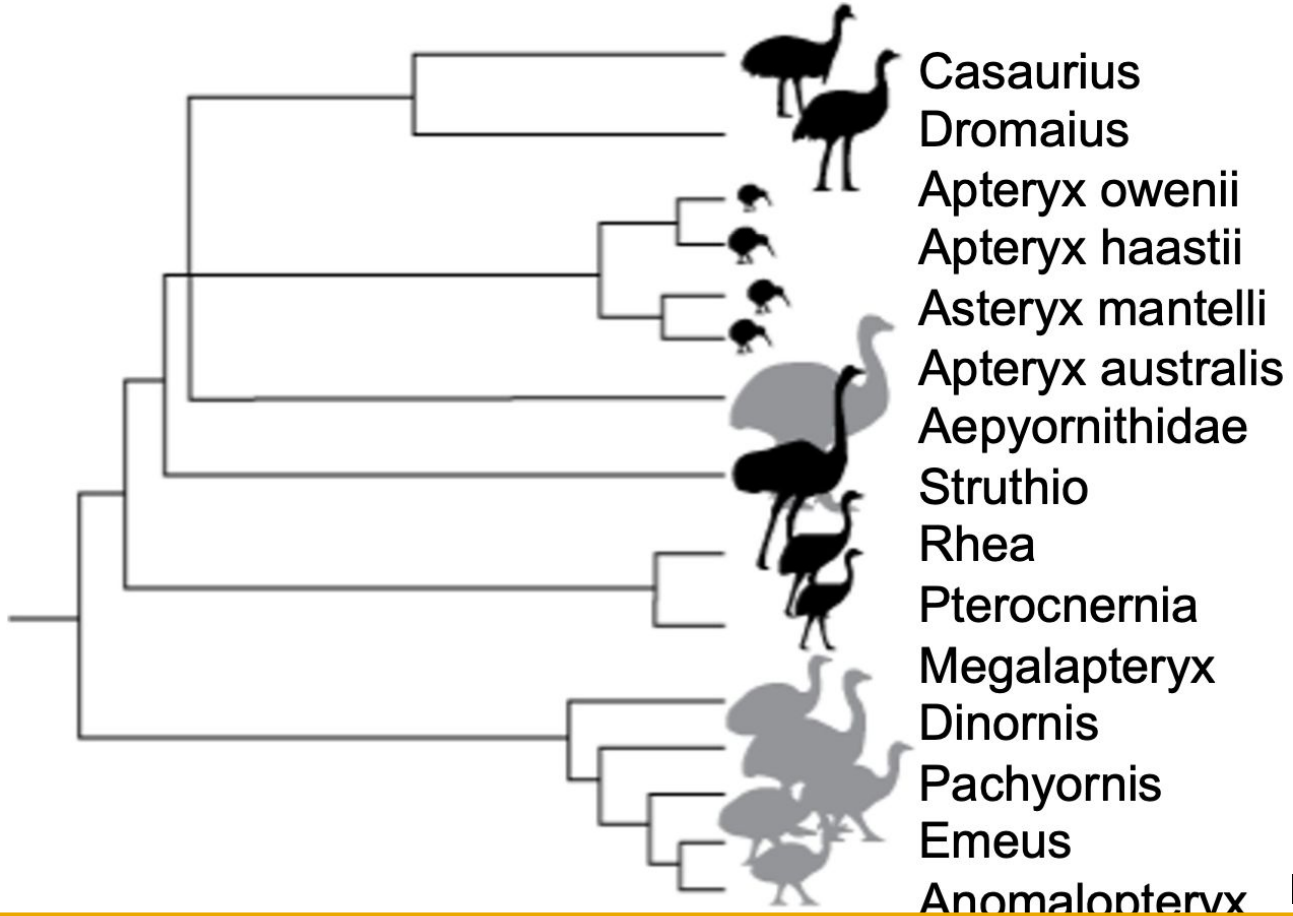
Slides for Pre-reading

Slides with yellow borders will not be covered in class, but is still testable content - you should review this before class.

