THE UNIVERSITY OF CHICAGO

MASTERS IN COMPUTATIONAL SOCIAL SCIENCE
THE UNIVERSITY OF CHICAGO

MACS 30111

Classes and Objects (examples)

Misc

Topics:

- Stock Span Example
- Class Inheritance in Python
- Python string formatting
- M/D/1 Queue Example

Stock Span example

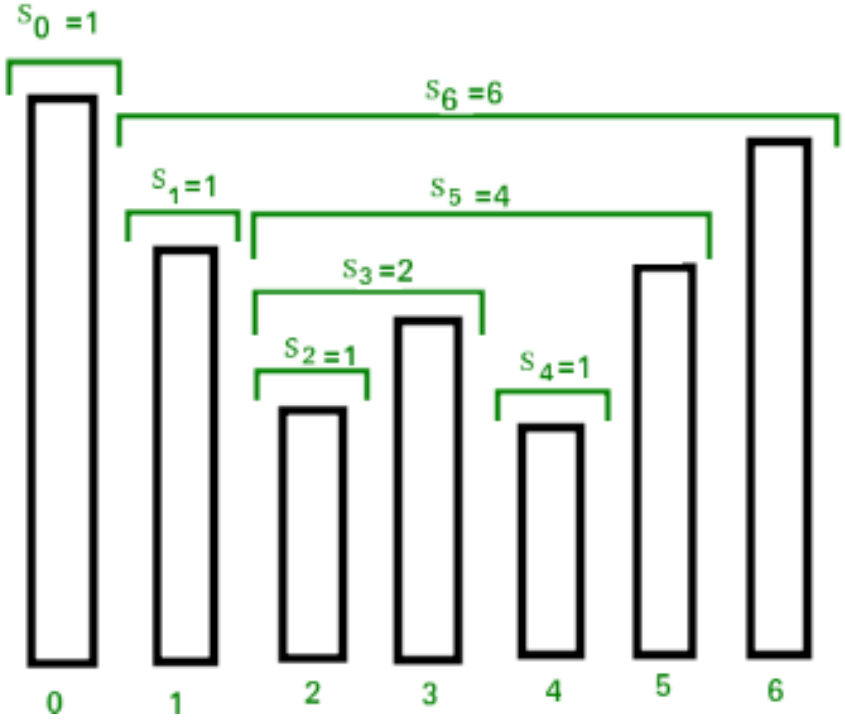
- **The stock span problem** is a financial problem where we have a series of **N** daily price quotes for a stock and we need to calculate the span of the stock's price for all N days. The span Si of the stock's price on a given day i is defined as the maximum number of consecutive days just before the given day, for which the price of the stock on the current day is less than its price on the given day.

- How could we represent this using our current skillset?

