Intro. to Computer Science: Programming with Python

Assoc. Prof. Lipyeow Lim
Information & Computer Sciences
University of Hawai`i at Māanoa

What is Computer Science ?

The science of solving problems using computers!

Examples:

- Simple calculations to solving puzzles
- Keeping in touch with friends: email, facebook, etc.
- Finding information: Databases, Google, Youtube
- Entertainment: Games, Animations
- Answering questions: IBM’s Watson in Jeopardy
- Automating tasks: smartphones, cars, machinery

Do you speak the language of computers?

The Languages of Computers

- Computers speak machine language
  - architecture-specific
  - not human friendly
- More human friendly languages (Assembly, C etc) need to be translated to machine language!
- Today we will use Python
  - Python interpreter (a program) will translate the python code to machine code and execute it

Python, Perl etc.

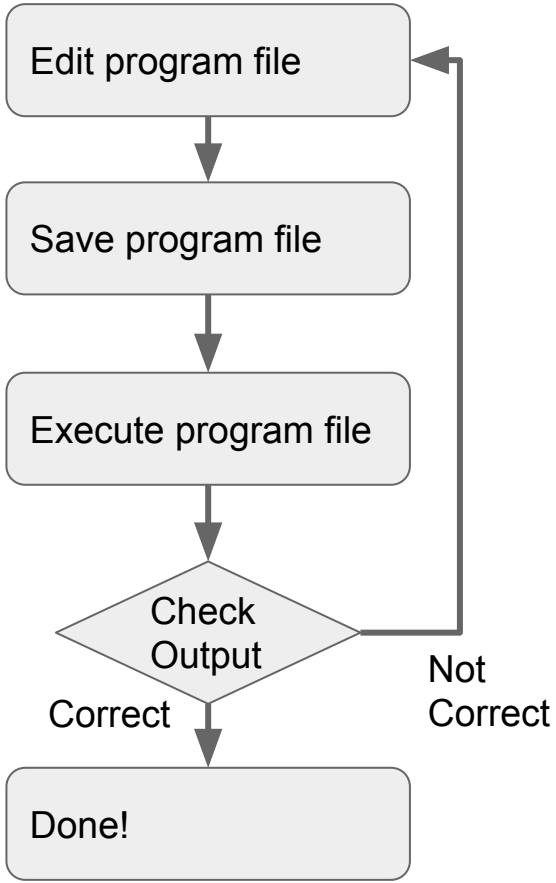
C, Fortran, Java etc.

Assembly Language

Machine Code

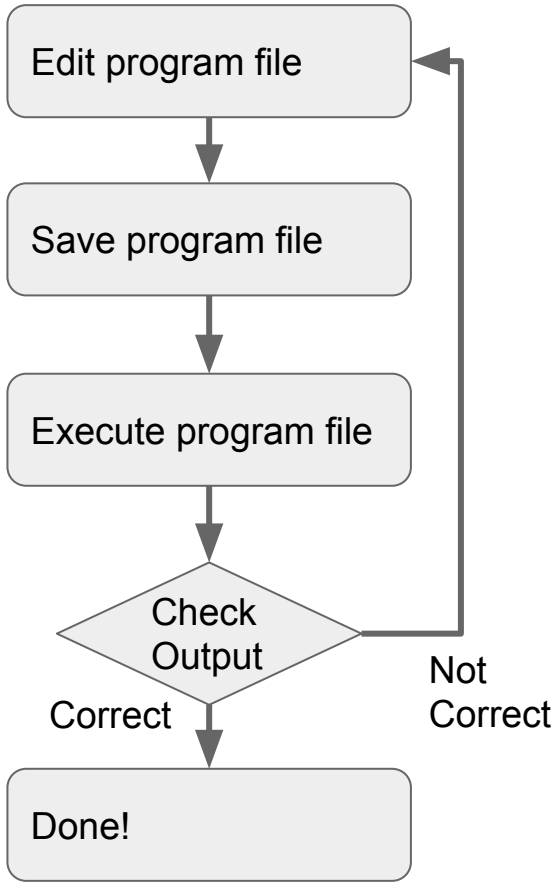
Programming Workflow

- Create edit the program file using a text editor (eg. Notepad)
- Save the file in a directory in the file system
- Let the python interpreter know where to find the program file to be executed.
- Work in the same directory as the program file.



