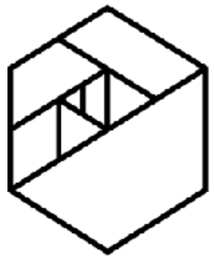
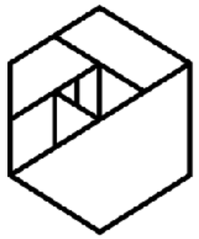


METIS

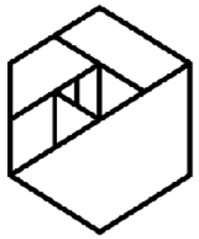
Introduction to Data Science



METIS

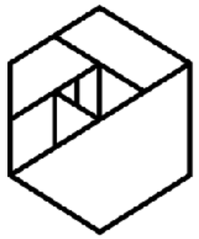
Expectations

- Please participate and **ask questions**.
- Please follow along and **TRY OUT** the examples yourself during the class
- All the answers are in the slide decks or GitHub repository, but please try to complete the exercises **without looking at the answers**.
- Have fun!



METIS

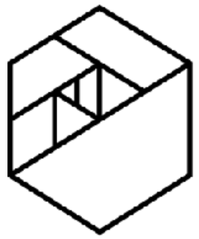
Introduction



METIS

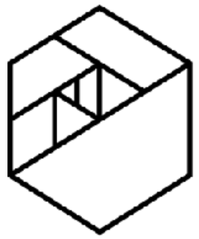
Who are you?

- Your name (or what you want me to call you)
- Where you work and/or your job role
- What you hope to get out of this class
- Your level of experience with coding



METIS

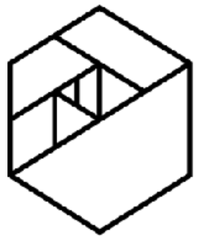
What is Data Science?



METIS

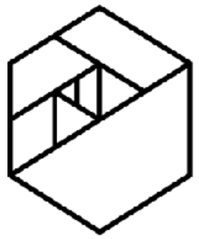
Data Science is the art of **turning data into actions**. This is accomplished through the creation of data products, which provide actionable information without exposing decision makers to the underlying data or analytics

Booz Allen Hamilton, Field Guide to Data Science, Pg. 17



METIS

Extracting useful information



METIS

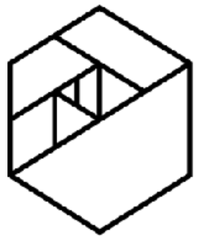
Extracting useful information from data

Answering business questions with data

- Know what you want to know

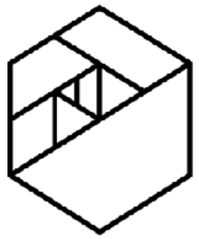
Answering business questions **with data**