Stock Span example

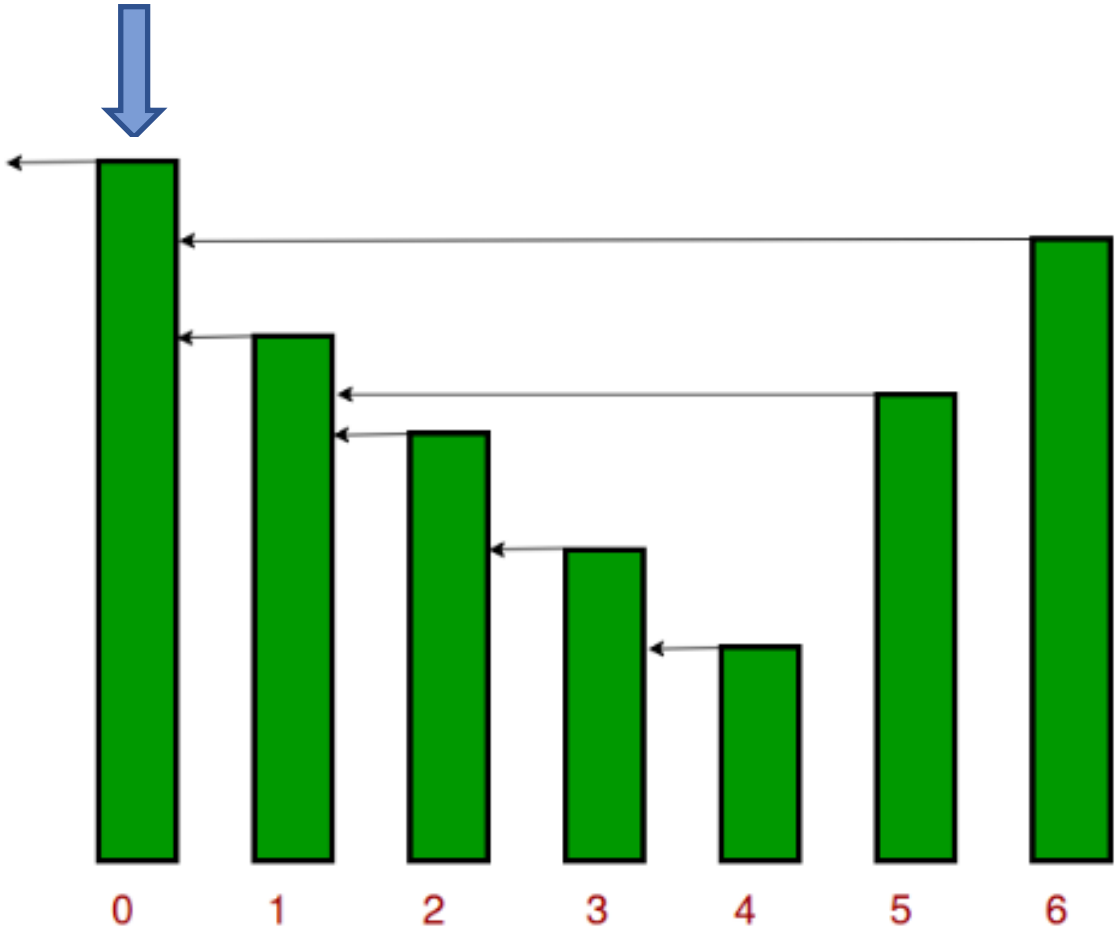
- Financial problem
- A series of n daily price quotes for a stock
- The span of the stock's price for all days:
  - S_i: max consecutive days
  - Stock price less than or equal to the current day
  - Including the current day

- Price = [100, 80, 60, 70, 60, 75, 85]



List / stack implementation

Reference: course website M4

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for i in range(1, n):
    while( len(st) > 0 and price[st[-1]] <= price[i]):
        st.pop()

    if len(st) <= 0:
        S[i] = i + 1
    else:
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    st.append(i)
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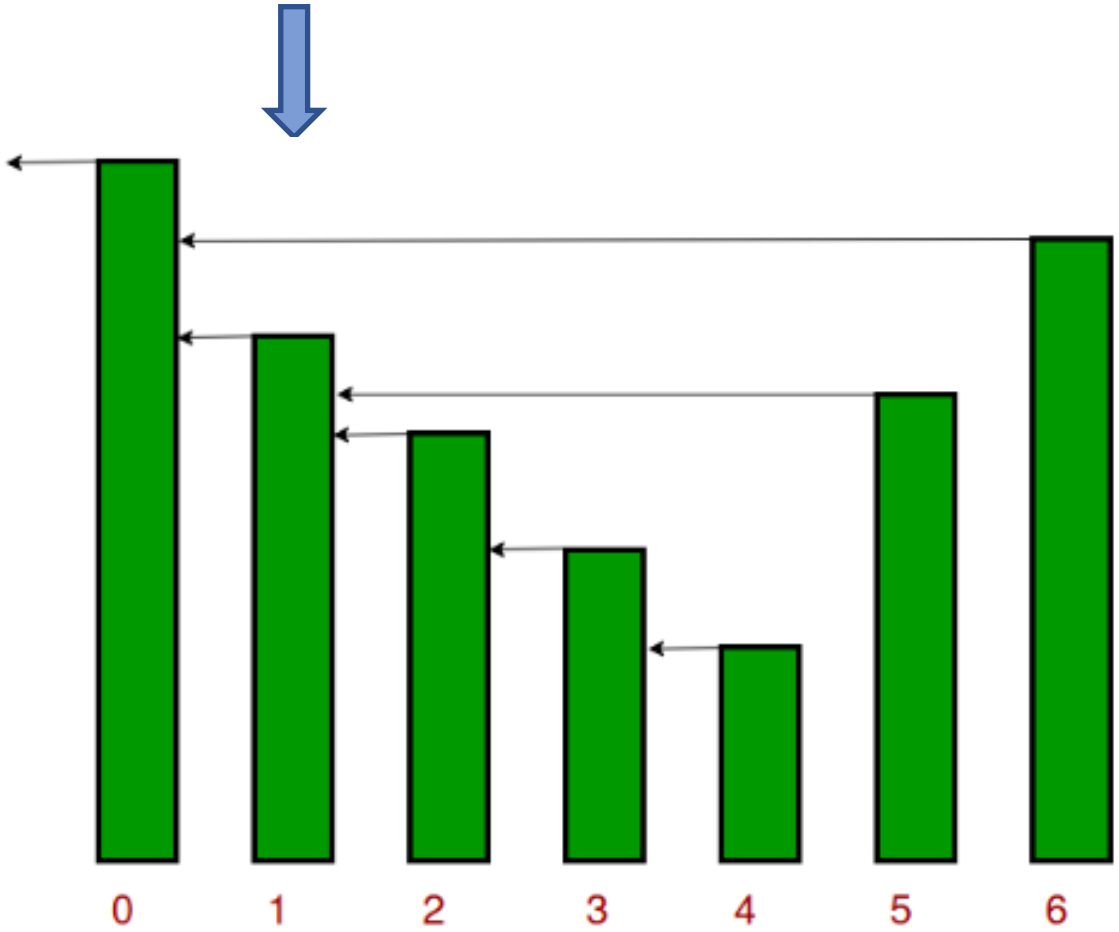


