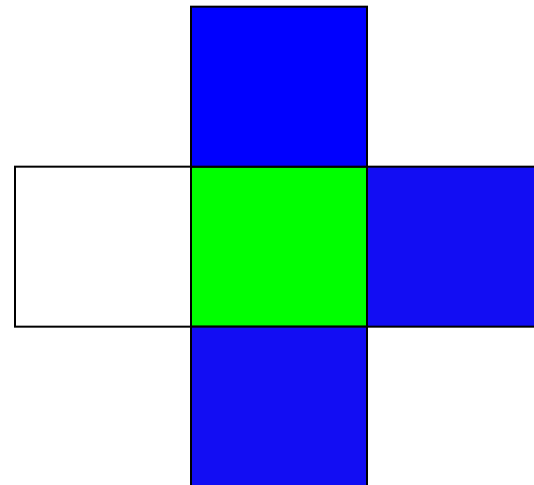
Surroundings are
always in **NEWS** order.

NxWx
N E W S

What are
these two?



N E W S

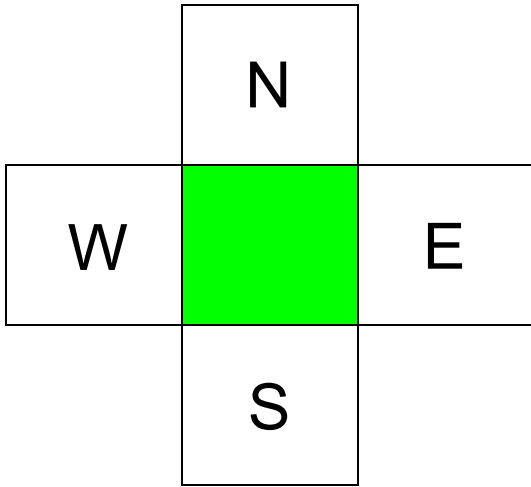


N E W S



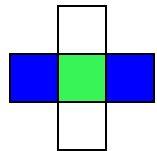
Wow - this one is
disgusting!

Surroundings

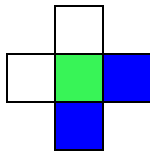


How many ***distinct*** surroundings are there?

5-second challenge

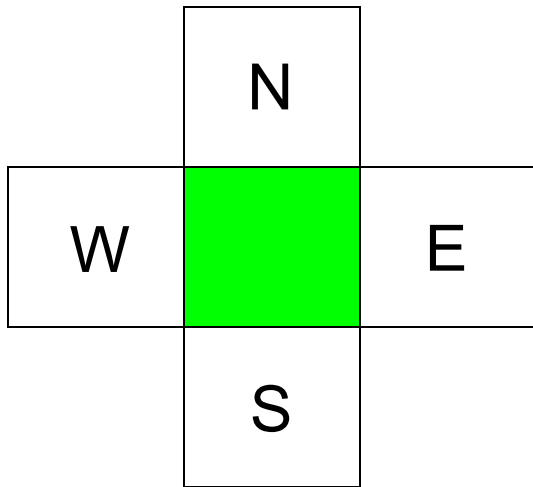


xEWx



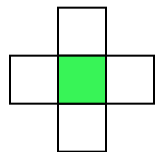
xExS

Surroundings

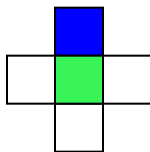


How many distinct
surroundings are there?

