Class 3, Problem Set 1

UNIVERSITY OF
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Introduction to Programming and Numerical Analysis

Plan for today

1. Brush up on important concepts/syntax
   - Send me an email (some days) before class
   - Figure syntax
   - SciPy.optimize
2. Work on PS1
3. Meeting back in **general** at 16:55

In [2]:

```
import numpy as np
import matplotlib.pyplot as plt
plt.style.use('seaborn-whitegrid')
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import cm
```

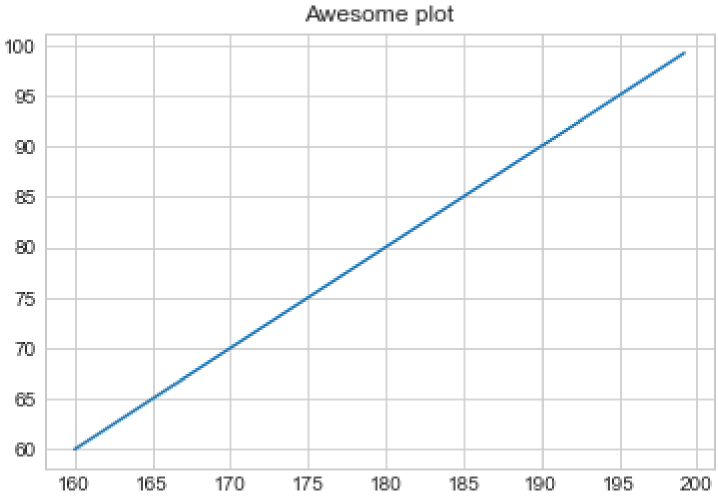
Figure syntax

Probably different from what you know (SAS, Stata etc.)

... get used to it...

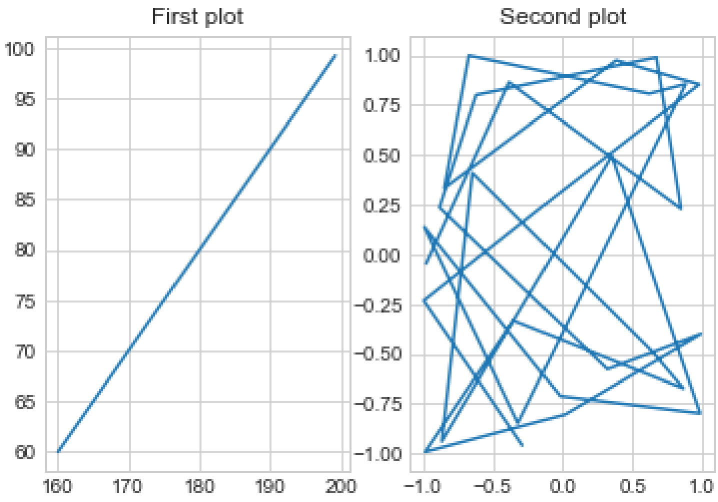
In [3]:

```
height, weight = np.arange(160,200,1.4), np.arange(60,100,1.4)

# Initialize canvas - From documentation: "Unique identifier for the figure"
fig1 = plt.figure()

# From documentation: add_subplot(nrows, ncols, index, **kwargs)
ax1 = fig1.add_subplot(1,1,1)

# Choose method: .plot(), .hist(), .plot_surface() etc.
ax1.plot(height, weight)

# Customize
ax1.set_title('Awesome plot'); #; suppress print
```