Setup your Programming Environment

1. Notepad Window
    a. Search “Notepad”.
    b. Ctrl-S to save file
    c. Save file to directory Documents\leilehua
    d. name your file “map1.py”
2. Command Prompt Window
    a. Search “command”. Hit Enter.
    b. cd Documents/leilehua
    c. activate eq_env
    d. dir
3. Run Python interpreter
    a. In command prompt window type “python map1.py”
    b. Close the plotting window to exit.



Problem 1a: Visualize a Map of the World

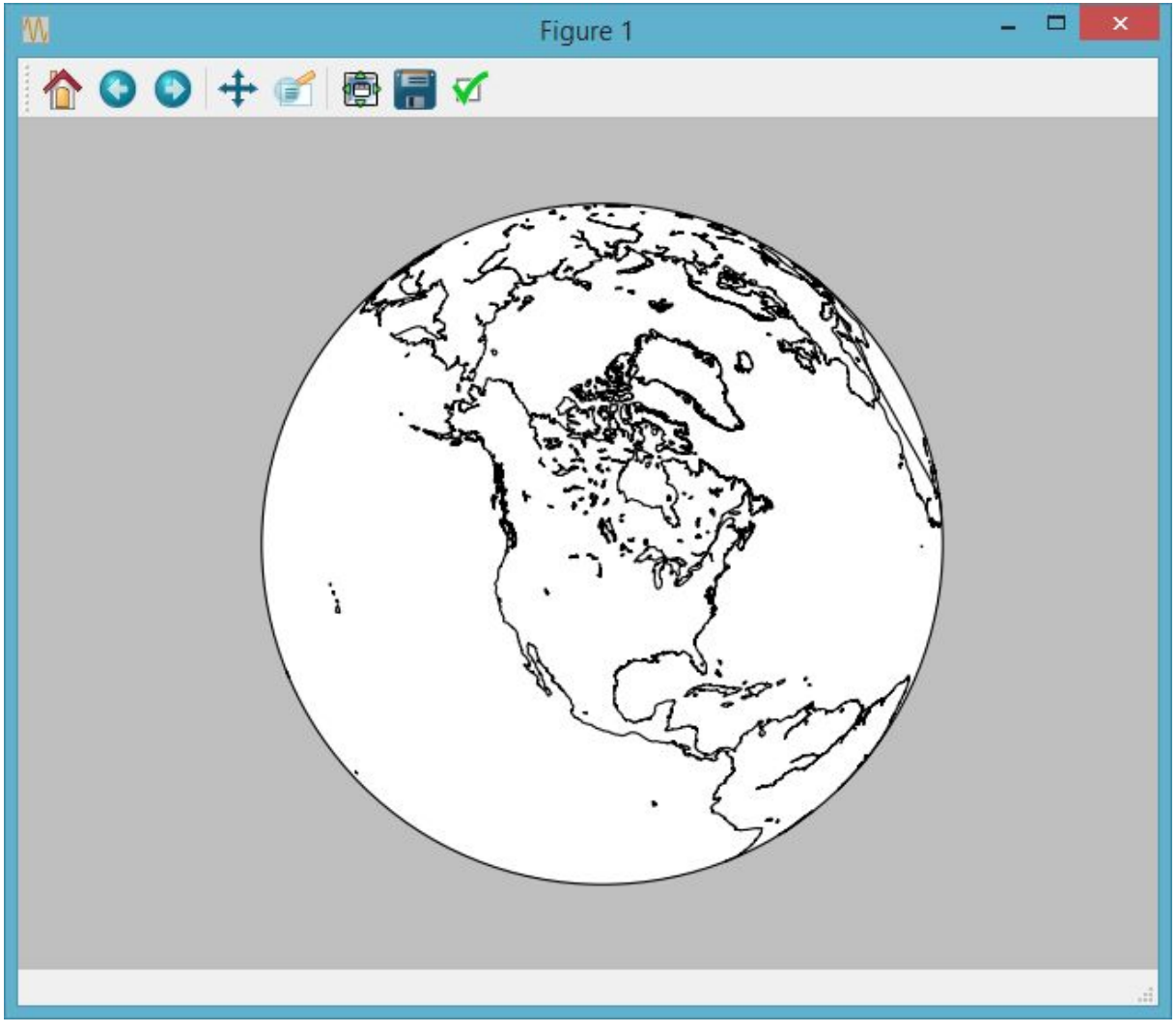
```
from mpl_toolkits.basemap import Basemap
import matplotlib.pyplot as plt
import numpy as np

my_map = Basemap(projection='ortho',
                 lat_0=50, lon_0=-100,
                 resolution='l',
                 area_thresh=1000.0)

my_map.drawcoastlines()

plt.show()
```

Cut and paste this program into Notepad.