- Know what you want to know
- Have the **technical skills** to get it



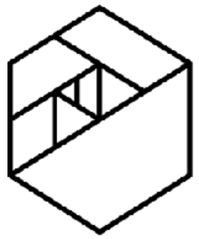
METIS

Analyst  Developer



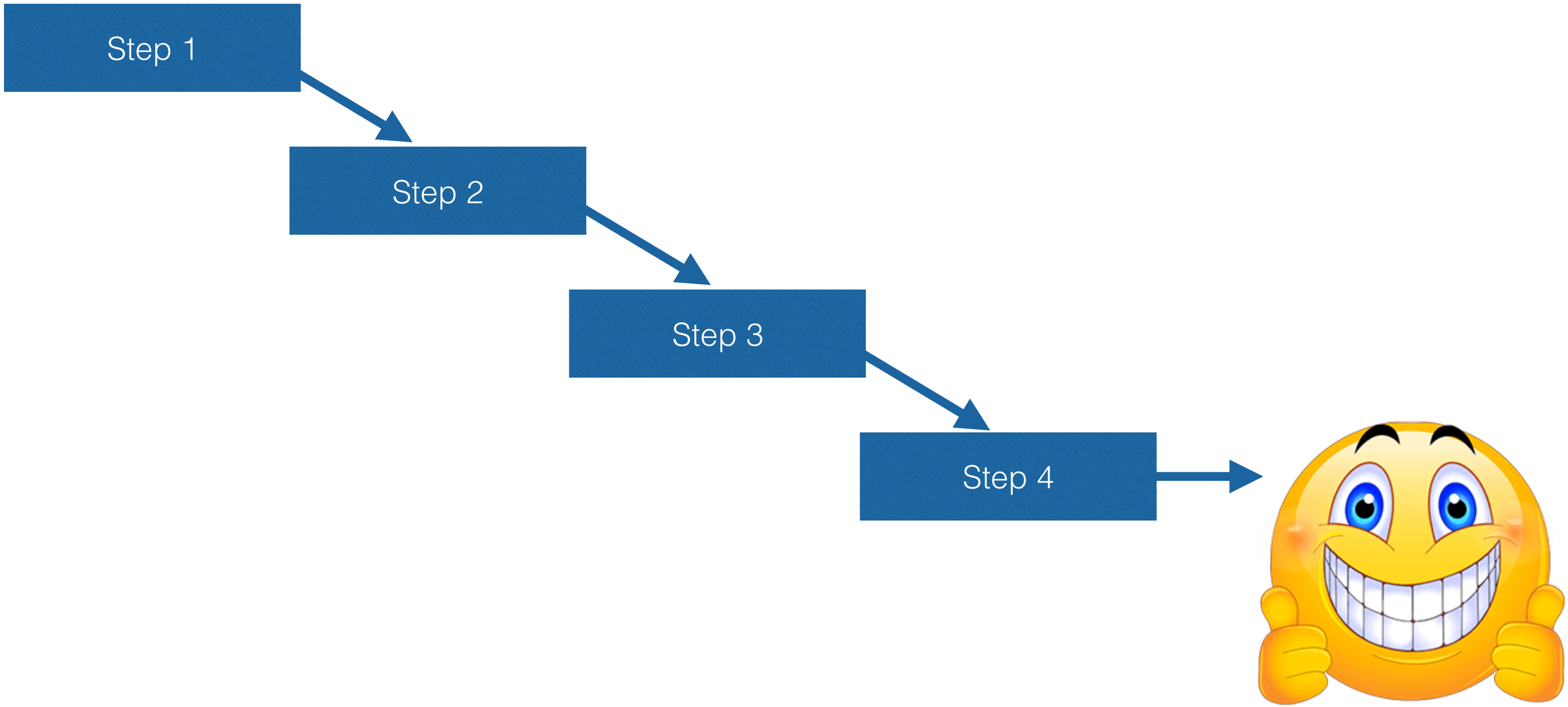
METIS

Analyst + Developer



METIS

What Data Science is Not



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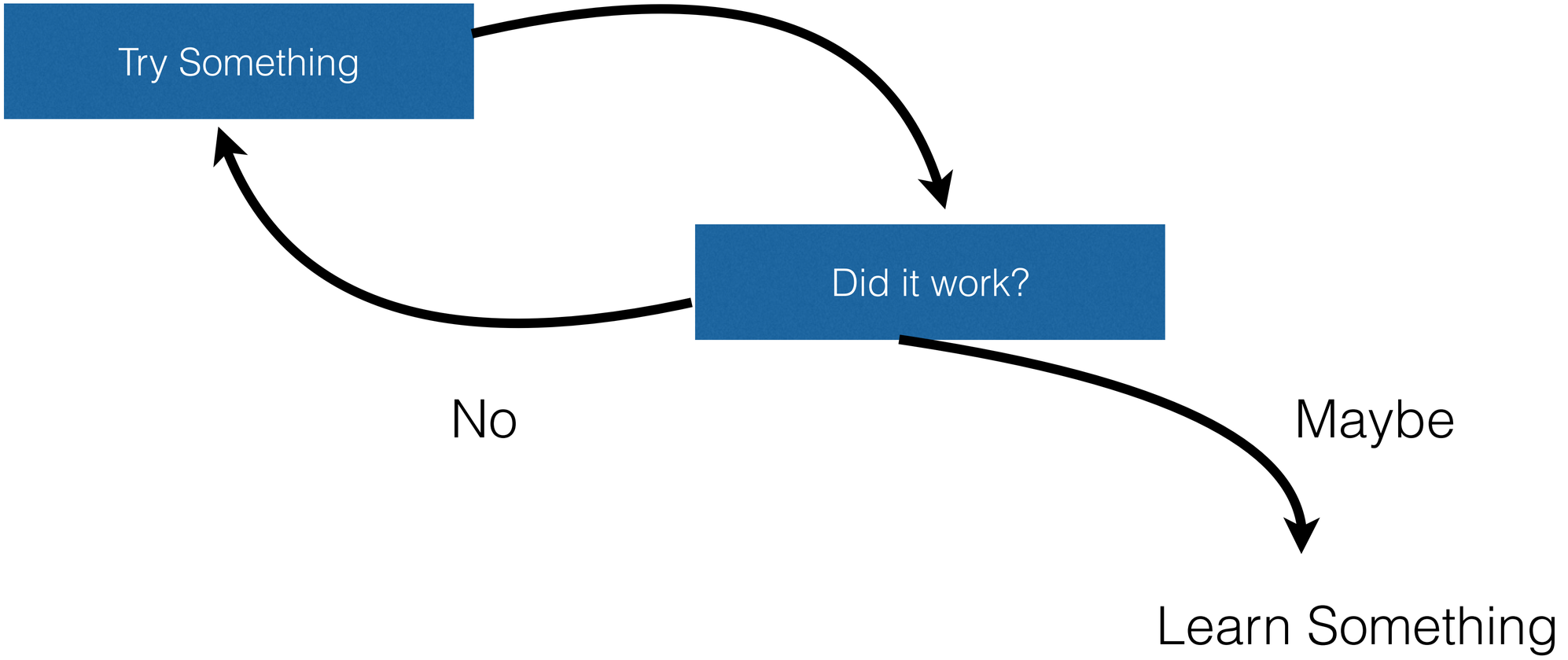
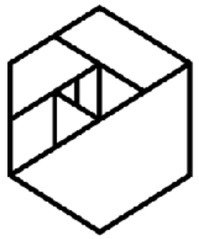
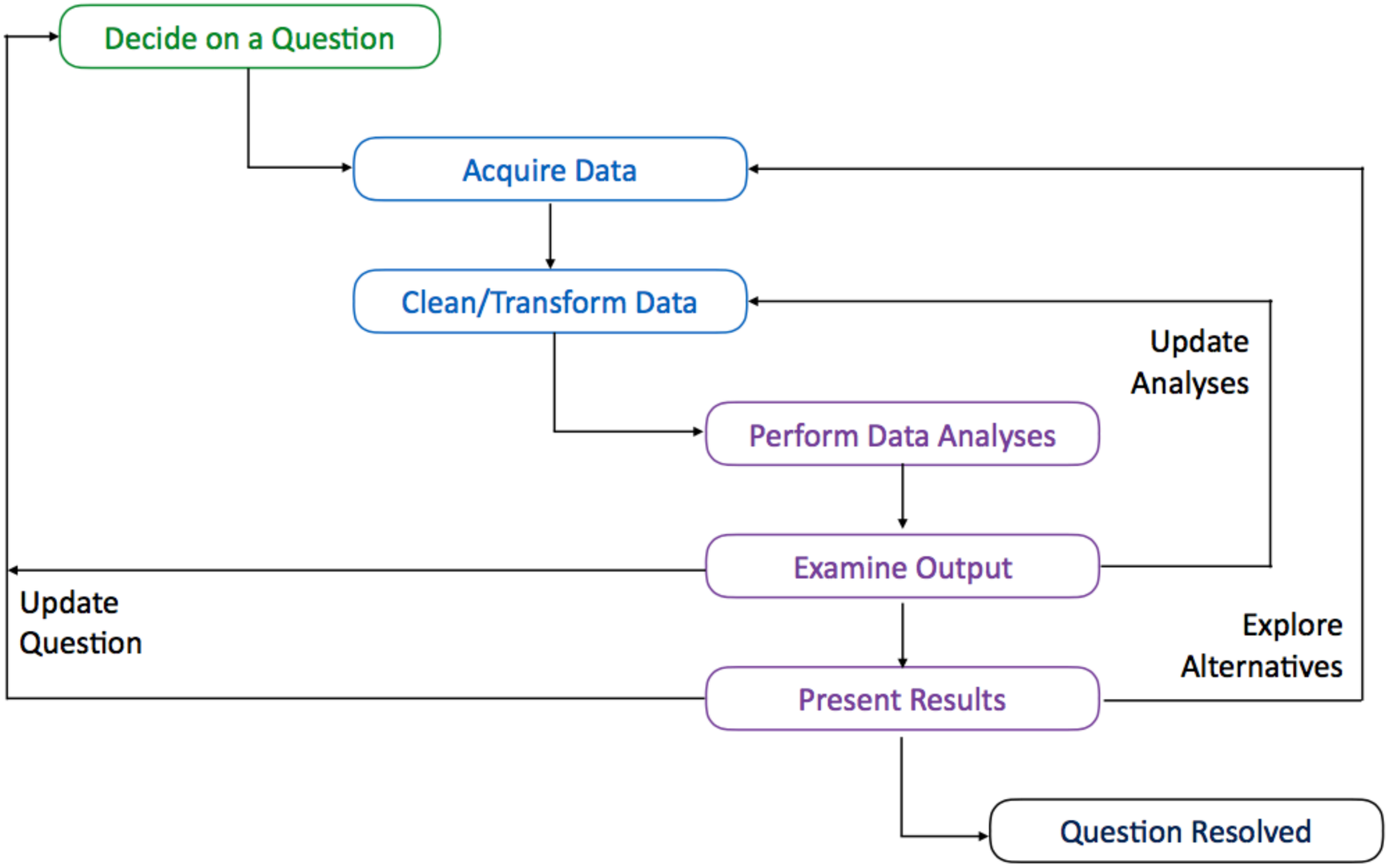
What Data Science is

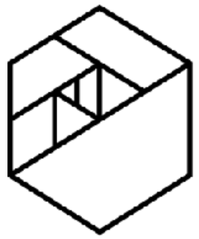




METIS

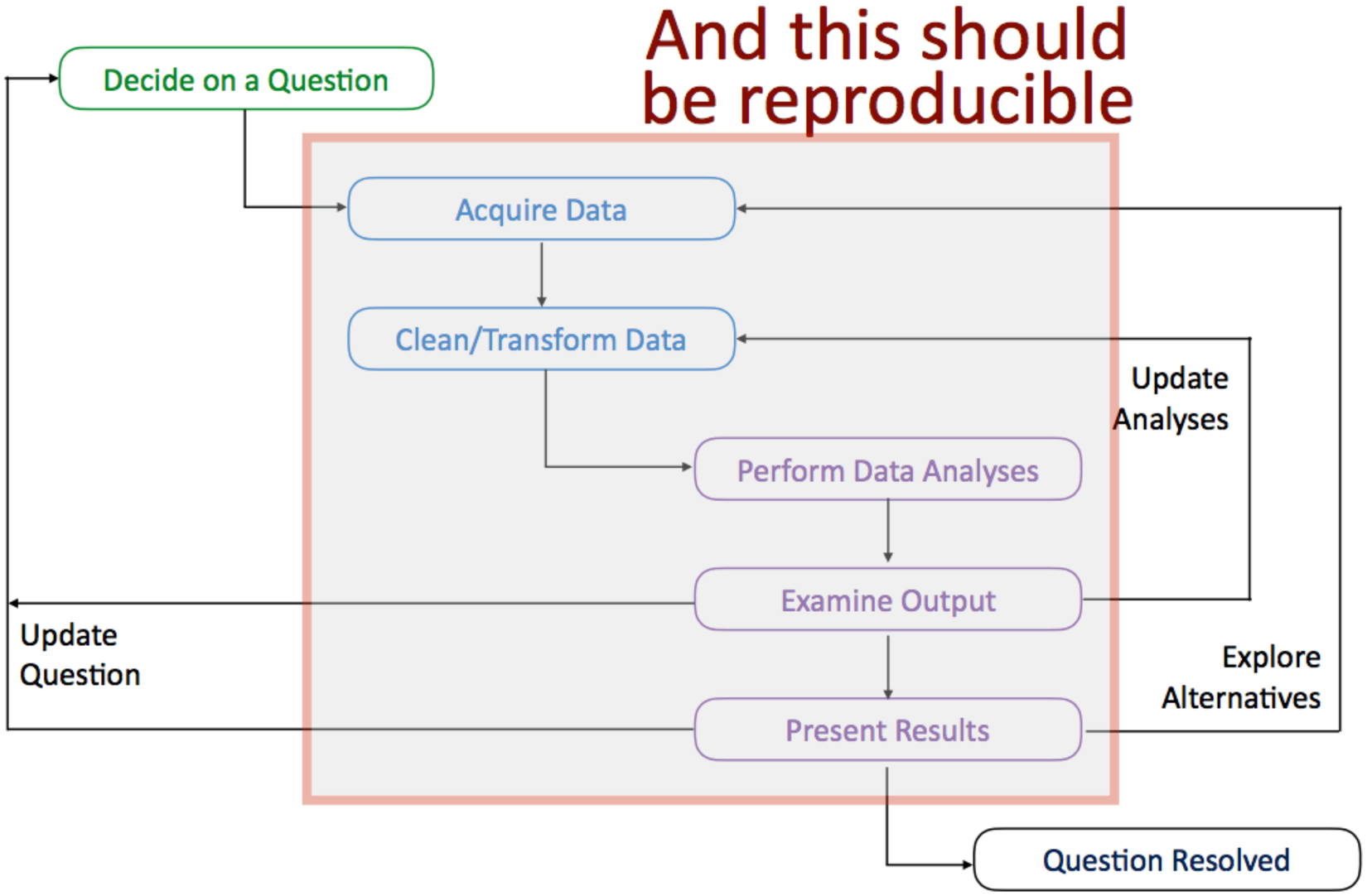
Research Process

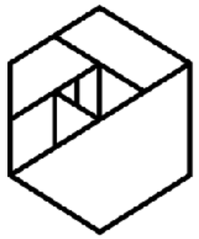




METIS

Research Process

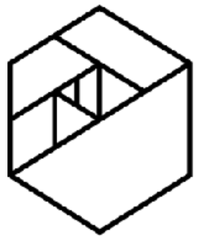




METIS

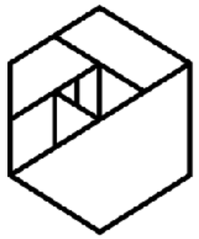
"The term "data scientist" will subside and may well sound dated five years from now. **The skills will become more commonplace and commoditized. When that happens, the real boom will begin**, because the technology will become widely adopted and thus more useful. … **Instead, we need self-service tools that empower smart and tenacious business people to perform Big Data analysis themselves**.

–Andrew Brust, "Data scientists don't scale", http://www.zdnet.com/article/data-scientists-dont-scale/