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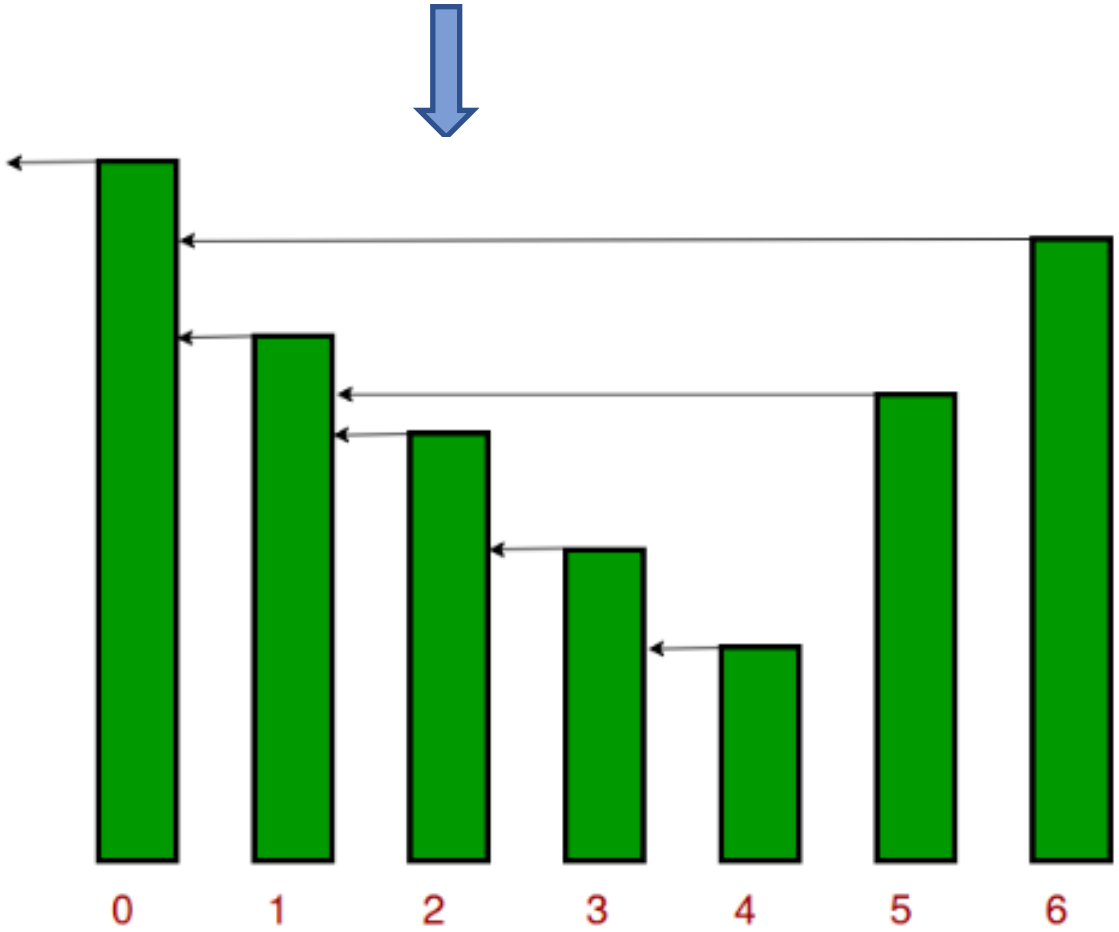
TOP