Save as map1.py.

Execute it.

Problem 1A: Result



Problem 1b: Visualize a Map of the World

```
my_map = Basemap(projection='ortho',
                 lat_0=50, lon_0=-100,
                 resolution='l',
                 area_thresh=1000.0)

my_map.drawcoastlines()

plt.show()
```

other projection:

robin, merc

```
my_map.drawcountries()
my_map.fillcontinents(color='coral')
my_map.drawmapboundary()
my_map.drawmeridians(np.arange(0, 360, 30))
my_map.drawparallels(np.arange(-90, 90, 30))
```

Problem 2: Visualize Hawaiian Islands

Change:

- Change center (lat,lon)
- projection='merc'
- Add lower left (ll) and upper right (ur) latlon
- resolution='h'
- Change gridline spacing
- Area_thresh

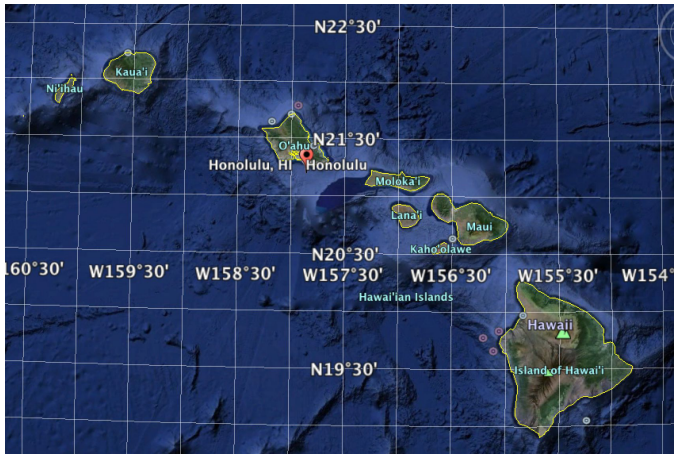
Problem 2a: Center Map on Hawaii

```
my_map = Basemap(projection='ortho',
                 lat_0=50, lon_0=-100,
                 resolution='l',
                 area_thresh=1000.0)
```

Change the coordinates for the center of map

Problem 2b: Zoom into Hawaii

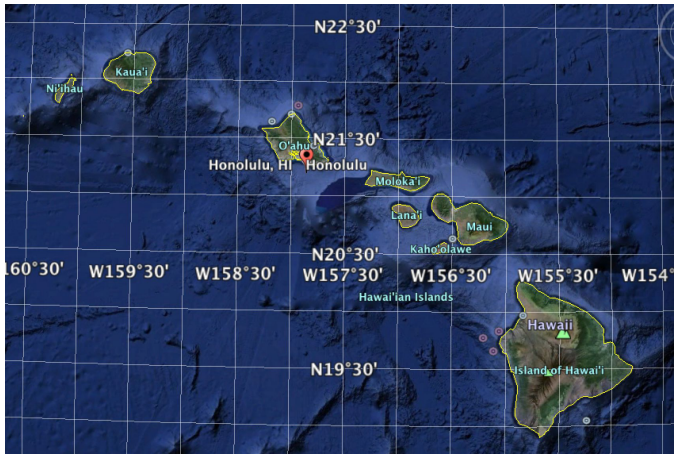
```
my_map = Basemap(projection='merc',
                 lat_0=20.5, lon_0=-157.5,
                 resolution='l', area_thresh=1000.0,
                 llcrnrlon=-160.5, llcrnrlat=18.5,
                 urcrnrlon=-154, urcrnrlat=22.5)
```



Add the coordinates for the lower left and upper right corner of map

Problem 2C: Fix Resolution Issues

```
my_map = Basemap(projection='merc',
                 lat_0=20.5, lon_0=-157.5,
                 resolution='h', area_thresh=1.0,
                 llcrnrlon=-160.5, llcrnrlat=18.5,
                 urcrnrlon=-154, urcrnrlat=2 )
```



Tells the computer NOT to display features smaller than this number of square kilometers

Code 2:

```
from mpl_toolkits.basemap import Basemap
import matplotlib.pyplot as plt
import numpy as np

my_map = Basemap(projection='merc', lat_0=20.5, lon_0=-157.5,
                 resolution='h', area_thresh=1.0,
                 llcrnrlon=-160.5, llcrnrlat=18.5,
                 urcrnrlon=-154, urcrnrlat=22.5)

my_map.drawcoastlines()
my_map.drawcountries()
my_map.fillcontinents(color='coral')
my_map.drawmapboundary()
my_map.drawmeridians(np.arange(0, 360, 1))
my_map.drawparallels(np.arange(-90, 90, 1))

plt.show()
```