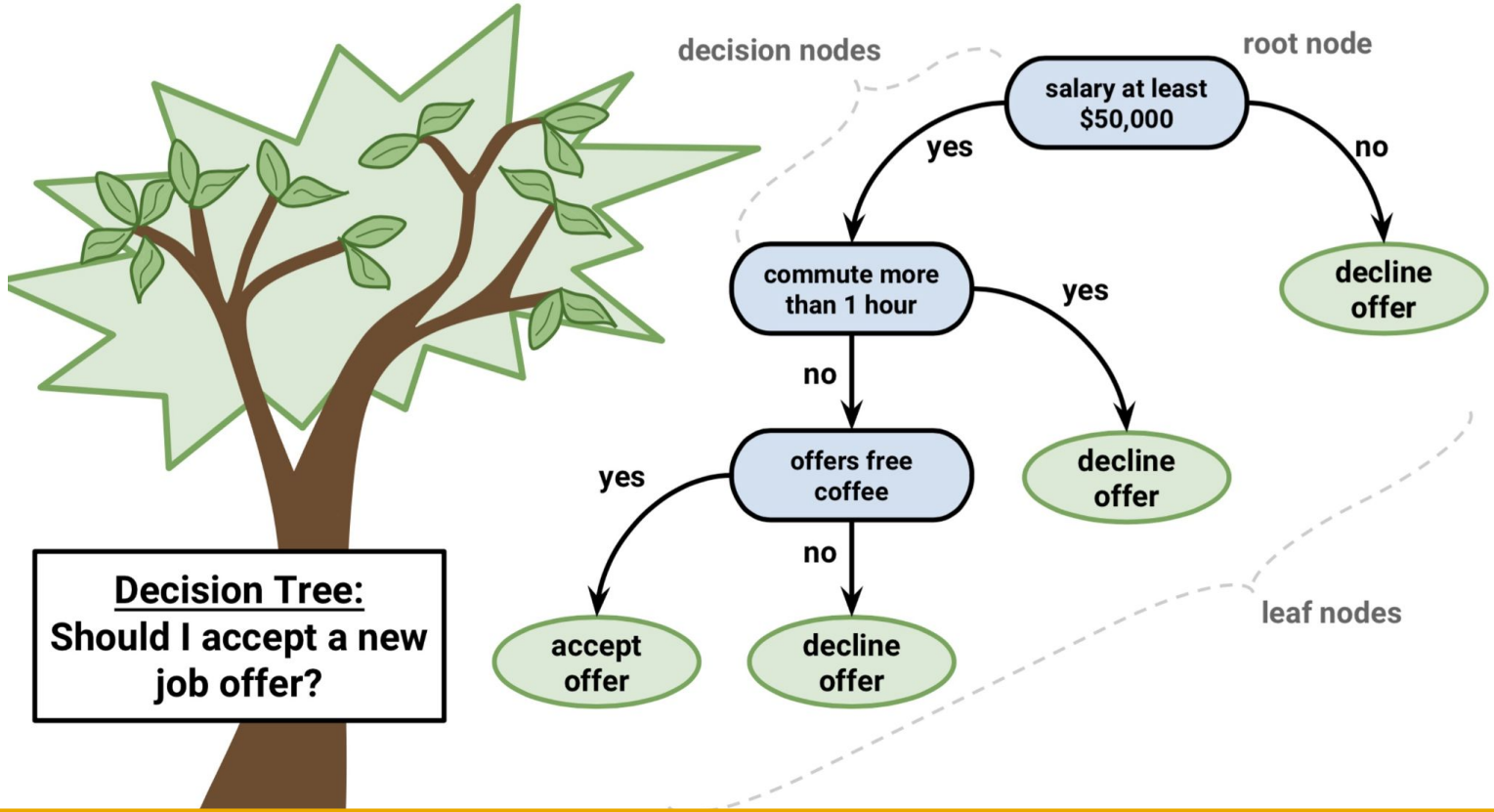
Non-CS Decisions Trees

Rooted trees in CS often (but not always) drawn with root on top



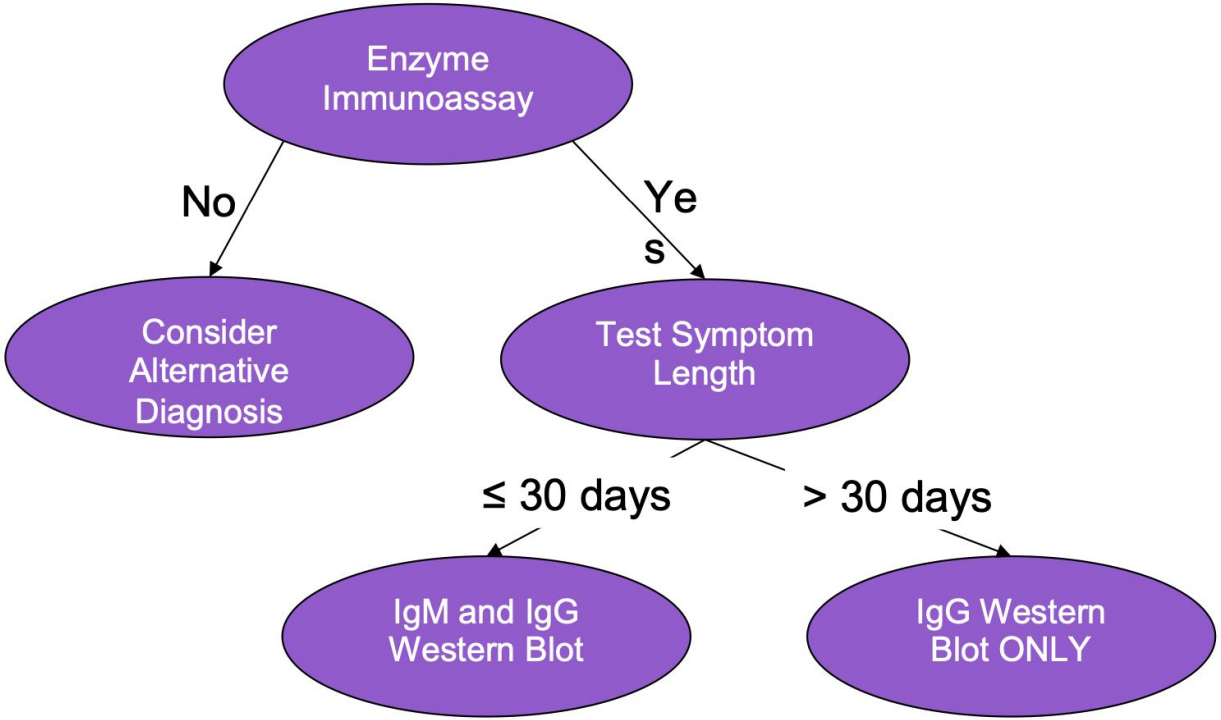
Decision trees

Trees whose node labels are attributes, edge labels are conditions



Decisions Trees in Medicine