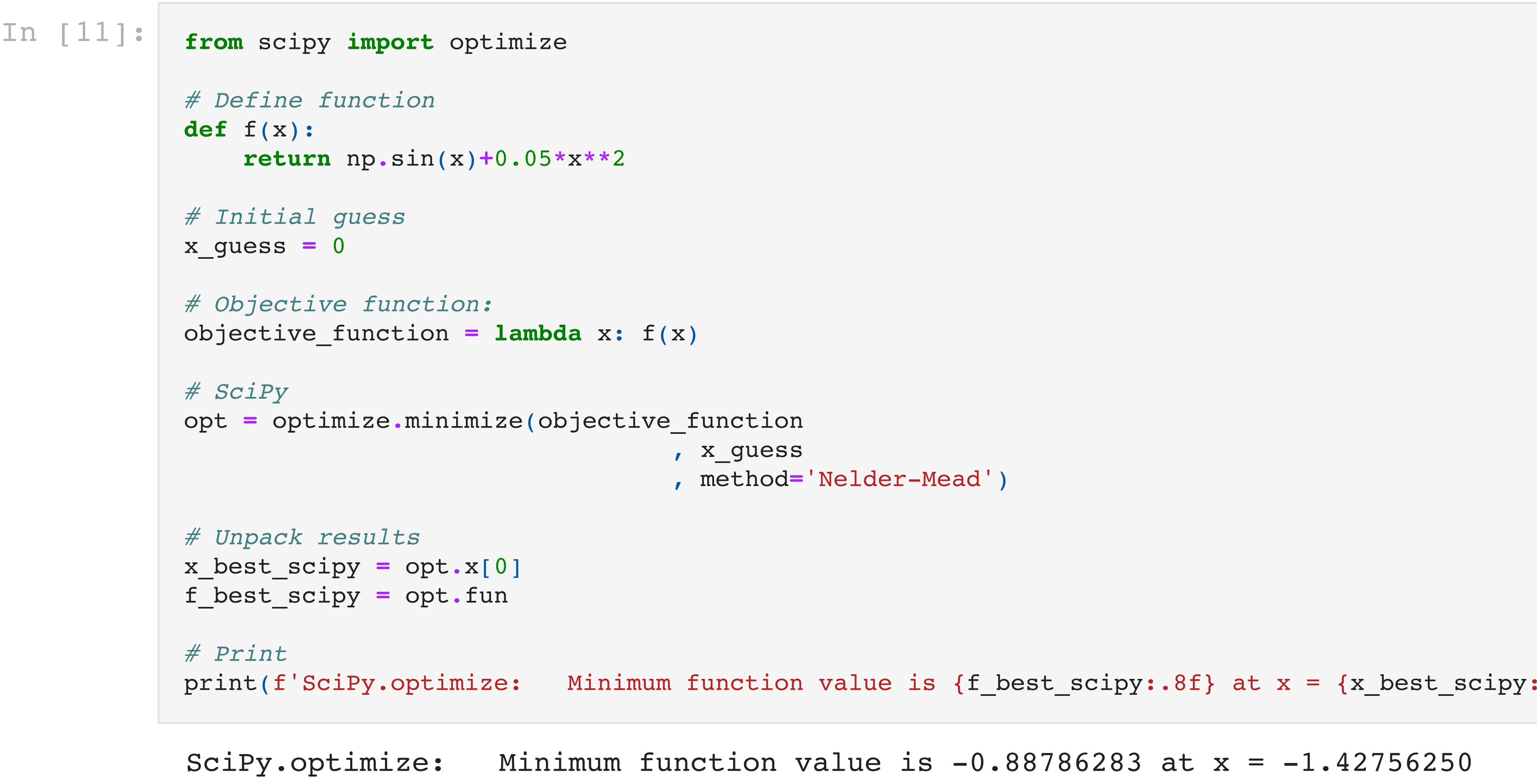
In [7]:

```
fig2 = plt.figure()

ax2_1 = fig2.add_subplot(1,2,1)
ax2_1.plot(height, weight)
ax2_1.set_title('First plot')

ax2_2 = fig2.add_subplot(1,2,2)
ax2_2.plot(np.cos(height), np.sin(weight*height**2))
ax2_2.set_title('Second plot');
```



SciPy.optimize

- Moduel for optimizing - more precise than 'just' looping through combinations
- One problem can be solved in different ways - don't let it knock you out
- Remember that we minimize! So if your maximizing your objective should be negative



In [11]:

```
from scipy import optimize

# Define function
def f(x):
    return np.sin(x)+0.05*x**2

# Initial guess
x_guess = 0

# Objective function:
objective_function = lambda x: f(x)

# SciPy
opt = optimize.minimize(objective_function
                                  , x_guess
                                  , method='Nelder-Mead')

# Unpack results
x_best_scipy = opt.x[0]
f_best_scipy = opt.fun

# Print
print(f'SciPy.optimize:   Minimum function value is {f_best_scipy:.8f} at x = {x_best_scipy:
```

```
SciPy.optimize:   Minimum function value is -0.88786283 at x = -1.42756250
```

Let's go!

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