Problem 3a: Plotting a Point on the Map

Plot the location of Leilehua HS (21.501279, -158.012428)

```
my_map.drawmeridians(np.arange(0, 360, 1))
my_map.drawparallels(np.arange(-90, 90, 1))

lats = 21.501279
lons = -158.012428
x,y = my_map(lons,lats)
my_map.plot(x, y, 'bo', markersize=10)

plt.show()
```

Code 3A:

```
from mpl_toolkits.basemap import Basemap
import matplotlib.pyplot as plt
import numpy as np

my_map = Basemap(projection='merc', lat_0=20.5, lon_0=-157.5,
                 resolution='h', area_thresh=1.0,
                 llcrnrlon=-160.5, llcrnrlat=18.5,
                 urcrnrlon=-154, urcrnrlat=22.5)

my_map.drawcoastlines()
my_map.drawcountries()
my_map.fillcontinents(color='coral')
my_map.drawmapboundary()
my_map.drawmeridians(np.arange(0, 360, 1))
my_map.drawparallels(np.arange(-90, 90, 1))

lats = 21.501279
lons = -158.012428
x,y = my_map(lons,lats)
my_map.plot(x, y, 'bo', markersize=10)

plt.show()
```

Can also take a list of points coded as:

```
lats = [ 21.5, 22.0  ]
```

Problem 3B: Plotting Several Points on the Map

Now that you know how to plot more than one point,

Add the location of Roosevelt HS (21.311071, -157.837614) to your map!

Code 3B:

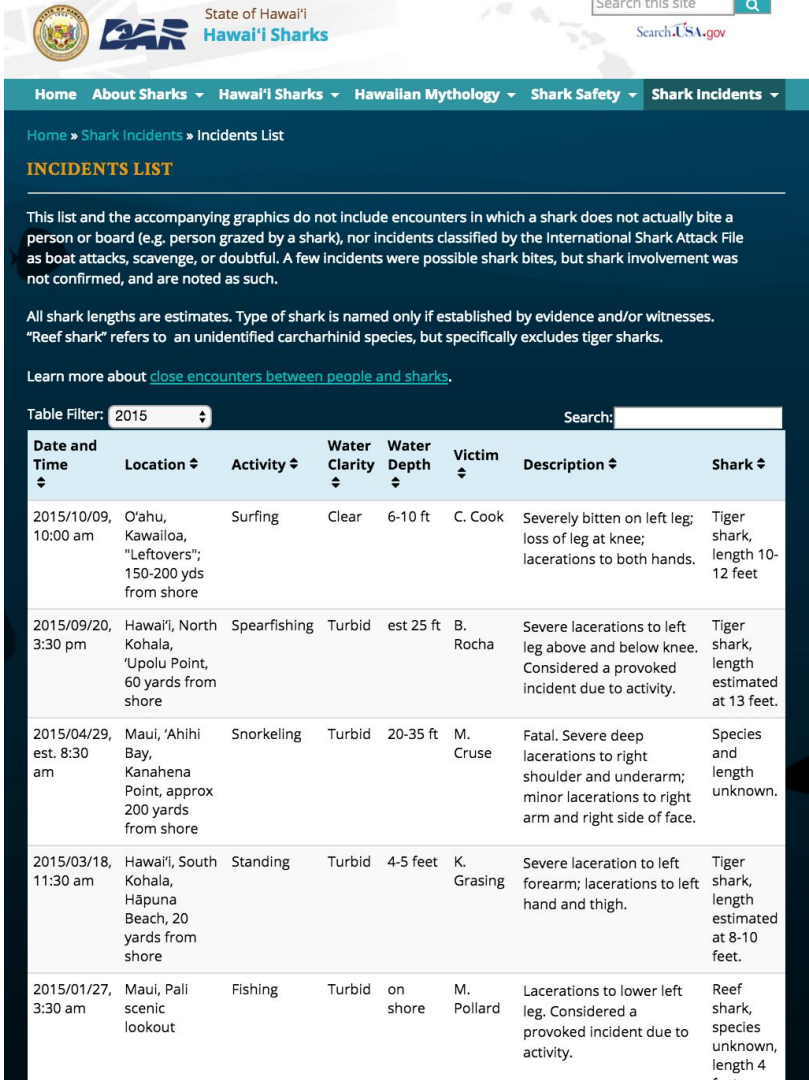
```
from mpl_toolkits.basemap import Basemap
import matplotlib.pyplot as plt
import numpy as np

my_map = Basemap(projection='merc', lat_0=20.5, lon_0=-157.5,
                 resolution='h', area_thresh=1.0,
                 llcrnrlon=-160.5, llcrnrlat=18.5,
                 urcrnrlon=-154, urcrnrlat=22.5)

my_map.drawcoastlines()
my_map.drawcountries()
my_map.fillcontinents(color='coral')
my_map.drawmapboundary()
my_map.drawmeridians(np.arange(0, 360, 1))
my_map.drawparallels(np.arange(-90, 90, 1))

lats = [ 21.501279, 21.311071 ]
lons = [ -158.012428, -157.837614 ]
x,y = my_map(lons,lats)
my_map.plot(x, y, 'bo', markersize=10)

plt.show()
```