Decision tree for Lyme Disease diagnosis



Decisions Trees in Business

GBR Graziadio Business Review
A Peer-Reviewed Journal of Relevant Information and Analysis

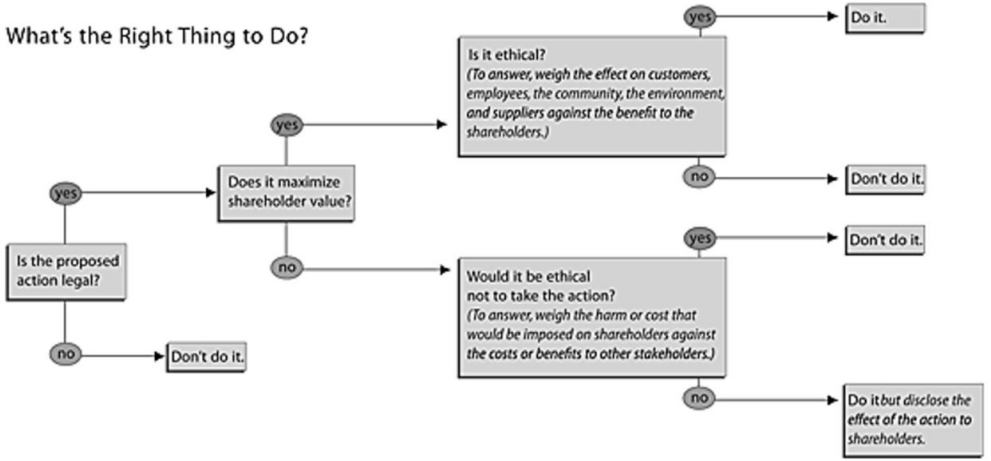
How Gerber Used a Decision Tree in Strategic Decision-Making

Possible outcomes explored in an in Products Safety Commission.