METIS

Time to Insight



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Time to Insight

Time = $$

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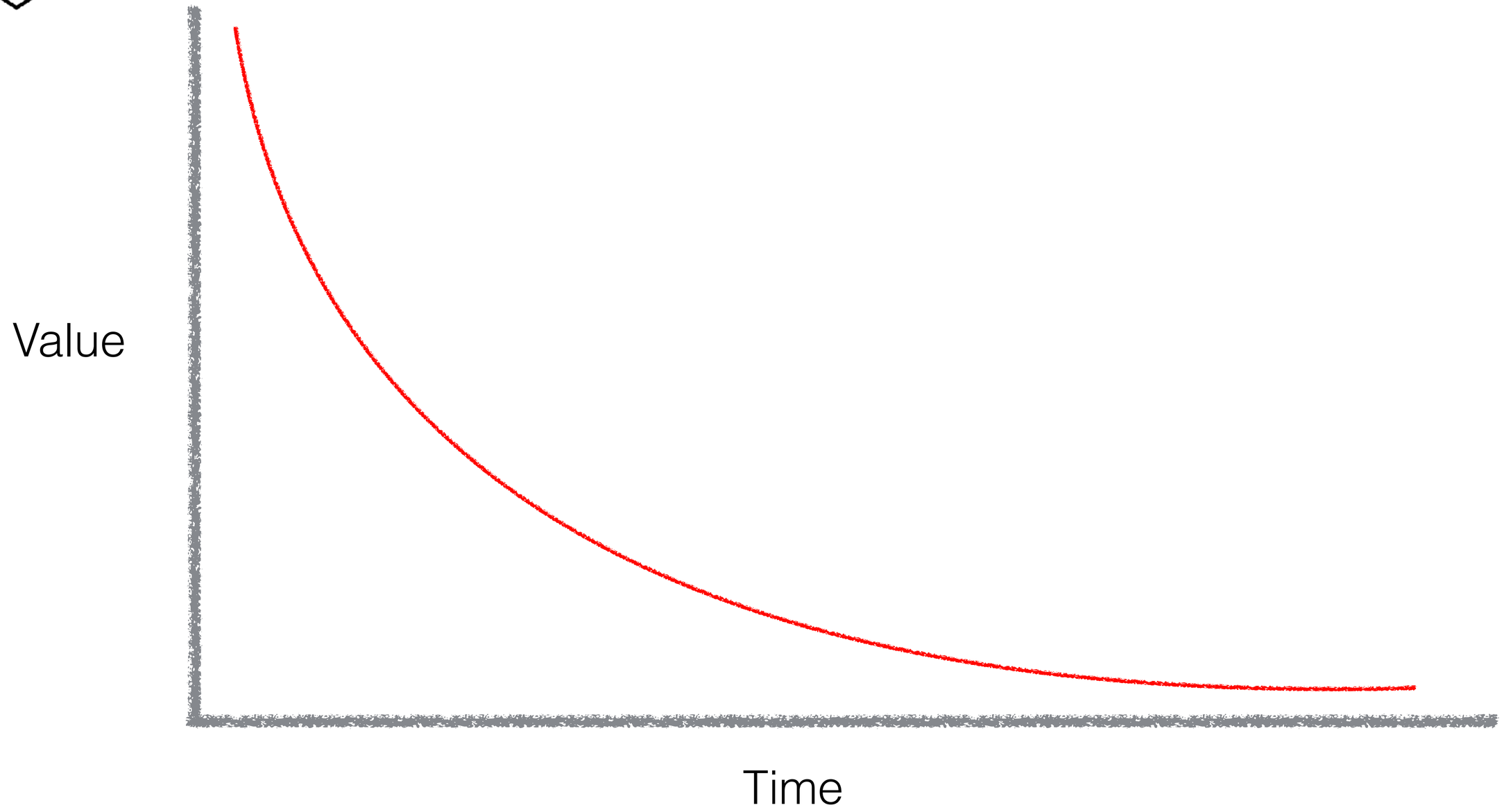
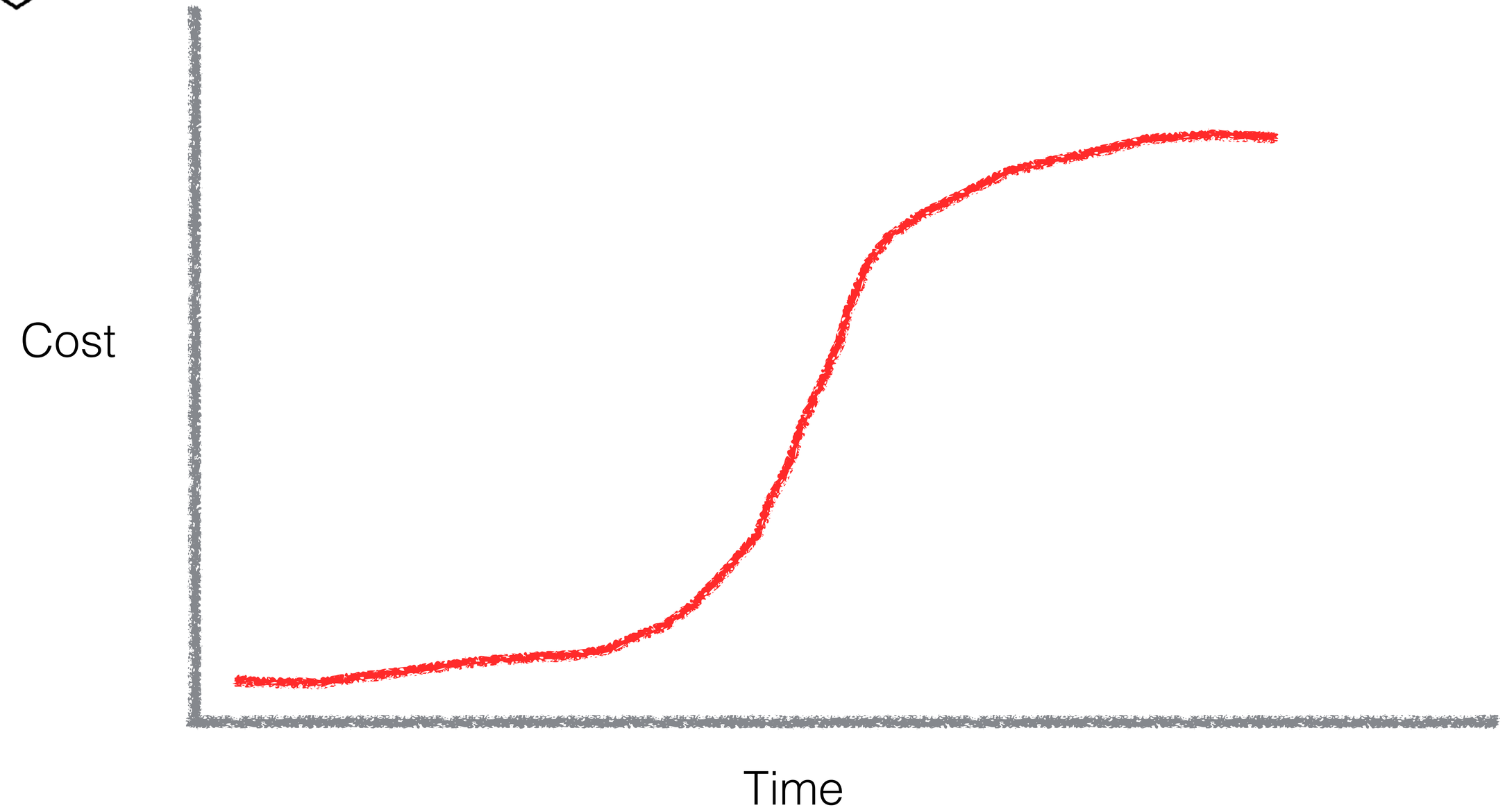
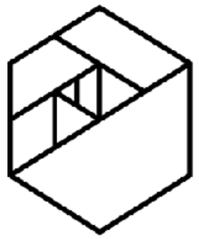
Value of Insights over Time



METIS

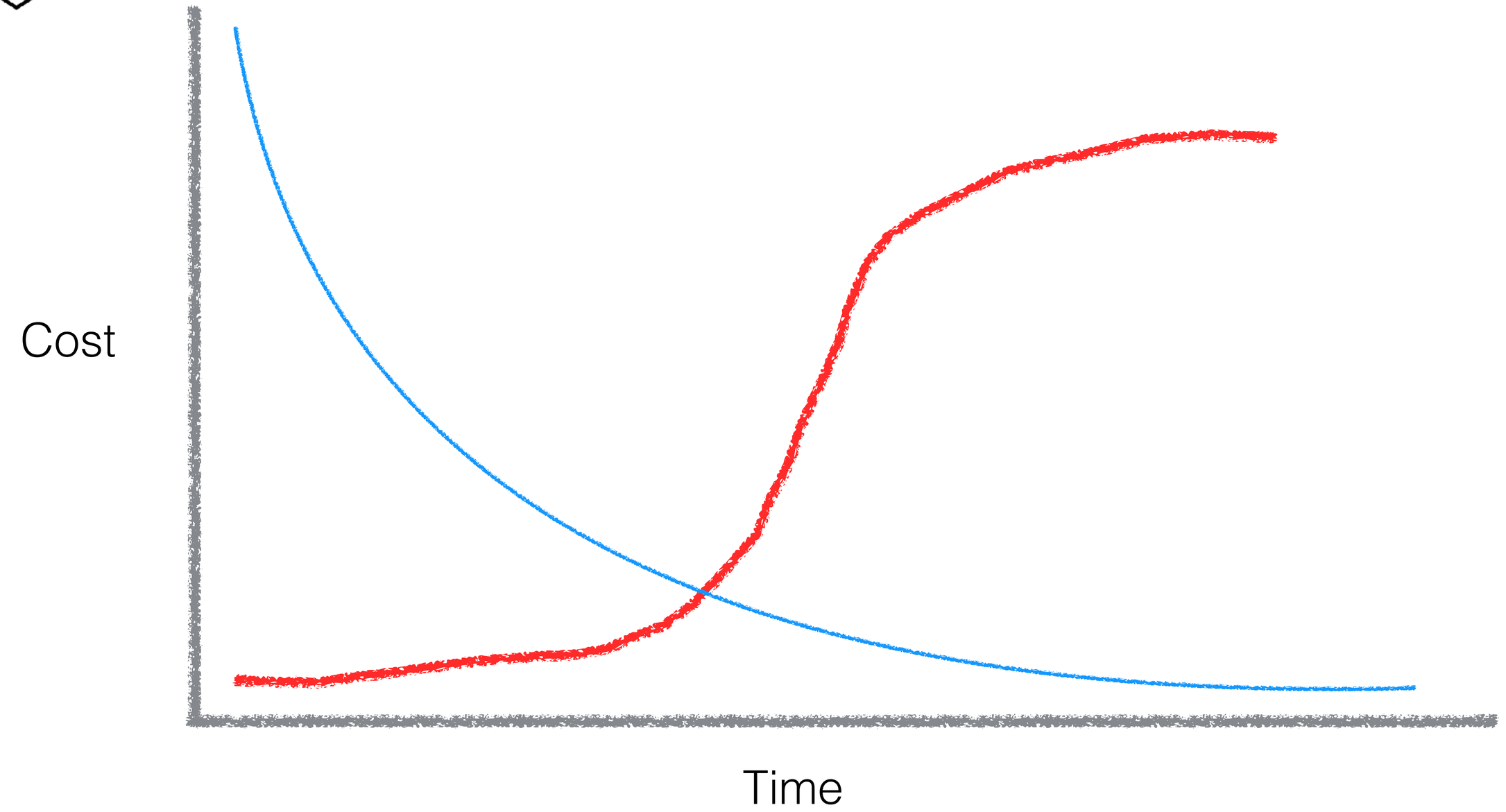
Cost of Insights over Time

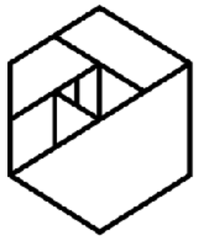




METIS

Cost of Insights over Time





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What skills does a data scientist need?