| 0 |

BOTTOM

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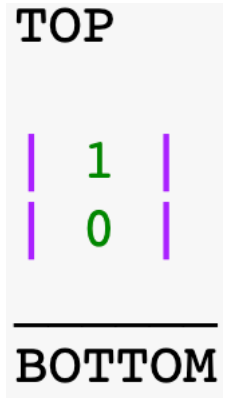

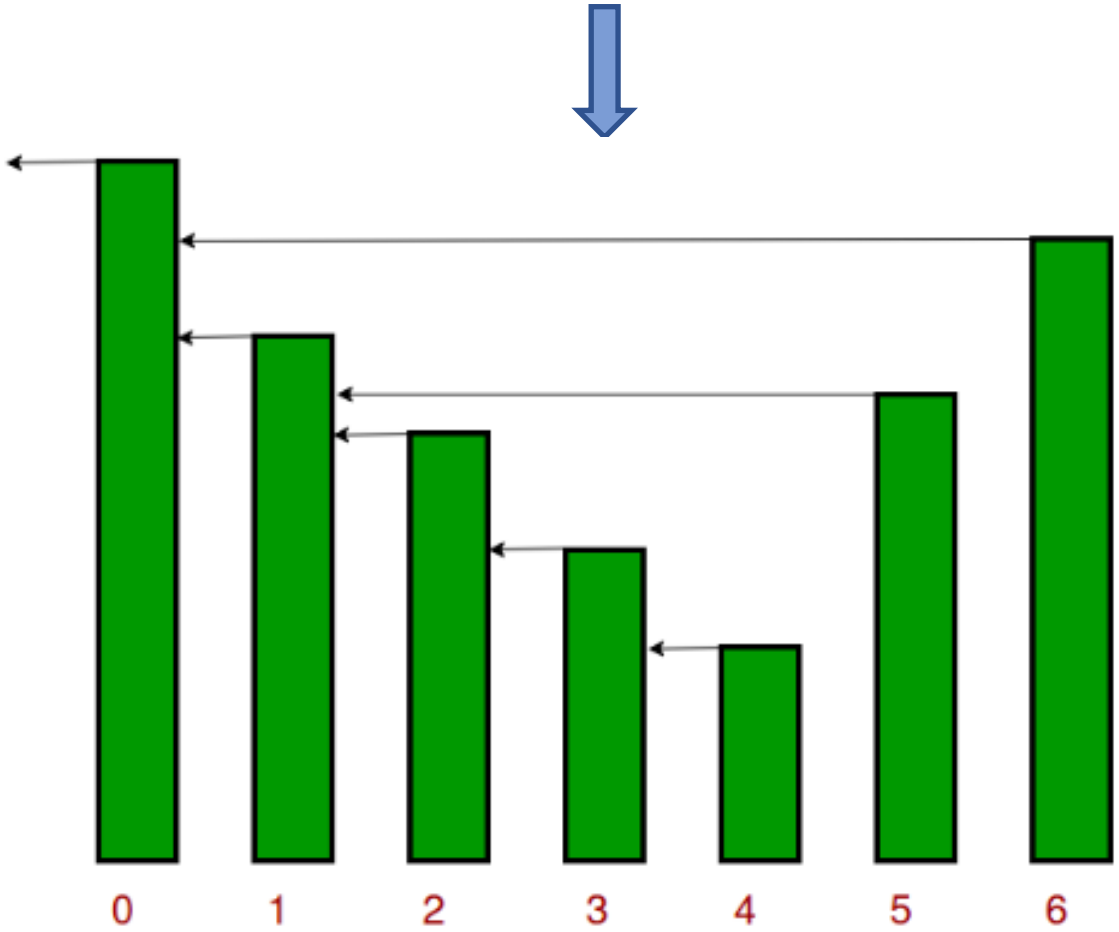


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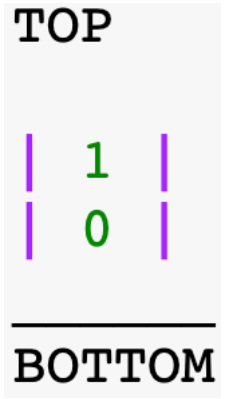