By JAY BUCKLEY and THOMAS J. DUDLEY, DBA

1999 Volume 2 Issue 3

Decision trees can assist executives in making strat



From algorithms to code: How do programs work?

How do programs work?

Programs are a way of encoding ***algorithms*** in a precise enough way for computers to understand the instructions.

How do programs work?

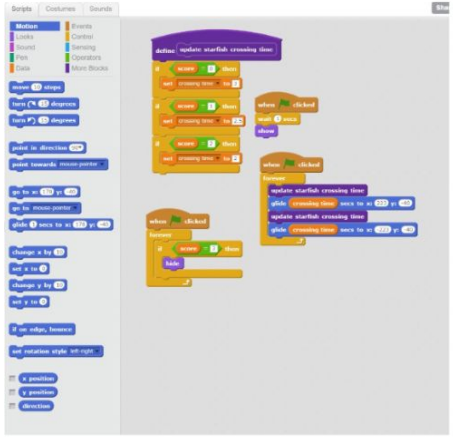
Programs are a way of encoding ***algorithms*** in a precise enough way for computers to understand the instructions.

Programmers use a **high level language** like Snap, Scratch, Python, C++, Java, Racket, etc.

These languages may look very different

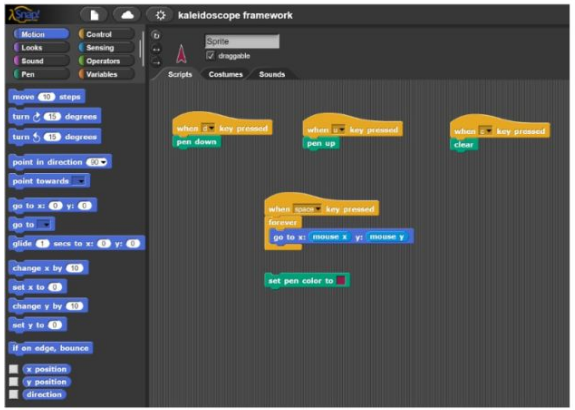
```
File  Edit  View  Language  Racket  Insert  Tabs  Help
Untitled (define ...) Save        Check Syntax  Debug  Macro Stepper  Run  Stop
(define first car)
(define rest cdr)

(define (addWithCarry x y carry)
  (cond
    ((and (null? x)(null? y)) (if (= carry 0) '() '(1)))
    ((null? x) (addWithCarry '(0) y carry))
    ((null? y) (addWithCarry x '(0) carry))
    ( #t  (let ((bit1 (first x))
                (bit2 (first y)))
            (cond
              ((= (+ bit1 bit2 carry) 0) (cons 0 (addWithCarry (rest x) (rest y) 0)))
              ((= (+ bit1 bit2 carry) 1) (cons 1 (addWithCarry (rest x) (rest y) 0)))
              ((= (+ bit1 bit2 carry) 2) (cons 0 (addWithCarry (rest x) (rest y) 1)))
              (   #t                     (cons 1 (addWithCarry (rest x) (rest y) 1))))))))
```



```
        /**
         * Simple HelloButton() method.
         * @version 1.0
         * @author john doe <doe.j@example.com>
         */
        HelloButton()
        {
          JButton hello = new JButton( "Hello, wor
          hello.addActionListener( new HelloBtnList

          // use the JFrame type until support for t
          // new component is finished
          JFrame frame = new JFrame( "Hello Button"
          Container pane = frame.getContentPane();
          pane.add( hello );
          frame.pack();
          frame.show();          // display the fra
        }
```




```
    }

    if (bInvokeUI)
    {
        *pbInvokeUI = bInvokeUI;
        *ppwszIdentity = NULL;
        EapTrace("MEapPeerGetIdentity() requesting invoke UI" );
    }
    else
    {
        //GetIdentityToUse( domConnData, domUserData, ppwszIdentity );
    }
```

```
def add5(x):
    return x+5

def dotwrite(ast):
    nodename = getNodename()
    label=symbol.sym_name.get(int(ast[0]),ast[0])
    print '    %s [label="%s' % (nodename, label),
    if isinstance(ast[1], str):
        if ast[1].strip():
            print '= %s"];' % ast[1]
        else:
            print '"]'
    else:
        print '"];'
        children = []
        for  in n, childenumerate(ast[1:]):
            children.append(dotwrite(child))
        print ,'    %s -> {' % nodename
        for  in :namechildren
            print '%s' % name,
```