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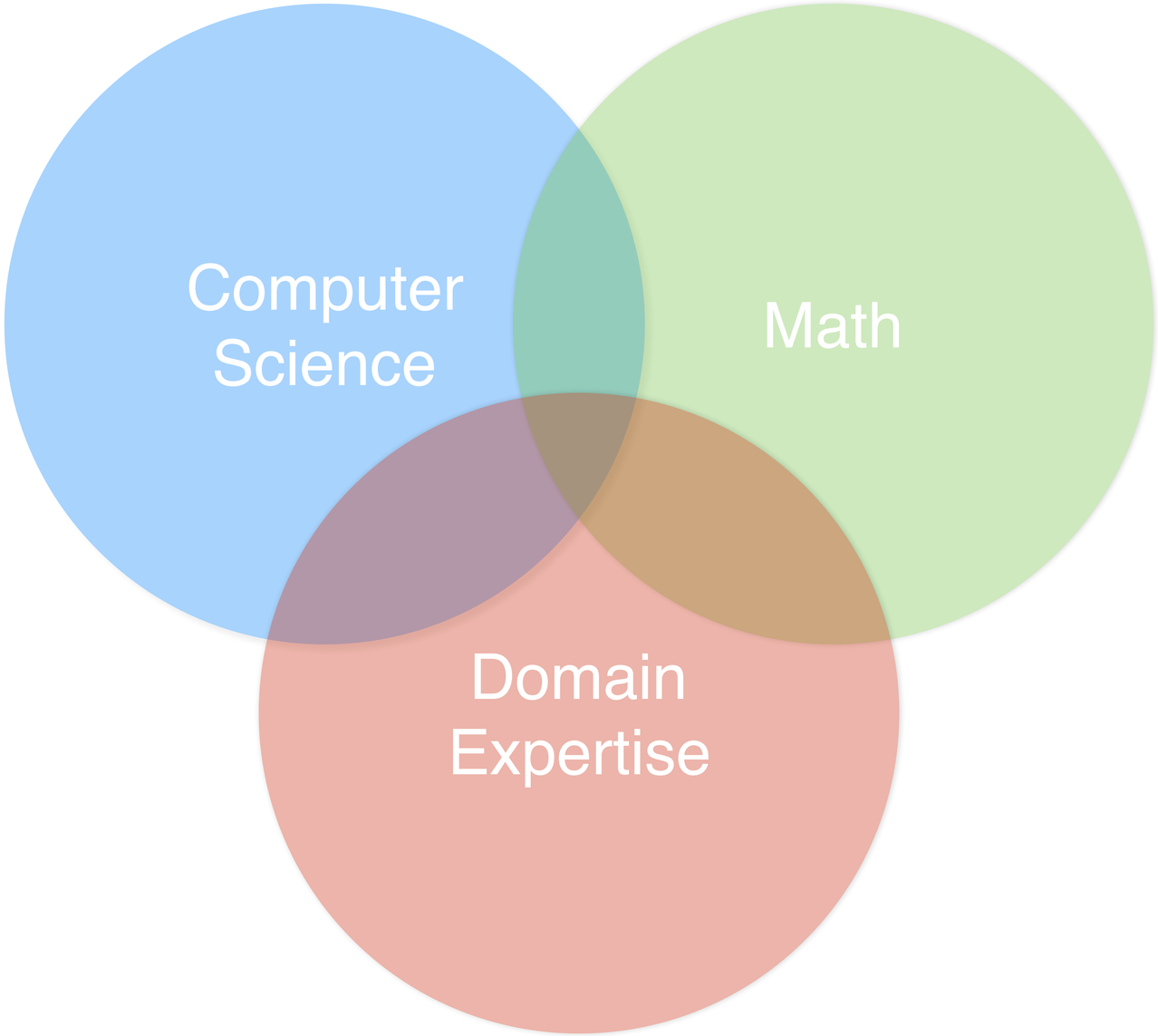

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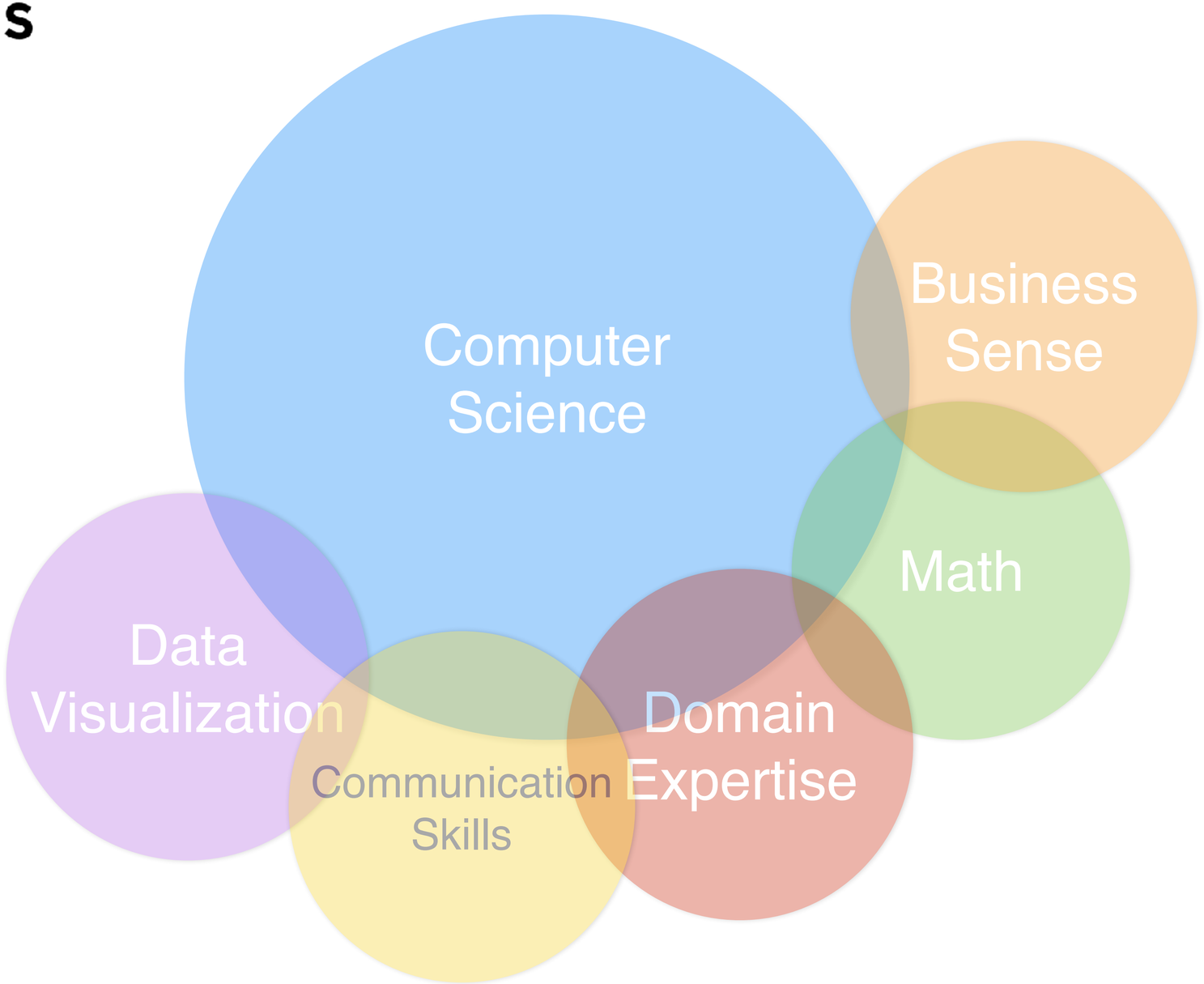
Computer Science
Business Sense
Math
Data Visualization
Communication Skills
Domain Expertise

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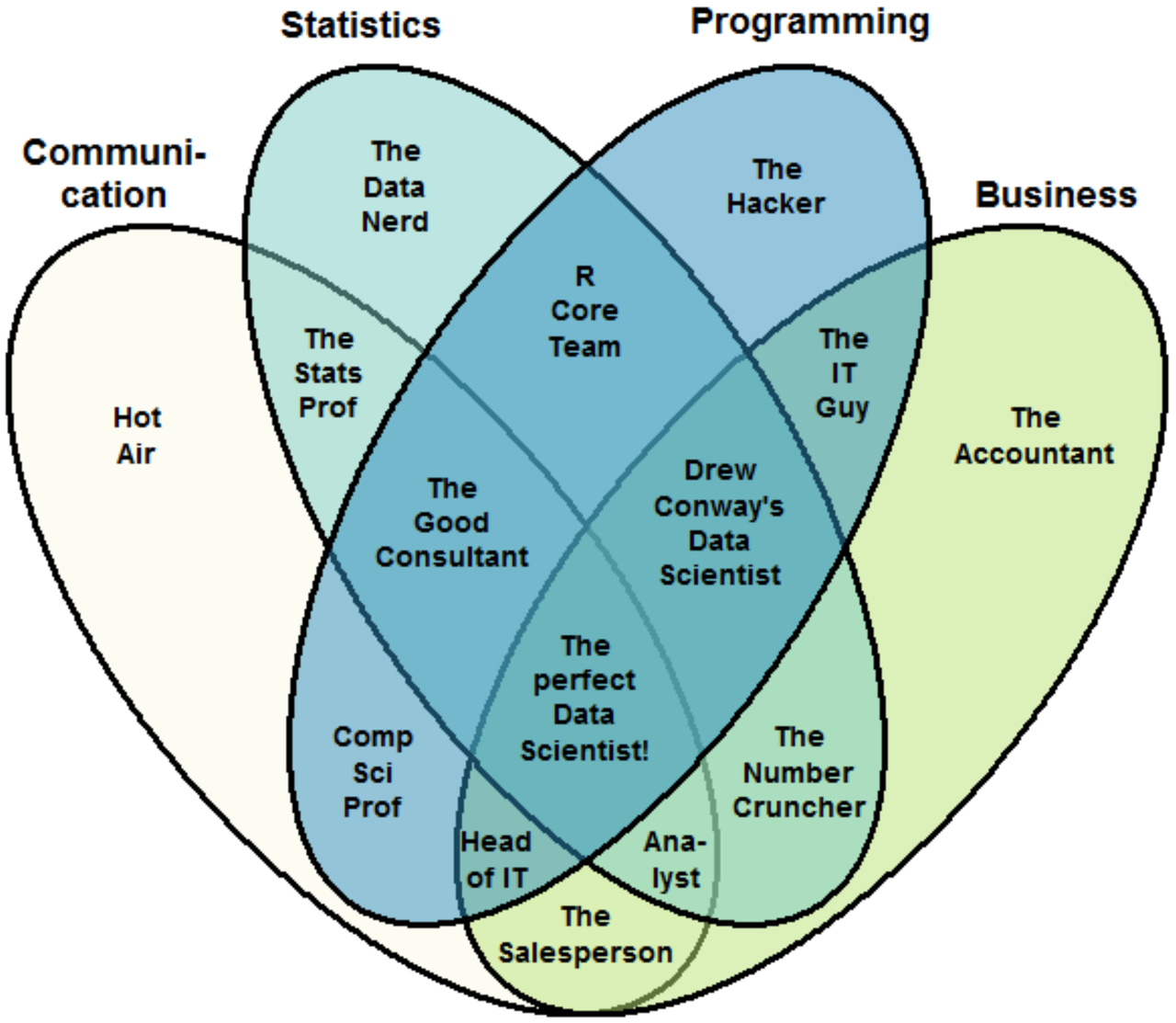
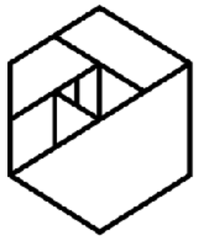
The Data Scientist Venn Diagram