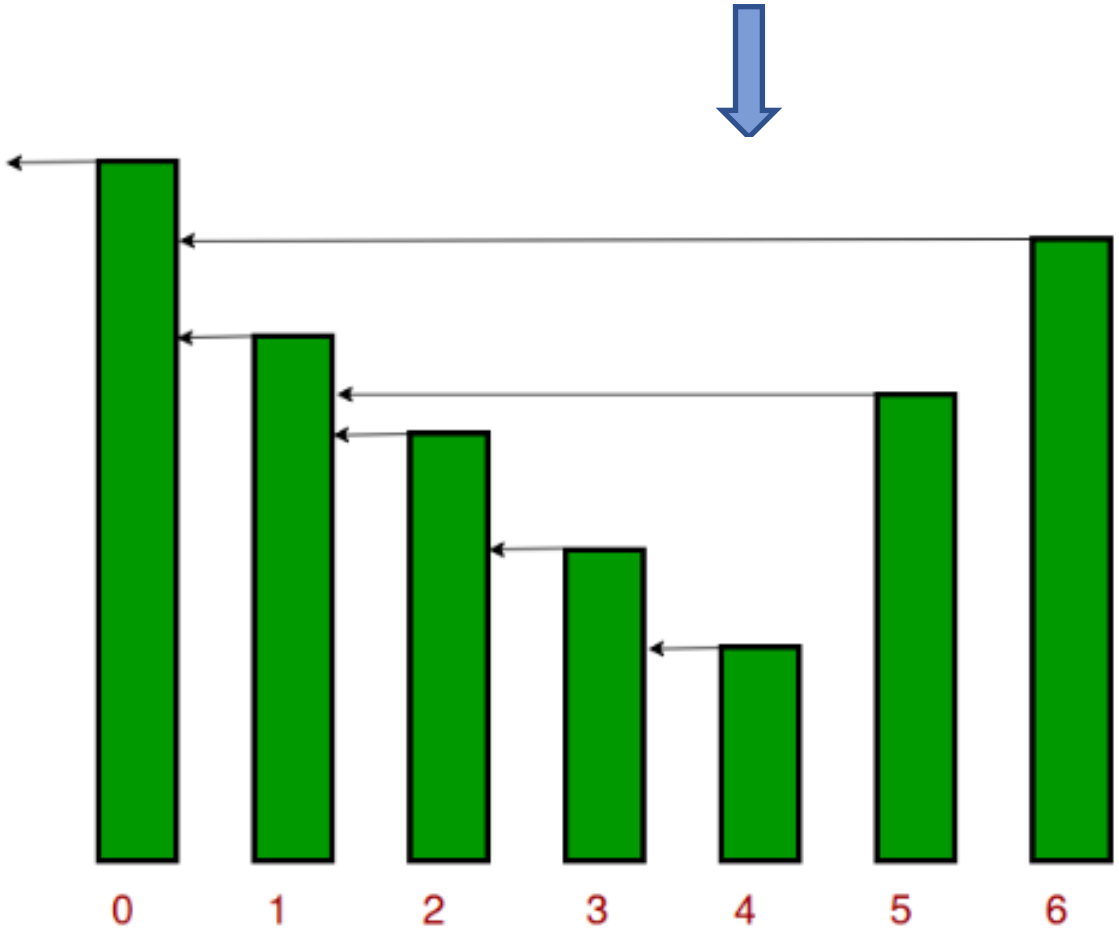


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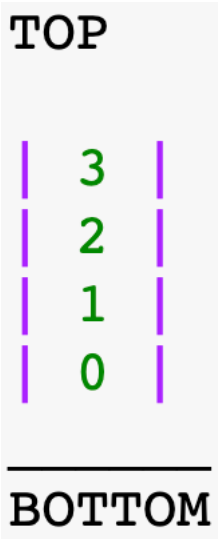