CPSC 100

Computational Thinking

Sequential Algorithm + Programming

Instructor: Firas Moosvi
Department of Computer Science
University of British Columbia

Course Admin

Agenda

- Learning Goals
- Course Admin
- Sequential Algorithm
- Intro to Programming

Clicker Question

Q: What is a classifier?

A. *This option is intentionally left blank*

B. A method to predict the future

C. An algorithm that maps input data to a specific category

D. A type of decision tree used for data mining

E. A type of data storage for algorithms

Clicker Question

Q: What is a classifier?

A. *This option is intentionally left blank*

~~B. A method to predict the future~~

C. An algorithm that maps input data to <u>one or more</u> categories

D. A type of decision tree used for data mining

E. A type of data storage for algorithms

Learning Goals

Learning Goals

After this week's lecture, you should be able to:

- Apply the sequential algorithm to spell a word and compute its cost.
- Apply the “Breaking Bad” algorithm to spell a word and compute its cost.
- Identify the differences between sequential and "Breaking Bad" algorithms
- Identify components of a block-based visual language (Snap!)

Clicker Questions (using Agora)

Clicker Question

Q: What is entropy in the context of decision trees?

A. The uncertainty or mixed information in a dataset

B. The number of nodes in a tree

C. The difference between training and test data

D. The length of the decision path in a tree

Clicker Question

Q: What is entropy in the context of decision trees?

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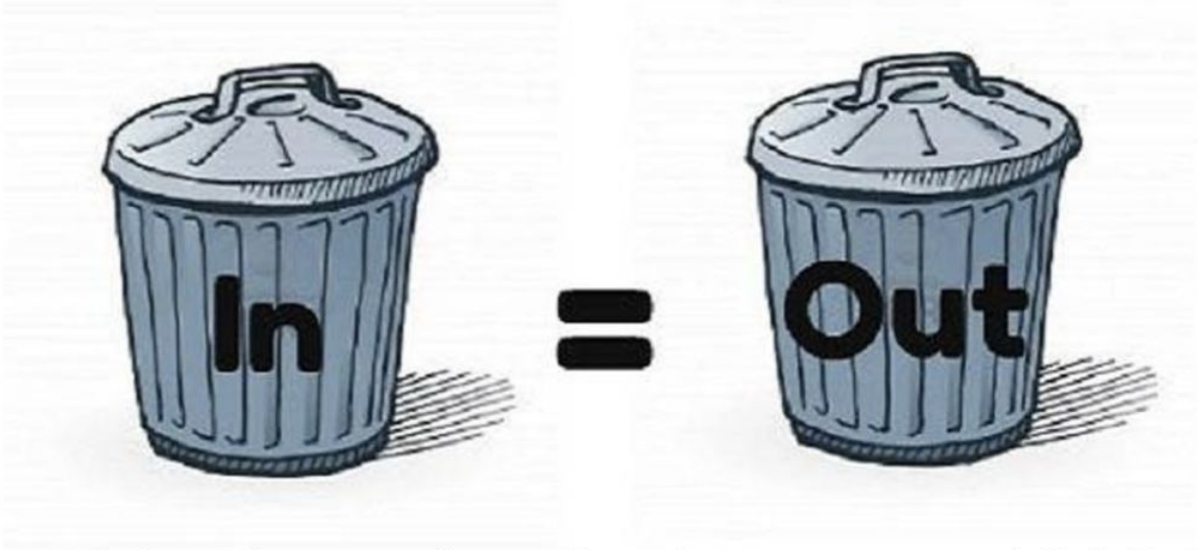
Data's influence on algorithms

Training data influences the classifier



Garbage in, Garbage out (GIGO)

Sequential Algorithm

Sequential Algorithm for Signaling Words

Jean-Dominique Bauby was a journalist who had *locked-in syndrome*.