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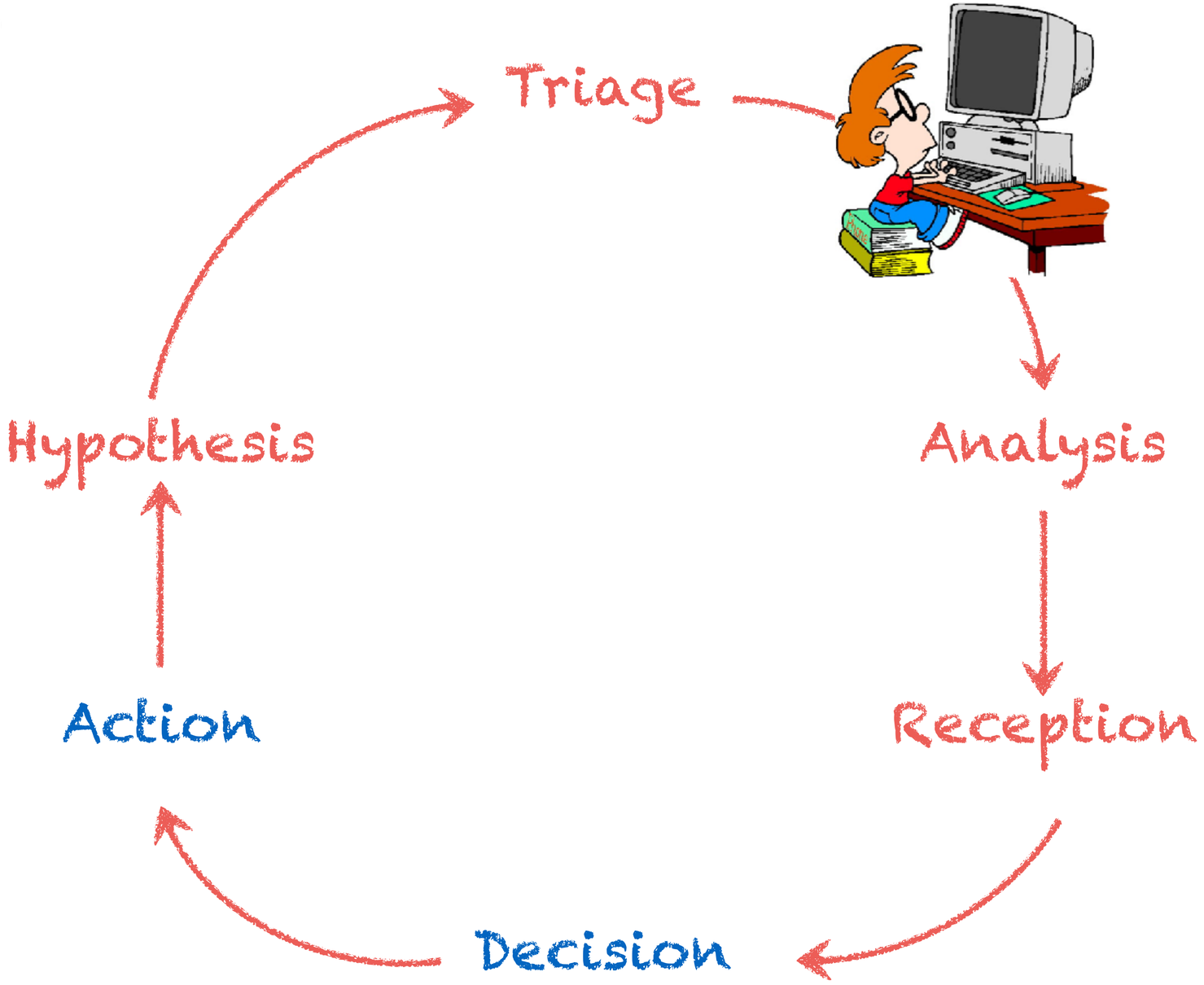
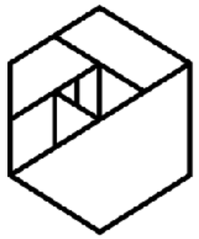
Data Scientists spend 50-90% of their time being…

METIS

METIS





METIS

By the end of the class you will be able to:

- Quickly and effectively prepare data for analysis
- Apply machine learning techniques to enhance security

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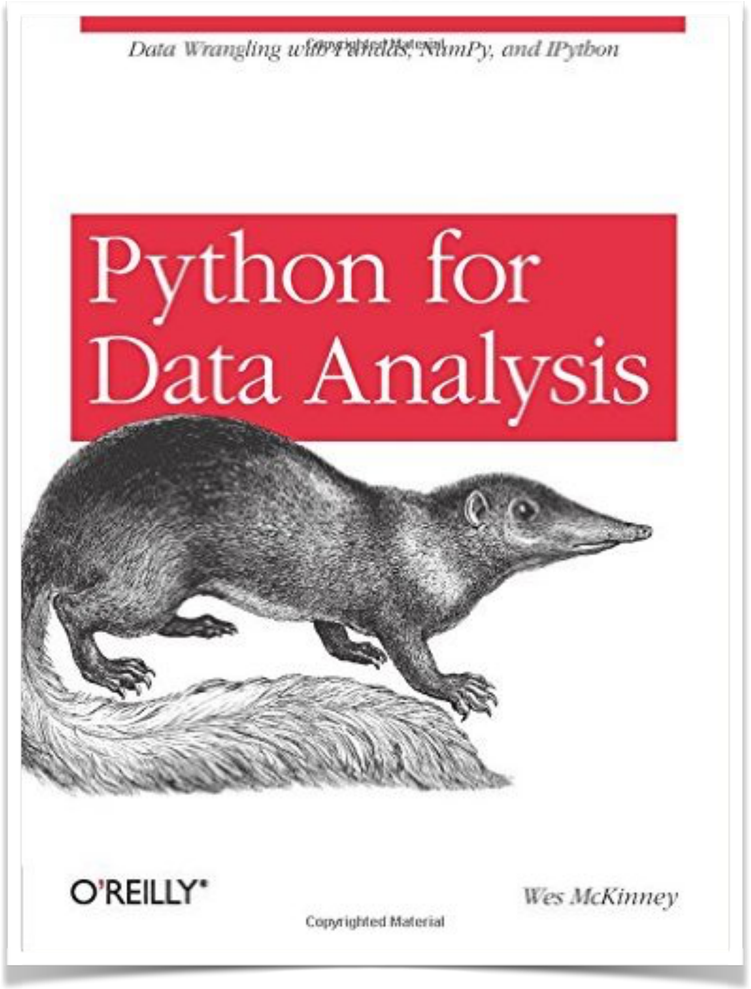
Recommended Reading



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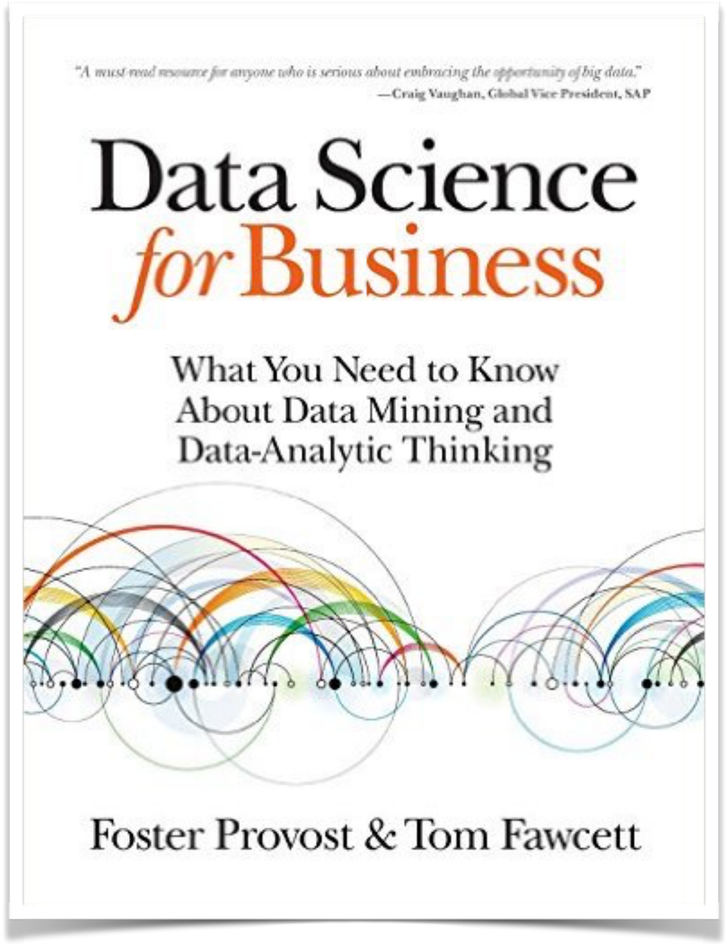
Recommended Reading