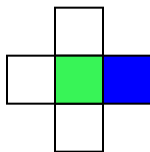
$2^4 == 16$ possible



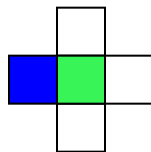
xxxx



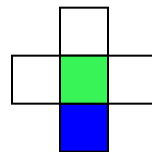
Nxxx



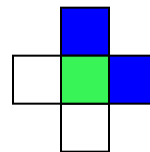
xExx



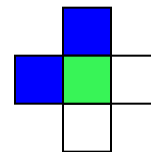
xxWx



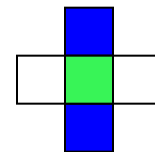
xxxS



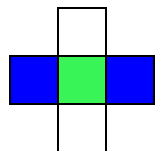
NExx



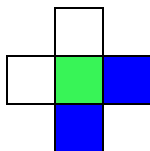
NxWx



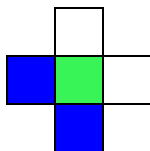
NxxS



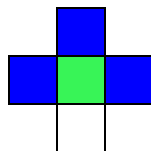
xEWx



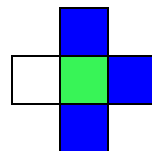
xExS



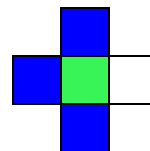
xxWS



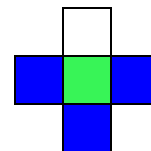
NEWx



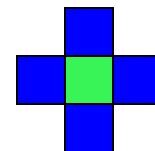
NExS



NxWS



xEWS

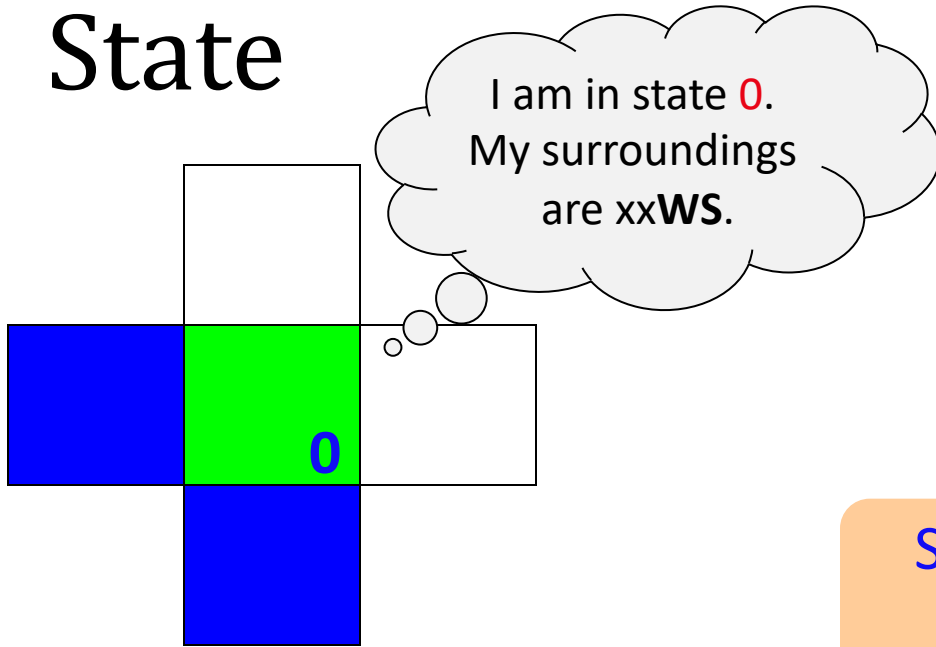


NEWS
(won't happen)

Aargh!



State



Picobot's memory is a single number, called its **state**.

State is the *internal context* of a computation, i.e., its *subtask*.

Picobot always starts in **state 0**.

State and **surroundings** represent everything Picobot knows about the world

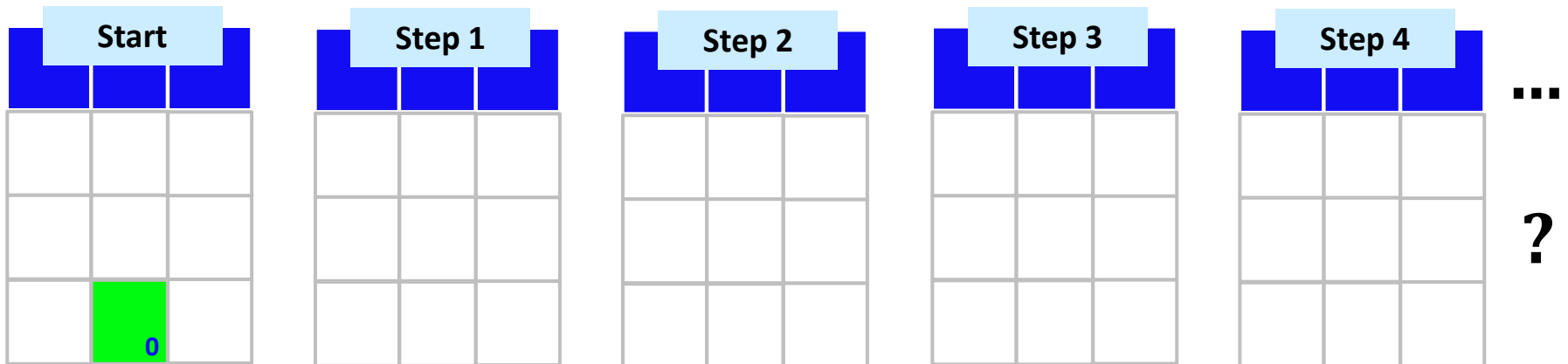
Picobot programming ~ *rules*

	current state	surroundings		step	new state
rule A	0	Nxxx	→	S	0
rule B	0	xxxx	→	N	0

these two rules are a complete Picobot program

Notes

Picobot checks its rules from the top each time.
When it finds a matching rule, that rule runs.



