**Practice Exam: Python for Physicists**

1) Give a short description of the types of python containers we have discussed: tuples, lists, sets, and dictionaries. When might you want to use a list instead of an tuple?

2) Explain the difference between a for loop and a while loop. When might a while loop be preferable?

3) Write down a generic function definition, and explain the different components.

4) What are the possible return types for a python function?

5) What is the difference between a global and a local variable?

6) Label the local and global variables for this code snippet. What do you expect for the print statements for this code snippet?

**def** add\_one(count):

count **+=** 1

**return** count

count **=** 1

print(count)

add\_one(count)

print(count)

count **=** add\_one(count)

print(count)

7) Identify the problem in this function definition.

**def** is\_detectable(luminosity, threshold**=**1e-11, distance):

flux **=** calc\_flux(luminosity, distance)

**return** flux **>** threshold

8) What do the two syntaxes below mean; what type of argument does the function take?

a) **def** myfunction(**\***args):

b) **def** myfunction(**\*\***kwargs):

9) What is the output of the following code snippet?

(**lambda** x: x**\*\***2)(2)

10) Write down a generic class definition, and explain the different components.

11) When should you use a classes? When can you simply use a container or a function?

12) Label the class attribute and the instance attribute in this code snippet.

**import** math

**class** Circle:

num\_instances **=** 0

**def** \_\_init\_\_(self, radius**=**1):

self**.**radius **=** radius

Circle**.**num\_instances **+=** 1

13) Explain the role of setter and getter methods in a class.

14) What is the output after executing the following lines in python?

a) my\_list = [1, 2, 3, 4, 5]

my\_list[::-1]

b) a = '1234'

a[-1]

15) When might you need to use pickle for file writing/reading, rather than e.g. JSON? When is it preferable to use JSON, and why?

16) What are the advantages of using numpy arrays, rather than native python interables coupled with for loops?

17) What is vectorization? How does it relate to numpy arrays?

18) Will this code snippet run successfully? If not, why not?

**import** numpy **as** np

matrix1 **=** np**.**arange(10)**.**reshape(2,5)

vector1 **=** np**.**arange(5)

matrix1 > vector2

19) Write a pseudo-code for a recursive function that calculates the Golden Ratio (the quotient between successive pairs of Fibonacci numbers).

20) Write a pseudo-code for generating a spectrum following the form for a set of energies E linearly spaced between 0.1 and 5, and fitting the spectrum with a functional form.

21) Write a pseudo-code for a function that generates a random password with at least 8 digits, including at least one letter, one integer, and one special character.

Additional page (write the task number!)