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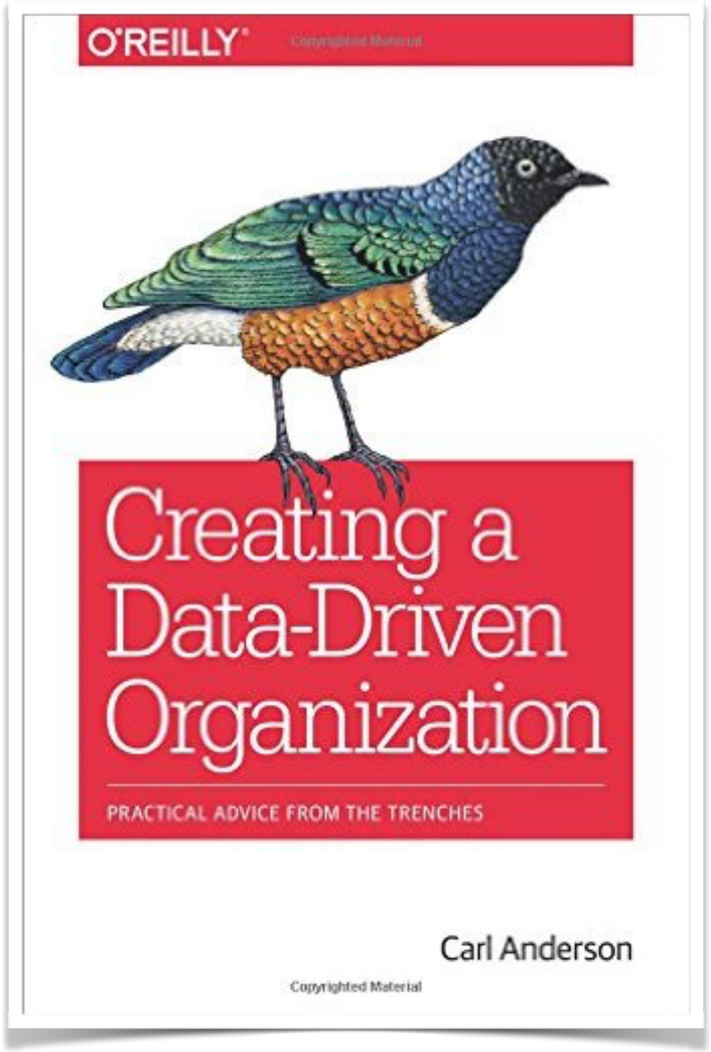
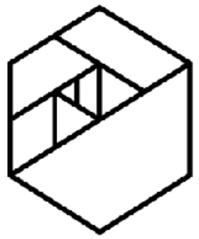
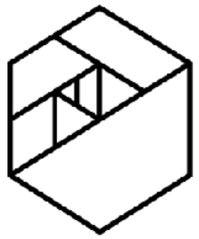
Recommended Reading





METIS

Questions?

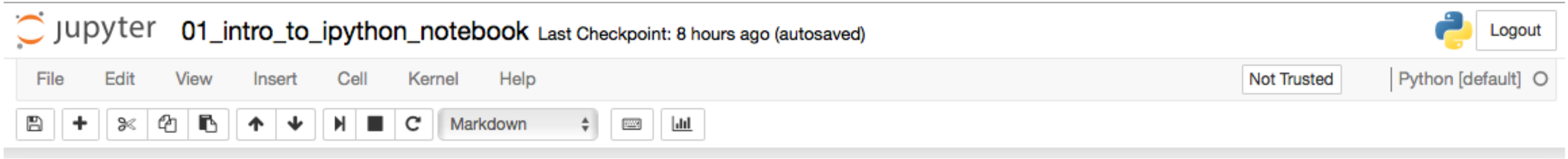


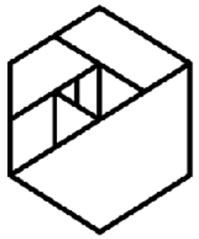
METIS

Jupyter Notebook

METIS

Jupyter Notebook



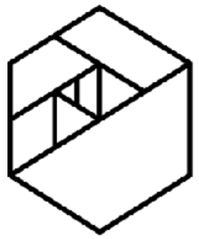


METIS

Jupyter Notebook

```
In [1]: print("Welcome to Intro to Data Science!")
```

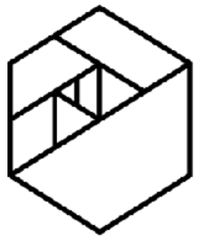
```
Welcome to Intro to Data Science!
```



METIS

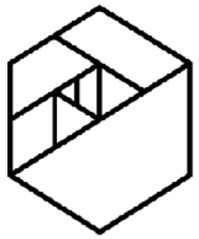
Exercise

- Please take 10 minutes to acclimate yourself to the Jupyter Notebook



METIS

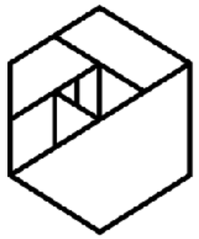
Version Control



METIS

Version Control

What is it?



METIS

Version Control

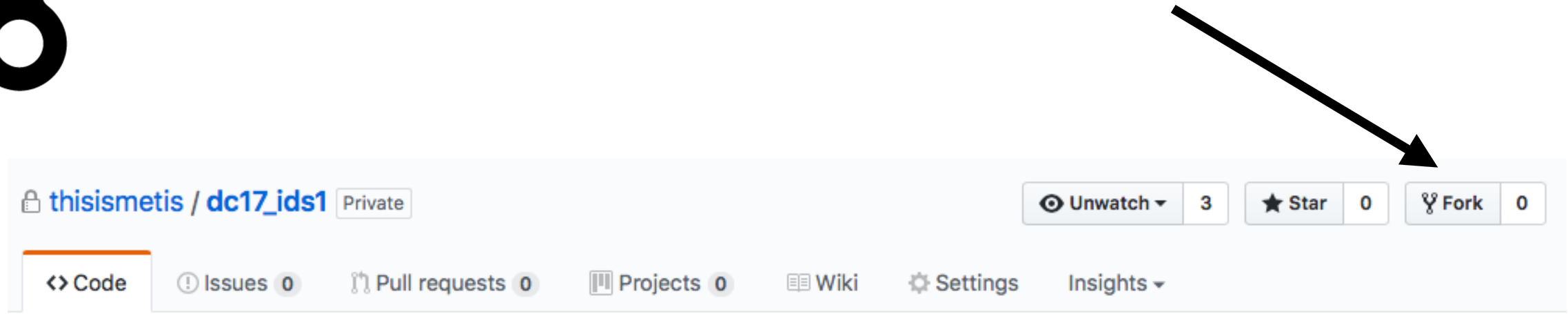
https://github.com/thisismetis/lol19_ids6_jan24