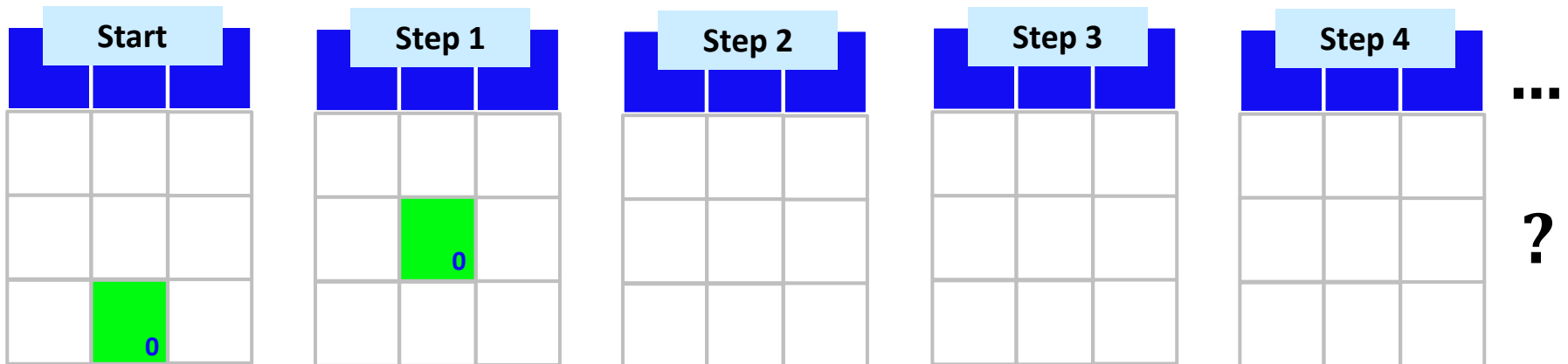
Picobot programming ~ *rules*

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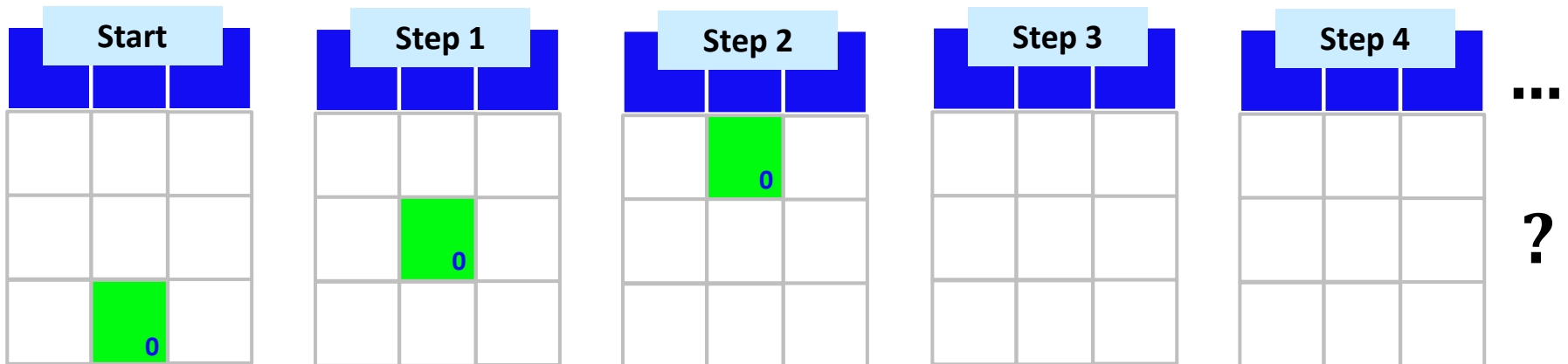
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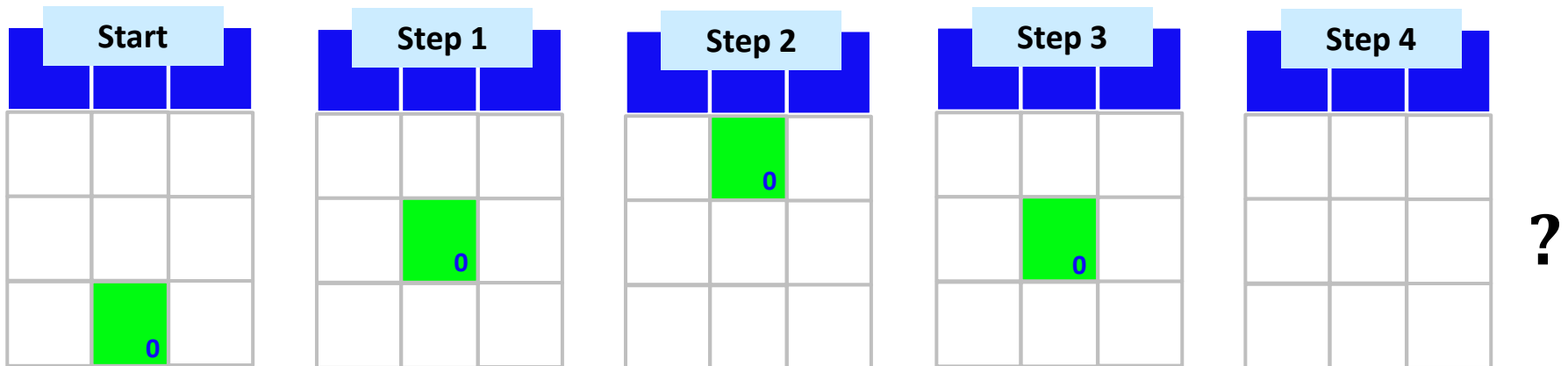
Picobot programming ~ *rules*

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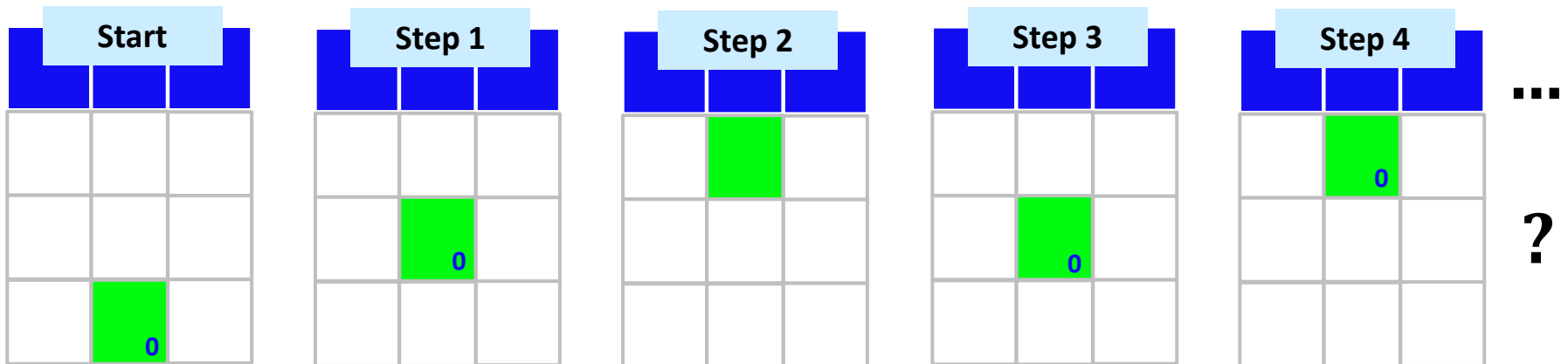
Picobot programming ~ *rules*

	current state	surroundings		step	new state
rule A	0	Nxxx	→	S	0
rule B	0	xxxx	→	N	0