He used the *partner-assisted scanning system* to dictate a 130 page book by blinking.

Sequential Algorithm for Signaling Words

“It is a simple enough system," Bauby explains.

"You read off the alphabet… until, with a blink of my eye, I stop you at the letter to be noted. The maneuver is repeated for the letters that follow, so that fairly soon you have a whole word.”

In other words, you go through each letter, row by row, and read off all the letters.

Sequential Algorithm for Signaling Words

A	B	C	D	1	2
E	F	G	H	3	4
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
5	6	7	8	9	0

Sequential Algorithm for Signaling Words

Let's set our goal to **minimize the number of letters that have to be looked** at to spell a word.

So each letter you look at has a cost of "1"

We also have to decide if there's any extra "cost" to having the "signals".

Let's say each signal also costs "1"

Sequential Algorithm for Signaling Words

Sequential

8 to get to the letter F
\+ 1 to signal “F”

---

9 total cost

A	B	C	D	1	2
E	F	G	H	3	4
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
5	6	7	8	9	0

Q: What is the cost to signal the word "FAN"?

A. 26
B. 28
C. 29
D. 30
E. 31

A	B	C	D	1	2
E	F	G	H	3	4
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
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Breaking Bad Algorithm

https://www.youtube.com/watch?v=pWso-qRaIlM#t=26s

Example of cost counting: Letter F

2 to get to the “E” row (1)
1 to signal the “E” row (1)
2 to get to “F” in the row
+1 to signal “F”

---

6 total cost

A	B	C	D	1	2
E	F	G	H	3	4
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
5	6	7	8	9	0

Breaking Bad Algorithm

Q: What is the cost to signal the word "FAN"?

A. 17
B. 18
C. 19
D. 20
E. 21

A	B	C	D	1	2
E	F	G	H	3	4
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
5	6	7	8	9	0

Activity

Activity: Algorithms in Action

Find a word that works better the Sequential way.

Find a word that works better the Breaking Bad way.

Which algorithm is better and why?

Rules:

- Both words must be at least 4 letters!
- Use the same chart

Discussion

Activity: Algorithms in Action

Your signal algorithms used

Decomposition: breaking the problem down into smaller tasks

Abstraction: describing the solution in a general way that's applicable no matter what order the letters/numbers are in the table