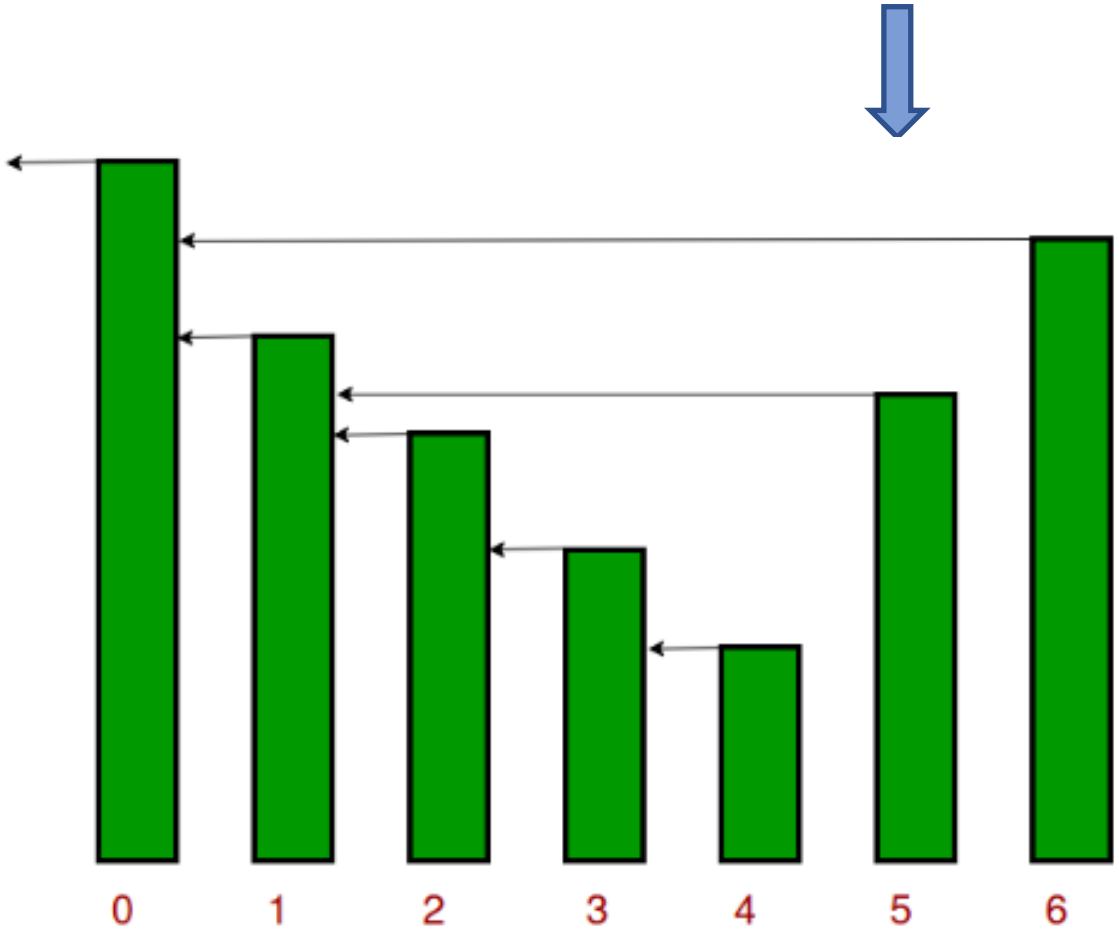


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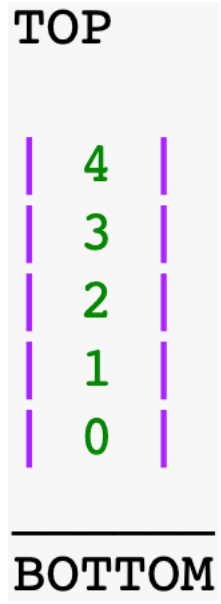