these two rules are a complete Picobot program

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Picobot checks its rules from the top each time.
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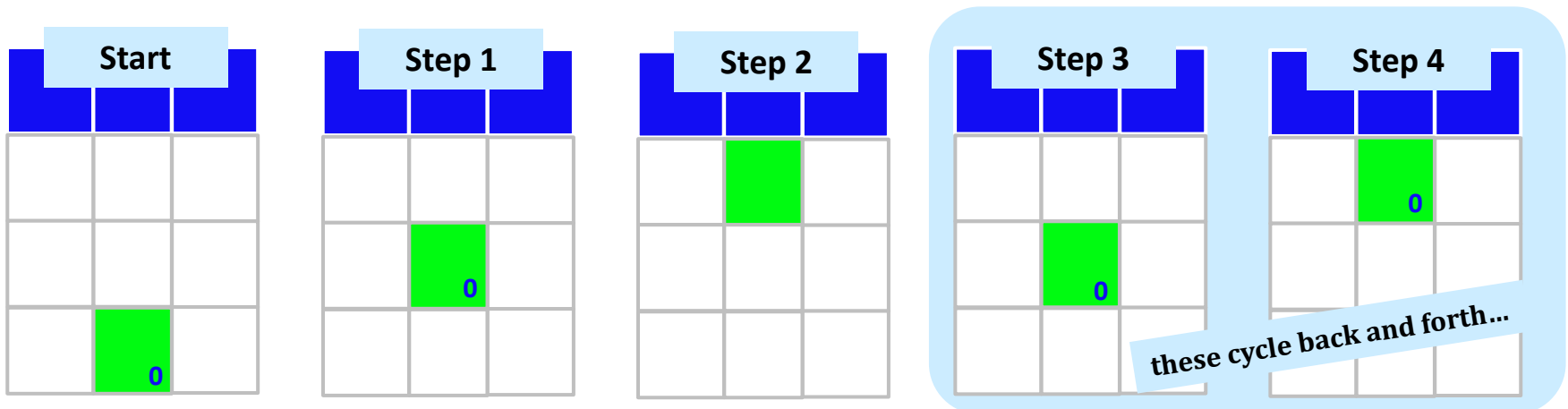
Picobot programming ~ *rules*

	current state	surroundings		step	new state
rule A	0	Nxxx	→	S	0
rule B	0	xxxx	→	N	0

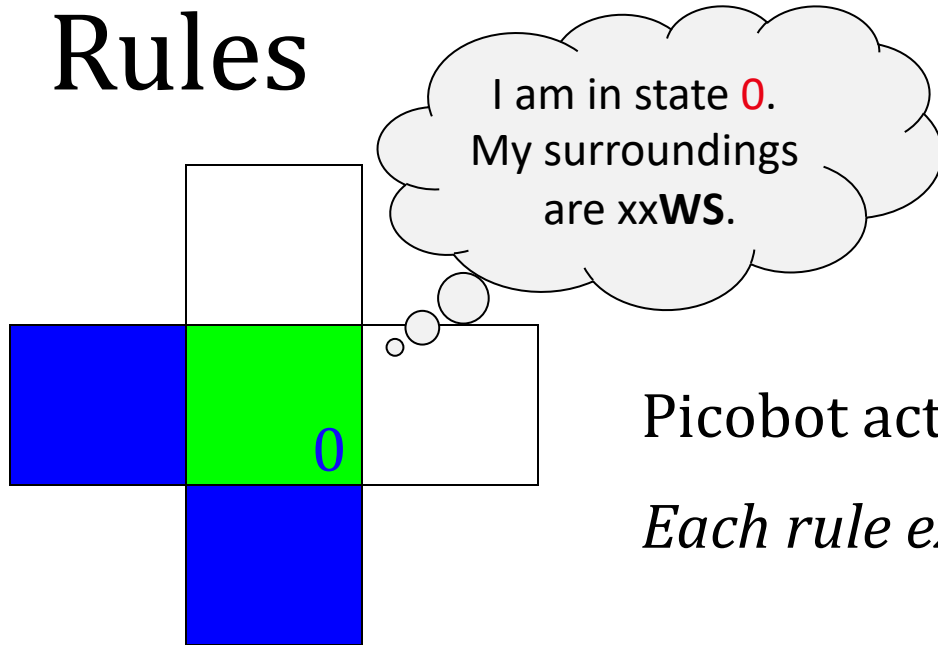
these two rules are a complete Picobot program

Notes

Picobot checks its rules from the top each time.
When it finds a matching rule, that rule runs.