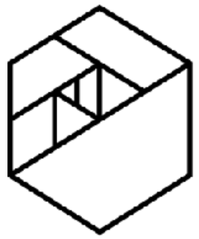
METIS

Version Control

Forking a Repository

https://github.com/thisismetis/lol19_ids6_jan24

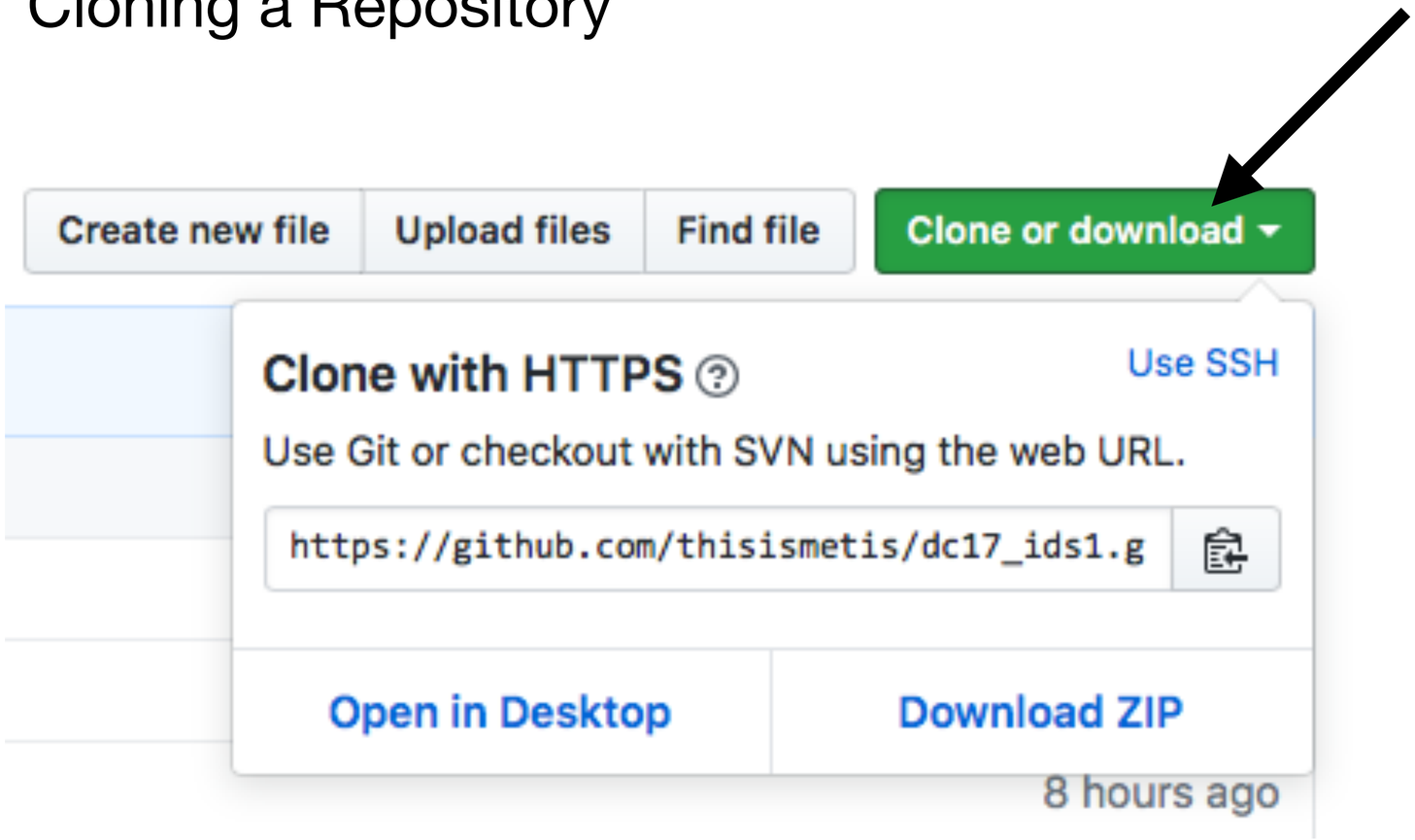


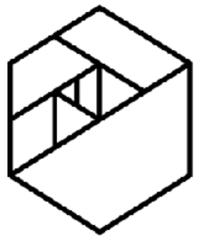


METIS

Version Control

Cloning a Repository





METIS

Version Control

```
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```

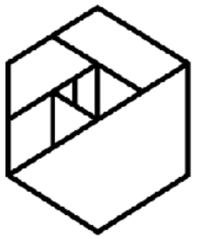

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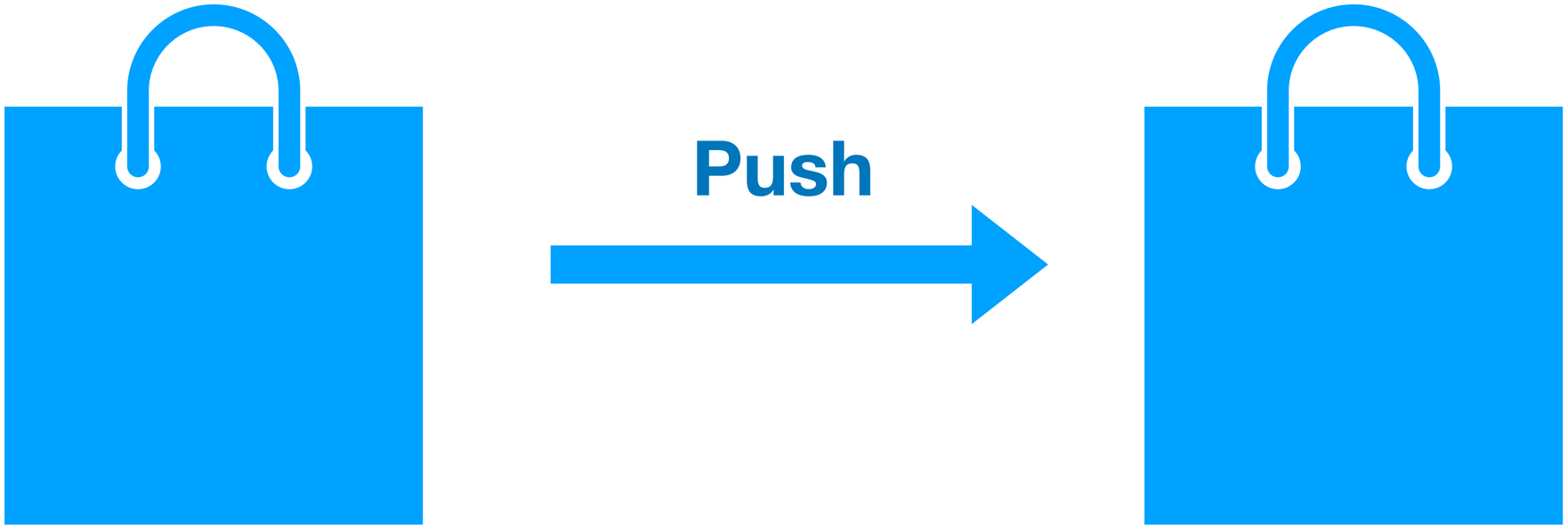

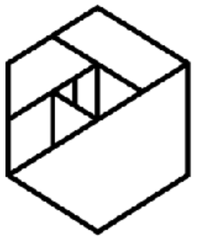

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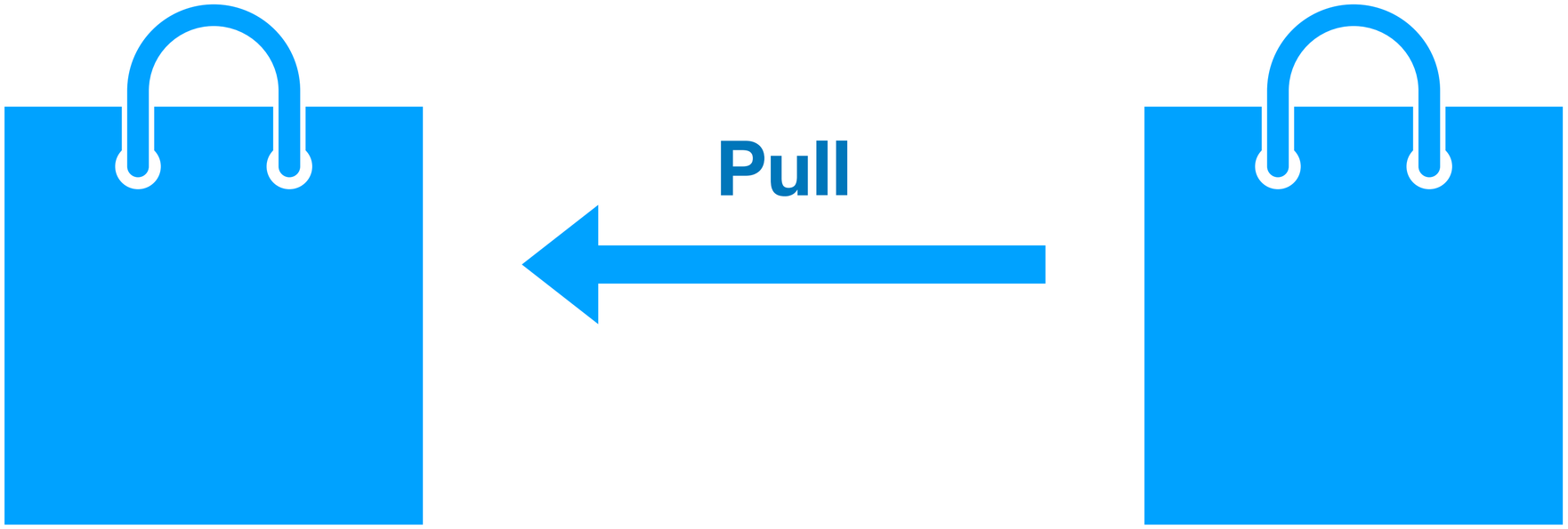
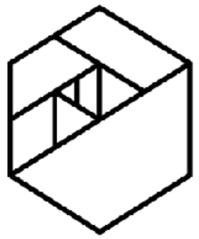
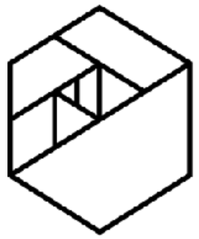




METIS

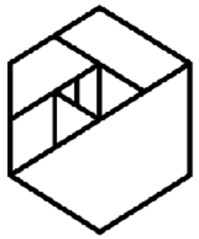
Before we start coding…



METIS

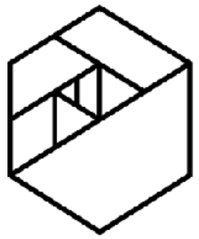
A Simple Problem

- Write down the steps necessary to calculate the minimum number of coins necessary to give change. IE: .62 = 2 Quarters, 1 Dime, 2 Pennies



METIS

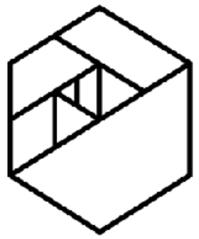
Atoms of Programming



METIS

Atoms of Programming

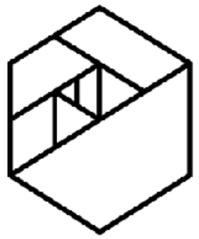
- Variables
- Math (Arithmetic)
- Assignment
- Conditional Logic (If/Else)
- Iteration
- Collections
- Functions
- Input/Output



METIS

Python Data Types

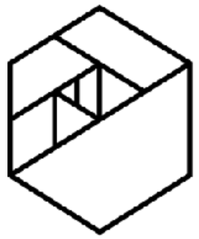
- Integer
- Floating Point
- String
- Boolean



METIS

Python Data Types

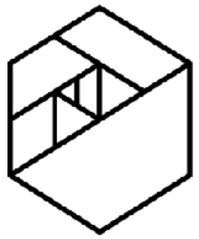
```
x = 5
```



METIS

Python Data Types

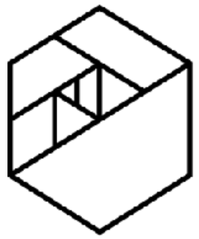
```
type( 5 )          int
type( 5.0 )        float
type(True)         bool
type(“test”)       str
```



METIS

Python Data Types

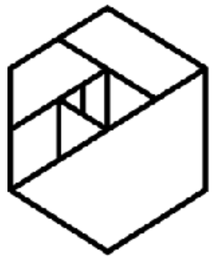
```
x = 5
type(x)          int
x = 5.0
type(x)          float
```



METIS

Python Data Types

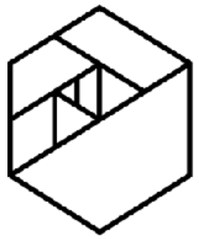
```
x = 5
type(x)                    int
type(float(x))             float

y = “test”
float(y)                   #Error
```



METIS

Quick Exercise

Declare a few variables and convert them to different data types
Which conversions don't work?



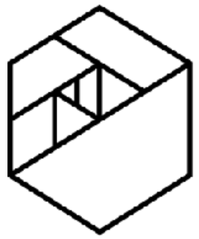
METIS

Comments

Comments are code that does not get executed.

Python has two styles: multiline and single

```
'''
This is a multi-line comment
More comment
'''