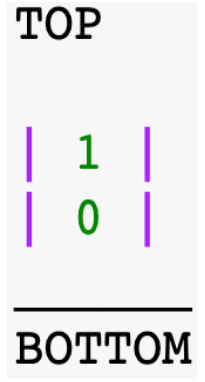

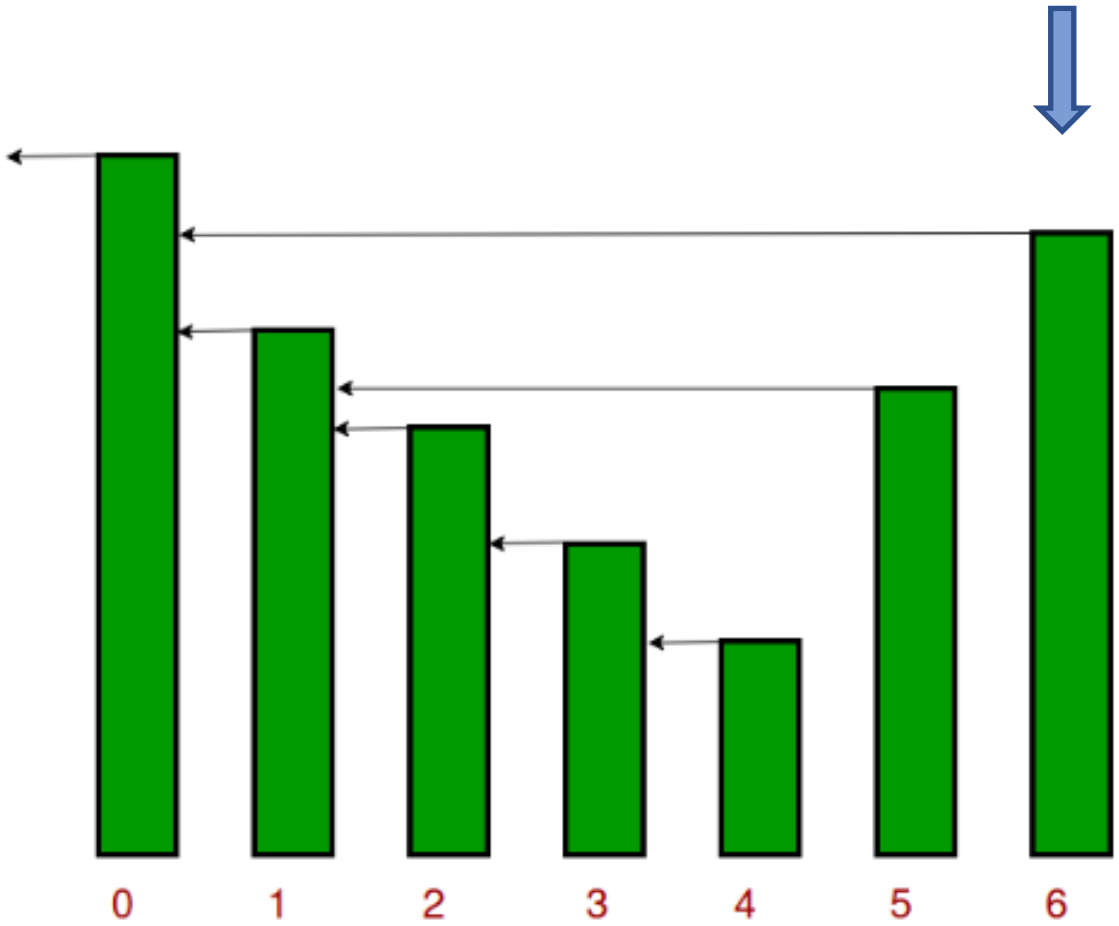


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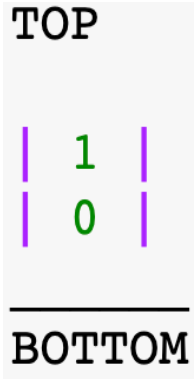

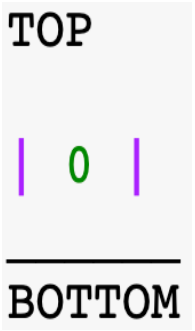

Class Inheritance

What if there’s lots of stuff?