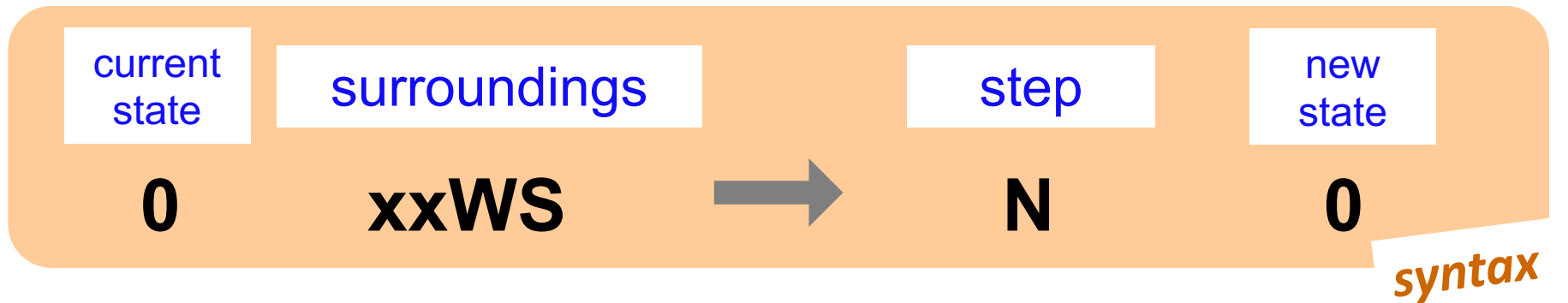


Rules



Picobot acts through a set of rules

*Each rule expresses **your intent** for Picobot!*



*If Picobot's in state
0 seeing xxWS,*

*Then move **N**orth, and
"change" to state 0.*

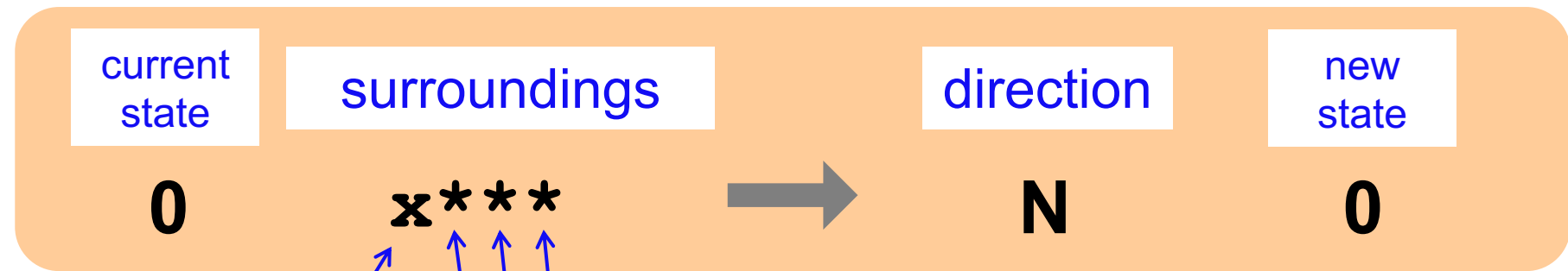
semantics

Wildcards

I only care about **NORTH being EMPTY**



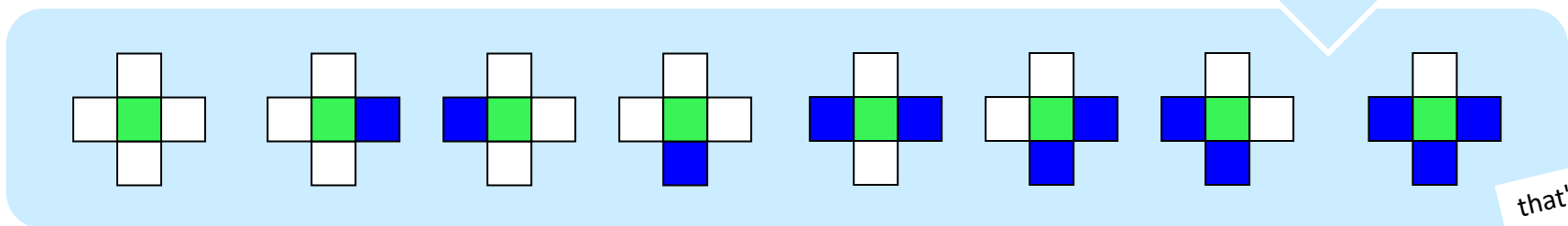
Asterisks * are wild cards.
They match walls ***or*** empty space:



N must be empty

EWS may be wall *or* empty space

8 surroundings
in one rule

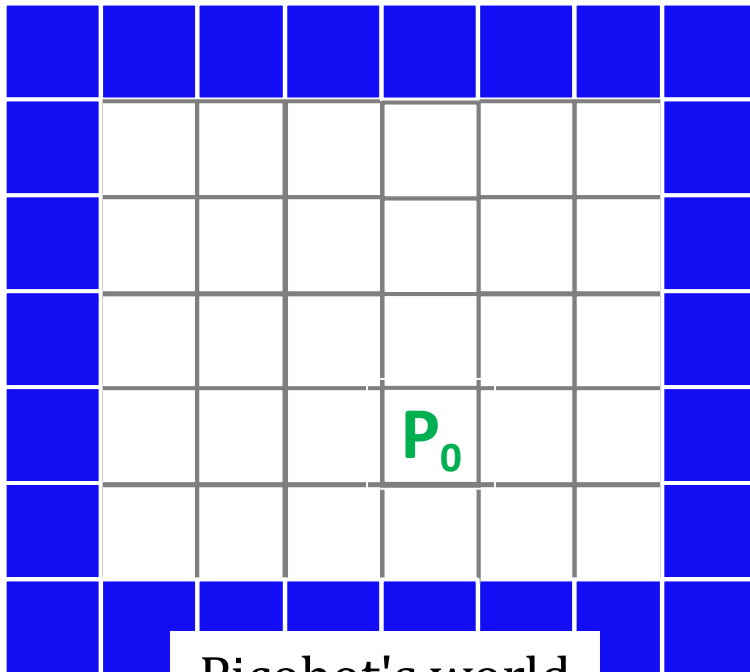


The Rule is *One step per rule*

One rule to rule
them all?



That's *precious*!



Picobot's world

	state	surr.	move	new state
rule (A)	0	N***	-> W	1
rule (B)	0	x***	-> N	0
rule (C)	1	***x	-> S	1
more rules				

Write a rule so Picobot returns back upwards...

- Run Picobot! Which rule **A**, **B**, or **C** runs *first*? _____
 - How many times does **rule (A)** run? _____
 - How many times does **rule (B)** run? _____
 - How many times does **rule (C)** run? _____

2. Picobot stops when no rule matches. *Where does it stop?*

3. Add a rule so that Picobot continues *back upwards*!

Hint: Use a step of **x** to stay in place ...

Extra #1 Rule A has a bug! What is it?

Extra #2 Add rules to finish exploring the empty room *from any starting point*...

