PHYS 210, Assignment 5

Create a new directory somewhere in your home directory with the name `yourusername_assignment_5` to store the files you will create for this assignment. To hand the assignment in, copy the directory with your results to `/home2/phys210/yourusername/`. Make sure it's there and has the right permissions (read and execute for everyone, write for you).

1 Functions I

Which lines of the following code are valid and which would raise an error? Explain why these errors occur. Save your explanations in a file called `functions1.txt`.

```
1  import numpy as np
2
3  def foo(a, b=3):
4      return np.sqrt(a + b)
5
6  def bar(c=1.2, d=np.pi):
7      print("d={}".format(d))
8      return d**3
9
10 def foobar(x):
11         x += 1
12     return x
13
14 m = foo()
15 n = foo(3)
16 o = foo(a=-1.23)
17 p = foo(b=42)
18
19 q = bar()
20 r = bar(d=-pi)
21
22 s = foo
23 t = bar
24 u = s(1, 2)
25 v = bar(c=foo)
```

2 Functions II

1. Using your code from assignment 3, exercise 2.1, write your own functions for calculating the mean, variance, and standard deviation. Save them to a file called `stats.py`.

2. Write a function that takes a filename and a number i as arguments, loads the file specified by the filename with `numpy.loadtxt`, and returns column number i. Use this function to load the third column from the sample data you used in the last assignment.

3. Import the module you created in the first question of this exercise (`stats.py`). It should include your statistical functions. Use these imported functions to calculate the mean, variance, and standard deviation of the data you loaded in the previous question.

Put the commented code in a file called `functions2.py`.

3 Recursion I

The Fibonacci sequence 1, 1, 2, 3, 5, 8, 13, ..., is defined as

$$F_n = F_{n-1} + F_{n-2} \ , \tag{1}$$

with

$$F_2 = 1, \quad F_1 = 1 \ . \tag{2}$$

Think about how you would write a function `fibonacci(n)` to calculate the nth number of the sequence F_n. Use the example from the lecture (`fact(n)`) as an inspiration. What is the 21th Fibonacci number? Write your function to a file called `fibonacci.py`.

Depending on how you calculate the Fibonacci numbers, the function might take a long time to finish running. To avoid problems when running your code, restrict yourself to the first 30 Fibonacci numbers or so.