Class Inheritance in Python

```
class Location(object):
    def __init__(self, latitude, longitude):
        self.latitude = latitude
        self.longitude = longitude
```

```
class Stack:
    def __init__(self):
        self.__lst = []
```

All classes inherit from *object*

Reference: https://docs.python.org/3/tutorial/classes.html#inheritance

Class Inheritance in Python

```
class DerivedClassName(BaseClassName):
    <statement-1>
    .
    .
    .
    <statement-N>
```

- Shape → circle/square
- Animal → dog/cat/bird
- Transportation → car/train/bike

Reference: https://docs.python.org/3/tutorial/classes.html#inheritance

Class Inheritance in Python

```
class Animal:
    def __init__(self, name, age):
        self.name = name
        self.age = age

    def call(self):
        print(self.name, 'can bark')
```

- Attribute
- Method

```
class Cat(Animal):
    def __init__(self, name, age, sex):
        super().__init__(name, age)
        self.sex = sex

    def call(self):
        print(self.name, 'barking: meow meow')
```

```
class Dog(Animal):
    def __init__(self, name, age, sex):
        # python 2.x
        super(Dog, self).__init__(name, age)
        # python 3.x
        # super().__init__(name, age)
        # Animal.__init__(self,name, age)
        self.sex = sex
    def call(self):
        print(self.name, 'barking: woof woof')
```

Dealing with inherited methods

- Define the class to be inherited
- Then define your later classes that will take traits from the original
- Create parameters (e.g. traits) and functions (aka methods) that belong to your class
- Call the methods based on either referring to the class of the object itself (child) or the original class (parent).
- Test: what happens if we call (cat object).call?

Python string formatting

```
name = 'bob'
```

```
'Hello, bob!'
```

```
# python 2.x
'Hello, %s' % name
```

```
# python 3.x
'Hello, {}'.format(name)
```

```
# python 3.6+
f'Hello, {name}!'
```

Reference: https://realpython.com/python-string-formatting/

Application: Animal class

- Make a method that belongs to the parent class
- Make a method that belongs to only one of the child classes
- Create a cat and a dog
- Call the method for each the cat and dog from the parent class
- Call the method from the child class from each of the child classes (including the one where it isn’t defined)

Time permitting: Divvy

(otherwise, work through on own!)

Divvy example: exploring inheritance

- So, instead of having a latitude and longitude attribute, we can define our class to have a location attribute that contains a Location object.
  - **What does this mean??**

https://book.cs-apps.org/data_structures/classes/index.html#composition

How is this structured?

- If we follow this approach, adding a method to compute the distance from one station to another becomes very simple:

```
class DivvyStation(object):

    def __init__(self, stationID, name, latitude, longitude, dpcapacity,
landmark, online_date):

        self.stationID = stationID
        self.name = name
        self.location = Location(latitude, longitude)
        self.dpcapacity = dpcapacity
        self.landmark = landmark
        self.online_date = online_date

    def distance_to(self, other_station):
        d = self.location.distance_to(other_station.location)
        return d
```

Variables:

trip_id: A unique integer identifier for the trip.

starttime, and stoptime: The start and end time of the trip.

bikeid: A unique integer identifier for the bike used in this trip.

tripduration: The duration (in seconds) of the trip.

from_station_id and to_station_id: The integer identifiers of the origin and destination stations.

from_station_name and to_station_name: The names of the origin and destination stations.

usertype: This field will be either Customer or Subscriber. A “customer” is a rider who purchased a 24-Hour Pass, and a “subscriber” is a rider who purchased an Annual Membership.

gender: The gender of the rider. This field only has a value when the rider is a subscriber.

birthday: The date of birth of the rider. This field only has a value when the rider is a subscriber.

Upcoming: Thursday

- More on classes
- Walk through SE 4