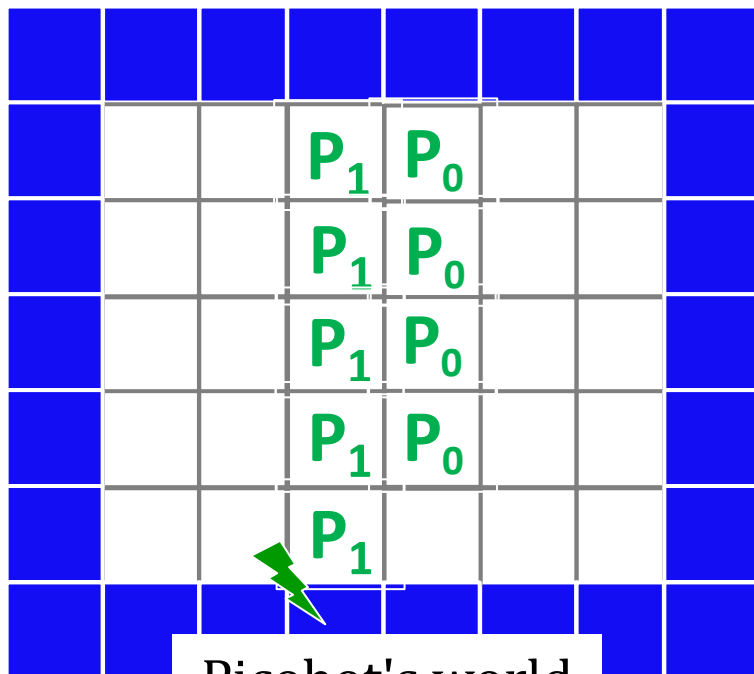
Extra #3 *How to do this in only 6 rules total?!*

The Rule is *One step per rule*

One rule to rule
them all?



That's *precious*!



Picobot's world

	state	surr.	move	new state
rule (A)	0	N* <u>*</u> *	-> W	1
rule (B)	0	x***	-> N	0
rule (C)	1	***x	-> S	1
more rules	1	***S	-> <u>X</u>	0

Write a rule so Picobot returns back upwards...

1. Run Picobot! Which rule **A**, **B**, or **C** runs *first*? **B**

1a. How many times does **rule (A)** run? **1**

1b. How many times does **rule (B)** run? **3**

1c. How many times does **rule (C)** run? **4**

2. Picobot stops when no rule matches. *Where does it stop?*

3. Add a rule so that Picobot continues *back upward*!

Hint: Use a step of **x** to stay in place ...

see above!

Extra #1 Rule A has a bug! What is it?

should be N*x*

Extra #2 Add rules to finish exploring the empty room from any starting point...

hw0pr3

Extra #3 How to do this in only 6 rules total?!

see above!

extra!

Warning! *What's wrong here?*

state	surroundings		direction	new state
0	x***	→	S	0
0	***x	→	N	0

these two rules are a broken Picobot program!

Notes

Picobot checks its rules from the top each time.
When it finds a matching rule, that rule runs.

Warning! *What's wrong here?*

state	surroundings	direction	new state
0	x***		
0	***x		

These two situations COULD BE the same!

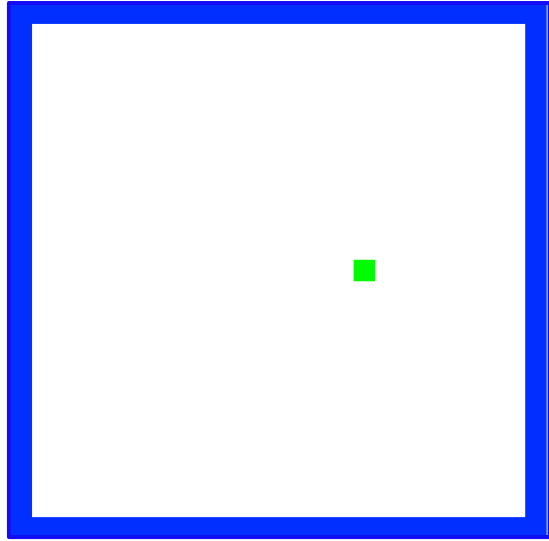
these two rules are a broken Picobot program!

Notes

Picobot checks its rules from the top each time.
When it finds a matching rule, that rule runs.

There can only be **ONE** rule per situation!
and a "situation" is *state* and *surroundings*

CS ~ Complexity Science



problem 3

Shortest Picobot
program:

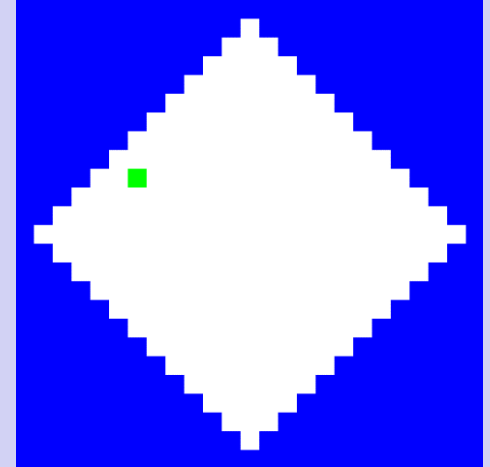
6 rules



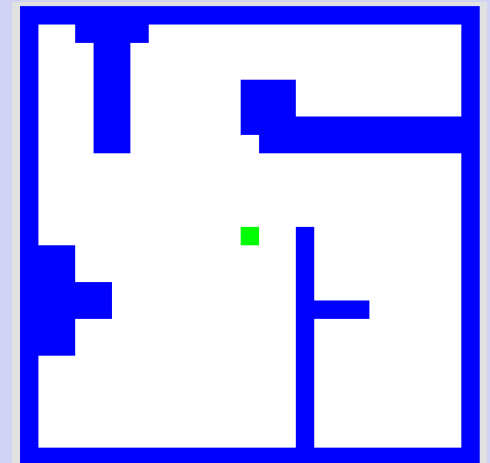
problem 4

Shortest Picobot
program:

8 rules

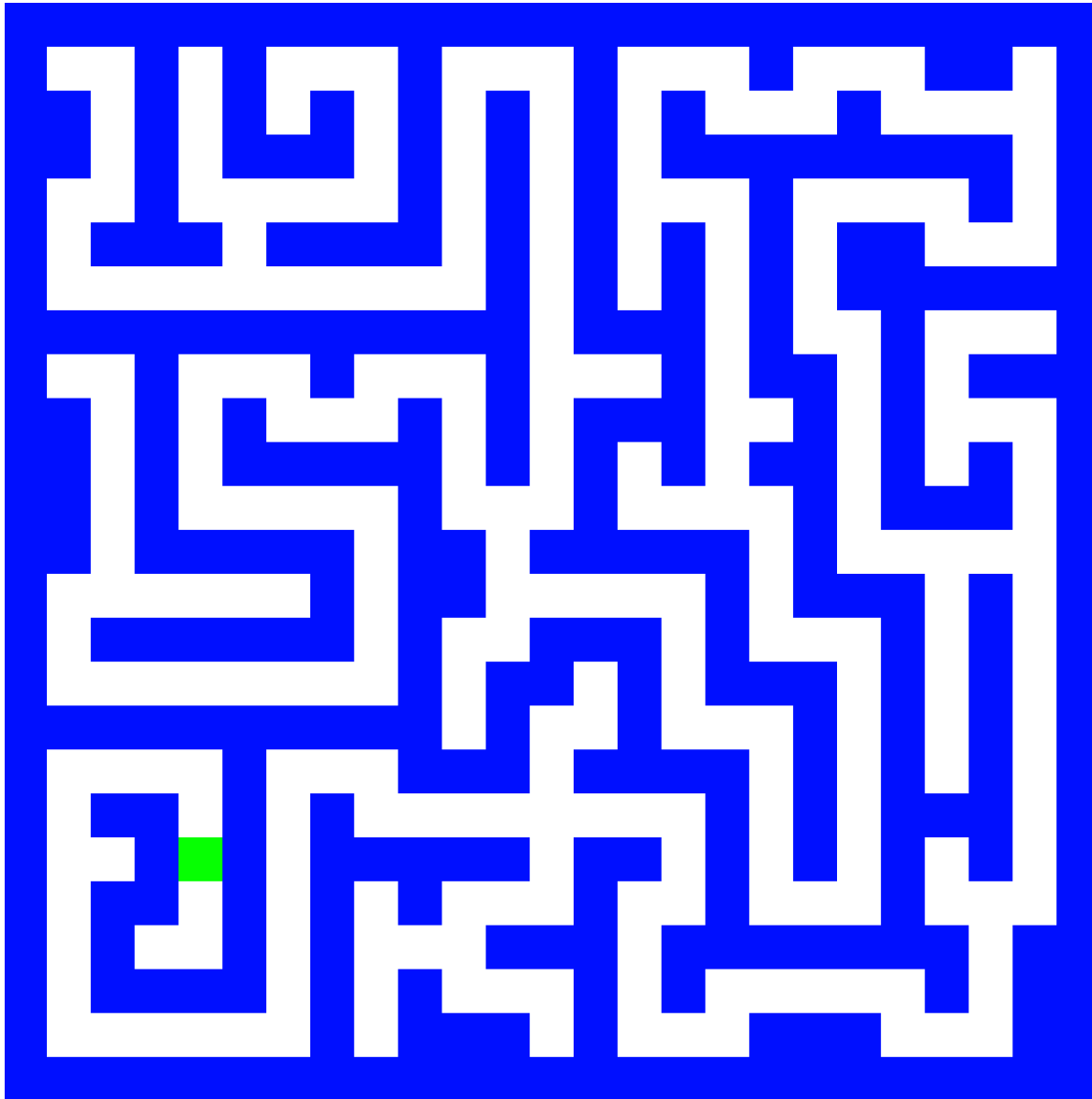


pr. 5 (extra!)



pr. 6 (extra!)

Maze strategies?





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Maze solving algorithm

From Wikipedia, the free encyclopedia

There are a number of different **maze solving algorithms**, that is, automated methods for the solving of **mazes**. The random mouse, wall follower, Pledge, and Trémaux **algorithms** are designed to be used inside the maze by a traveler with no prior knowledge of the maze, whereas the **dead-end** filling and **shortest path algorithms** are designed to be used by a person or computer program that can see the whole maze at once.

Mazes containing no loops are known as "standard", or "perfect" mazes, and are equivalent to a **tree** in graph theory. Thus many maze solving algorithms are closely related to **graph theory**. Intuitively, if one pulled and stretched out the paths in the maze in the proper way, the result could be made to resemble a tree.^[1]

Contents [\[hide\]](#)

1 Random mouse algorithm

commons.wikimedia.org/wiki/File:MAZE_2000x2000_DFS.png

Right Hand Rule

Maze strategies?

Right Hand Rule



Why might this be *difficult* for Picobot?

Maze strategies?

Right Hand Rule

Keep your
"right hand"
on the wall,
Picobot!

facing

to the
right

State **0**

State **1**

State **2**

State **3**

We'll need to use
state to represent
the *direction*
Picobot is facing.

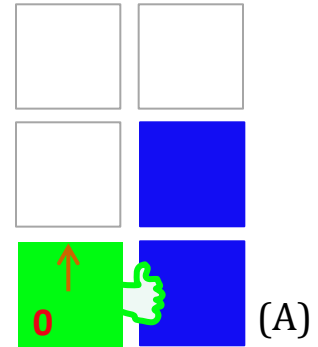


Suppose Picobot wants to traverse a maze *with its right hand always on the wall...*

(A) CORRIDOR rule

If you're facing N with a wall at right and space ahead then go forward

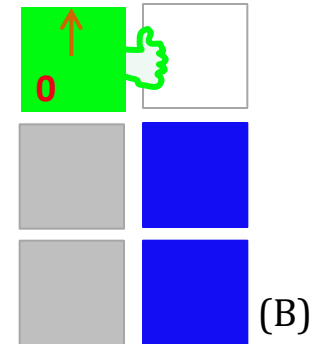
0 xE** -> N 0



(B) INTERSECTION rule

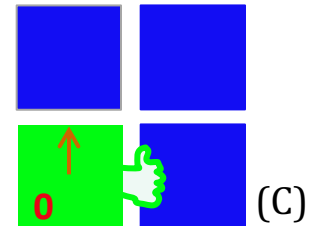
If you're facing North and lose the wall, then get over to the wall now!