Problem 4: Plot Shark Attacks

As of Oct 26, 2015, the DNLR shark incident list has 5 shark attacks at the following (lat, lon) locations:

21.400210, -157.726913
20.271381, -155.854866
20.605347, -156.439829
19.991010, -155.826133
20.849260, -156.656971

Plot the points on your map!



State of Hawai'i
Hawai'i Sharks

Search this site
Search.USA.gov

Home | About Sharks | Hawai'i Sharks | Hawaiian Mythology | Shark Safety | Shark Incidents

Home » Shark Incidents » Incidents List

INCIDENTS LIST

This list and the accompanying graphics do not include encounters in which a shark does not actually bite a person or board (e.g. person grazed by a shark), nor incidents classified by the International Shark Attack File as boat attacks, scavenge, or doubtful. A few incidents were possible shark bites, but shark involvement was not confirmed, and are noted as such.

All shark lengths are estimates. Type of shark is named only if established by evidence and/or witnesses. "Reef shark" refers to an unidentified carcharhinid species, but specifically excludes tiger sharks.

Learn more about close encounters between people and sharks.

Table Filter: 2015 Search:

Date and Time	Location	Activity	Water Clarity	Water Depth	Victim	Description	Shark
2015/10/09, 10:00 am	O'ahu, Kawailoa, "Leftovers"; 150-200 yds from shore	Surfing	Clear	6-10 ft	C. Cook	Severely bitten on left leg; loss of leg at knee; lacerations to both hands.	Tiger shark, length 10-12 feet
2015/09/20, 3:30 pm	Hawai'i, North Kohala, 'Upolu Point, 60 yards from shore	Spearfishing	Turbid	est 25 ft	B. Rocha	Severe lacerations to left leg above and below knee. Considered a provoked incident due to activity.	Tiger shark, length estimated at 13 feet.
2015/04/29, est. 8:30 am	Maui, 'Ahihi Bay, Kanahena Point, approx 200 yards from shore	Snorkeling	Turbid	20-35 ft	M. Cruse	Fatal. Severe deep lacerations to right shoulder and underarm; minor lacerations to right arm and right side of face.	Species and length unknown.
2015/03/18, 11:30 am	Hawai'i, South Kohala, Hāpuna Beach, 20 yards from shore	Standing	Turbid	4-5 feet	K. Grasing	Severe laceration to left forearm; lacerations to left hand and thigh.	Tiger shark, length estimated at 8-10 feet.
2015/01/27, 3:30 am	Maui, Pali scenic lookout	Fishing	Turbid	on shore	M. Pollard	Lacerations to lower left leg. Considered a provoked incident due to activity.	Reef shark, species unknown, length 4

Code 4:

```
from mpl_toolkits.basemap import Basemap
import matplotlib.pyplot as plt
import numpy as np

my_map = Basemap(projection='merc', lat_0=20.5, lon_0=-157.5,
                 resolution='h', area_thresh=1.0,
                 llcrnrlon=-160.5, llcrnrlat=18.5,
                 urcrnrlon=-154, urcrnrlat=22.5)

my_map.drawcoastlines()
my_map.drawcountries()
my_map.fillcontinents(color='coral')
my_map.drawmapboundary()
my_map.drawmeridians(np.arange(0, 360, 1))
my_map.drawparallels(np.arange(-90, 90, 1))

lats=[ 21.400210, 20.271381, 20.605347, 19.991010, 20.849260 ]
lons=[ -157.726913,-155.854866,-156.439829,-155.826133,-156.656971]
x,y = my_map(lons,lats)
my_map.plot(x, y, 'bo', markersize=10)

plt.show()
```