Preview: Programming

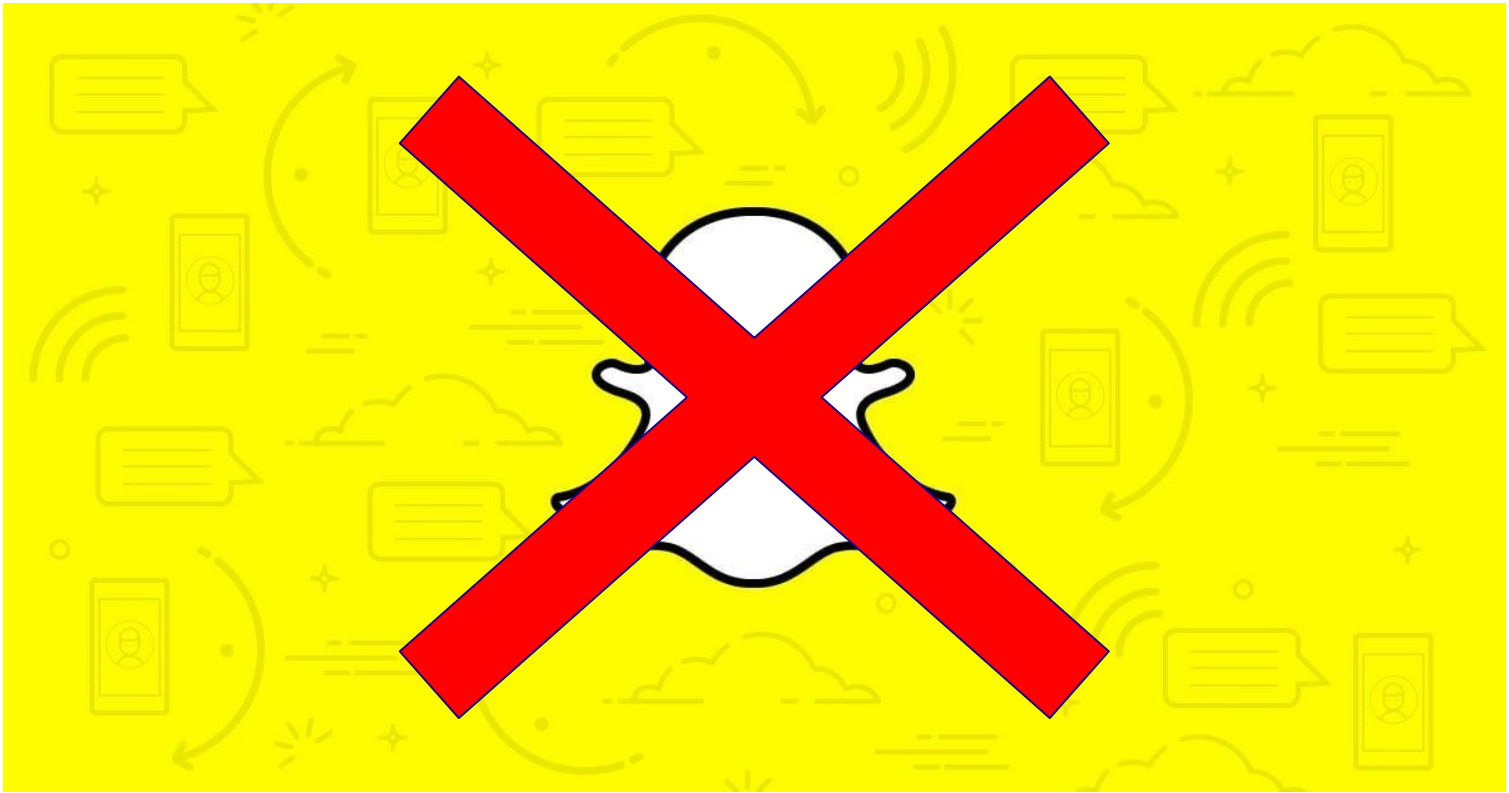
This is *not* a programming courses

But you do need to *understand* how programs work

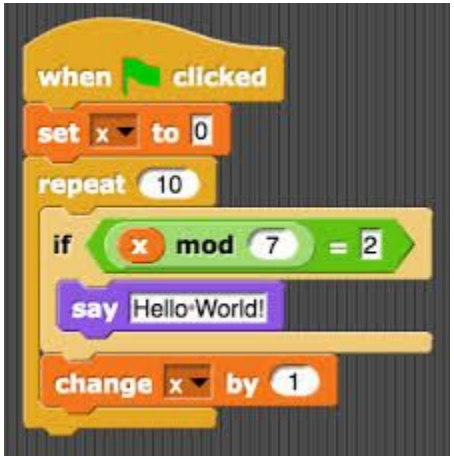
We'll cover a small amount of basic concepts in class and you'll work on a visual language in lab

Snap!

Demo




λSnap!


when clicked
set x to 0
repeat 10
if x mod 7 = 2
say Hello World!
change x by 1

From high to low level programming

Wrap Up

Example of cost counting: Letter L

3 to get to the “I” row

1 to signal the “I” row

4 to get to “L” in the row

+1 to signal “L”

---

9 total cost

A	B	C	D	1	2
E	F	G	H	3	4
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
5	6	7	8	9	0

Example of cost counting: Letter O

4 to get to the “O” row
1 to signal the “O” row
1 to get to “O” in the row
+1 to signal “O”

---

7 total cost

A	B	C	D	1	2
E	F	G	H	3	4
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
5	6	7	8	9	0

Example of cost counting: Letter V

5 to get to the “U” row
1 to signal the “U” row
2 to get to “V” in the row
+1 to signal “V”

---

9 total cost

A	B	C	D	1	2
E	F	G	H	3	4
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
5	6	7	8	9	0

Example of cost counting: Letter E

2 to get to the “E” row
1 to signal the “E” row
1 to get to “E” in the row
+1 to signal “E”

---

5 total cost

A	B	C	D	1	2
E	F	G	H	3	4
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
5	6	7	8	9	0