0 ->



(C) DEAD END rule

Write 1 rule to tell Picobot to do the right thing if it hits a dead end.



Repeat this IDEA for all four states, representing all four *facing directions*.

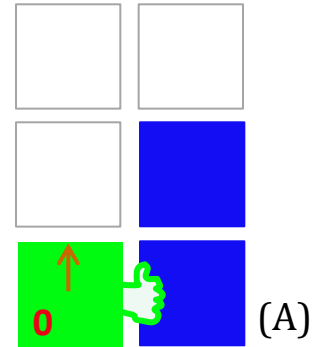
Suppose Picobot wants to traverse a maze *with its right hand always on the wall...*

(A) CORRIDOR rule

If you're facing N with a wall at right and space ahead then go forward

0 **xE**** -> N 0

state 0 means "still facing north"

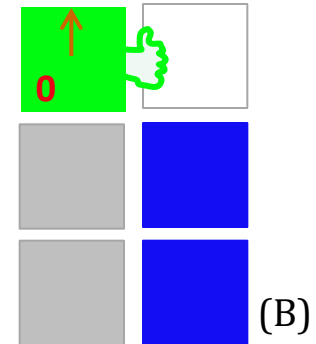


(B) INTERSECTION rule

If you're facing North and lose the wall, then get over to the wall now!

0 ***x**** -> E 1

state 1 means "now facing east"

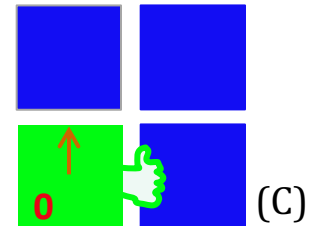


(C) DEAD END rule

Write 1 or 2 rules to tell Picobot to do the right thing if it hits a dead end.

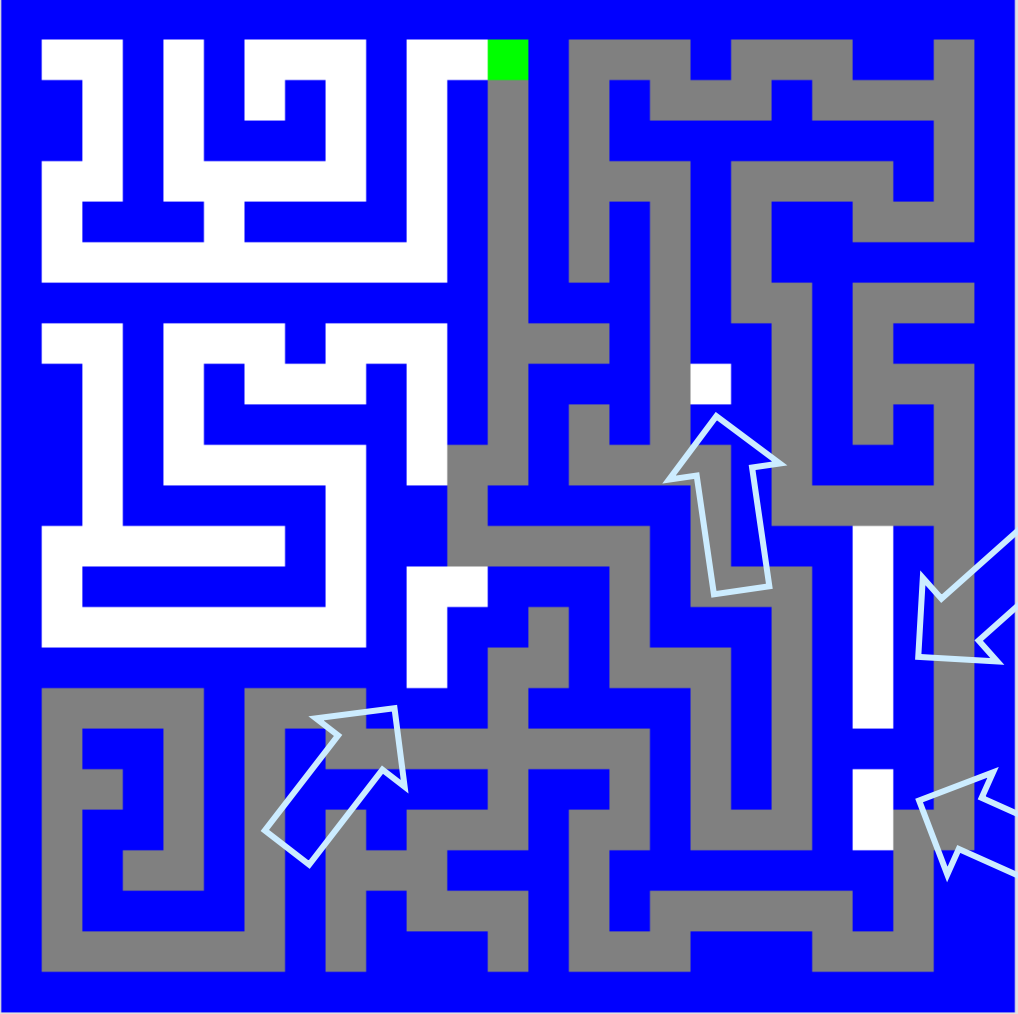
0 **NE**** -> X 2

state 2 means "now facing west"



Repeat this IDEA for all four states, representing all four *facing directions*.

Hooray!?!



Picobot

Rules

Is it working?

```
## twelve-rule maze-solver:
```

Enter rules for Picobot

Be sure to hit "Enter rules" after making

Messages

Go Stop Step Reset <-- MAP -->

Southward!

Northward!

- *Onward* -

Westward!

Eastward!

hw0

You are not alone!

Come to tutoring hours!

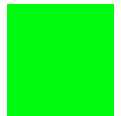
Post questions to piazza...

I can attest
to that!



Happy Picobotting!

Lead on!
I will follow.



*And, good luck with the **adventure** of Python!*