#Single line comment
```

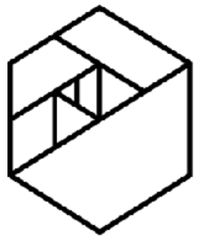


METIS

Getting Help

Python has a REALLY useful function called **help()** which gets you the documentation for variables or functions.

Give it a try.

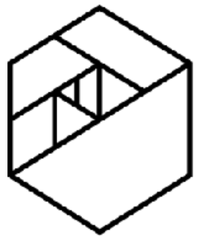


METIS

Lists

- Python and many other languages have a concept of variables that contain many variables. In Python, these are referred to as a list.
- They are indexed from zero

Index	Value
0	“First”
1	“Second”
2	“Third”
3	“Fourth”

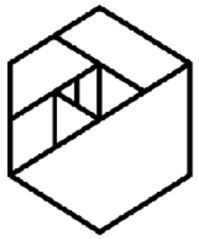


METIS

Lists

```
#Creating a list
myList = [“first”,”second”, “third”,
“fourth”]

#Accessing a list item
print( myList[0] )
>> First

#Adding to a list
myList.append( “fifth” )

#Getting list length
len( myList)
>> 5

What other list methods are available?
```

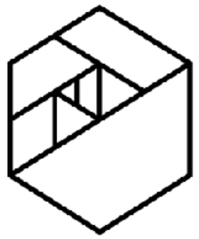
Index	Value
0	“First”
1	“Second”
2	“Third”
3	“Fourth”



METIS

List Slicing

```
myList[ startIndex :  endIndex : stepSize ]
```

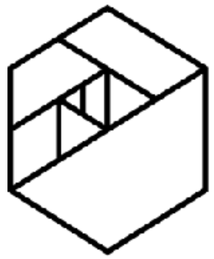


METIS

List Slicing

```
#Get every other item
myList = [“first”,”second”, “third”,
“fourth”]

myList[1::2]
>> [“Second”,”Fourth”]

#Reverse the list
myList[::-1]
>>
[“fifth”,”fourth”,”third”,”second”,”firs
t”]
```

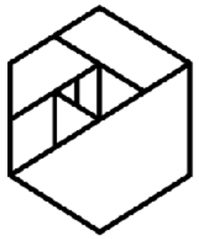
Index	Value
0	“First”
1	“Second”
2	“Third”
3	“Fourth”



METIS

Quick Exercise

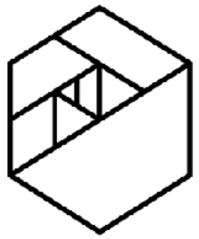
1. Create a list of 10 numbers
2. Reverse it
3. Sort it
4. Add two more numbers to it
5. Create a new list with every other item from the original list



METIS

Strings

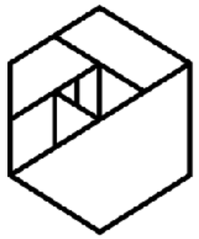
```
myName = “Charles S Givre”
```



METIS

Strings

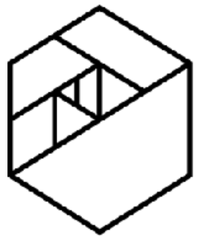
```
myName = “Charles S Givre”
```



METIS

Strings

```
myName = “Charles S Givre”

#You can slice strings
firstName = myName[0:7]

len(firstName)
>> 7

print(firstName)
>> Charles
```

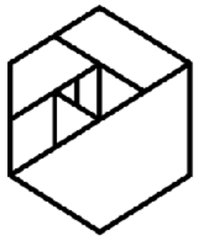


METIS

Strings

```
myName = “Charles S Givre”

#You can split strings
nameParts = myNames.split()
```

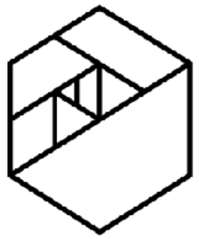
Try this…



METIS

Strings

- There are MANY useful functions that are associated with the String object including:
- upper()
- lower()
- capitalize()
- isalpha()
- and more…



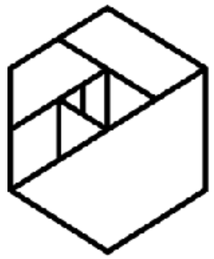
METIS

The Range Function

The range function produces a sequential list of integers.

```
range( start, end, step)
```

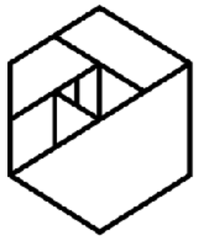
The end is NOT inclusive and the step size is optional.



METIS

Exercise

- Create a variable `my_new_list` and set it to contain "dude" and the string "55"
- Create a new variable `dude55` that is the concatenation of "dude" and “55"
- Create a variable `my_int` that is the int representation of "55"
- Create a new string called `my_substring` that is the 3rd through 5th characters of `dude55`
- Create a list called `my_range` that is all the multiples of 3 from 3-26

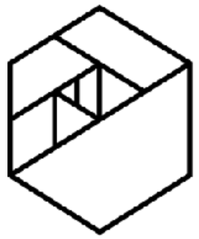


METIS

Dictionaries

- Dictionaries are similar to lists, however they are indexed by key instead of by position
- Keys must be unique
- Dictionaries have no order

Index	Value
firstName	“Charles”
middleName	“S”
lastName	“Givre”

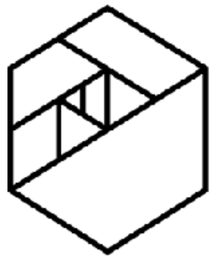


METIS

Dictionaries

```
#create a dictionary

record = {“firstName”:”Charles,
“middleName”:”S”,
“lastName”:”Givre”
}

#Accessing a dictionary item
print( record[‘firstName’] )
>> Charles

#Adding a dictionary item
record[‘Salutation’] = “Mr.”
```

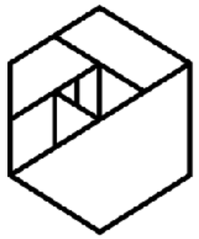
Index	Value
firstName	“Charles”
middleName	“S”
lastName	“Givre”



METIS

Exercise

- From the worksheet, print the name of the best borough (in the dictionary).
- Create a new key-value pair for `new jersey` (give it any value you like)
- Fix the boroughs stored in the `other boroughs` object so that they're both upper case

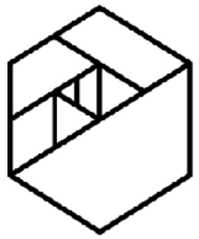


METIS

Functions

Functions are reusable blocks of code.

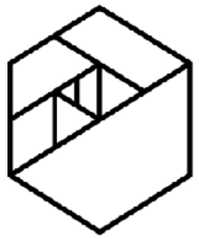
```
def isEven( x ):
    return x % 2 == 0
```



METIS

Functions

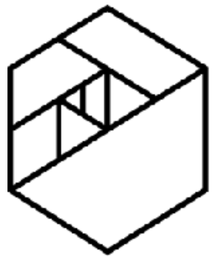
```
def reverseArray( myArray ):
    return myArray[::-1]

def addSalesTax( price, taxRate ):
    return price + (price * taxRate)

#calling a function
addSalesTax( 100.0, 0.06 )
>> 106.0
```



METIS

Functions

```
def calc_default_add(x, y, op="add"):
    if op == 'add':
        return x + y
    elif op == 'subtract':
        return x - y
    else:
        print('Valid operations: add, subtract')
```



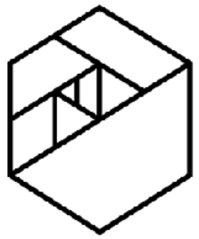
METIS

Exercise

Write two functions:

- One called `compute_pay` that takes two parameters (`hours` and `rate`), and returns the total pay.

- One called `get_hours_worked` that takes two parameters (`total_pay` and `rate`) and returns the total hours worked.

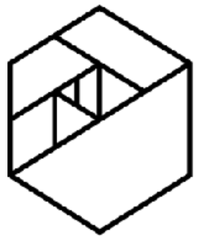


METIS

Iteration

One of the programming atoms is the concept of iteration. In Python, the basic loop is the `for` loop.

```
for i in range(0,5):
    print(i)
```

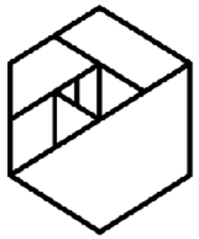


METIS

Iteration

What does this do?

```
names = [‘bob’, ‘steve’, ‘sally’, ‘sue’]
for name in names:
    print(name)
```



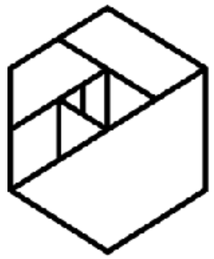
METIS

Iteration:
List Comprehensions

A list comprehension is shorthand for a simple loop. Often they are used for mathematical calculations.

```
squares = [x * x for x in range(1,11)]
```

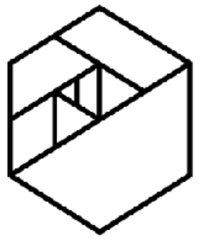
```
squares = []
for x in range(1,11):
    squares.append( x * x )
```



METIS

Exercise

- Given `words = ['yo','hello','awesome']` write a list comprehension that returns `["YO","HELLO","AWESOME"]`
- Given `word = "fancy"` write a list comprehension that returns `['F','A','N','C','Y']`
- Write a function called `awesome_sauce` that prints the numbers from 1 to 100. However, for multiples of 2 it should print 'awesome' instead of the number, and for multiples of 7 it should print 'sauce' instead of the number, and dor numbers which are multiples of both 2 and 7 it must print 'awesome sauce!'.

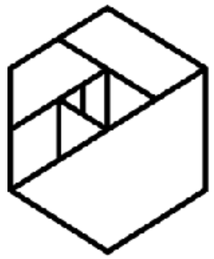


METIS

Loading Data

To load data from the internet, we will have to use some of Python's amazing modules.

```
import csv
import requests

with open('<file>', 'r') as f:
    vertebral_data = [row for row in csv.reader(f)]

#print the first 5 elements in vertebral_data
for line in vertebral_data[:5]:
    print(line)
```



METIS

Exercise

- Split every item in `iris_data` on the commas
- Split every item in `vertebral_data` on the spaces
- Get only the numeric entries in each item in `iris_data`