Quiz 1 - Computational Physics I

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Date: Monday 2 September 2024 **Duration:** 45 minutes

Credits: 20 points (5 questions) **Type of evaluation:** LAB

Provide short and concise answers to the following items:

1. **(4 points) Programming Languages**
   (a) Explain the difference between an interpreter and a compiler.
   (b) Provide 1 example of an interpreted programming language and 1 of a compiled language.

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a) An interpreter has the work to read the code and show an output of this. In the other hand, the compiler take the source code and "adapt" it depending on the computer to be possible to read it and show an output.

? how? objects? executables?

b) Interpreted: Python, Mathematica
Compiled: Fortran, C

2. **(4 points) Python Data Structures**
   (a) List 2 types of native data structures in Python.
   (b) Explain which one you would pick to store both numbers and strings.

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a) - tuples
- dictionaries

b) Dictionaries can store both, strings and numbers. It is necessary to assign a key to it (dic = {"key": number / string}). However, tuples can only store numbers.

3. **(4 points) Python Functions**
   (a) Briefly explain what a `lambda` function is in Python.
   (b) Briefly explain the concept of vectorisation in Python.

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a) Lambda function is a native function of Python that has "two" inputs the mathematical expression and the variables. This function makes easily evaluate a matematical function.

```
>> lambda x, y : x**2 + y**2
```

variables — Matematical expression

b) Vectorisation in Python refers to that native functions accept not only (single variables) (numbers, strings, ...) but also mult.-dimentional objects as vectors, matrices, etc.

4. **(4 points) Linux File Permissions**
In a Linux environment, the file permissions for a script named `run_test.sh` are currently set as `-rw-r--r--`. You need to allow all users to execute the script but want to keep the current read and write permissions unchanged.

(a) Explain the meaning of the current file permissions `-rw-r--r--` for `run_test.sh`.

(b) Provide the `chmod` command you would use to modify the permissions so that all users can execute the script without altering the read and write permissions.

(c) After applying the chmod command, what will the new permissions of the file `run_test.sh` be? Write them in both symbolic and numeric forms.

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a) - The first "-" explain the type of the file: executable ✗ any file.
- The following three explain the user permissions: User has the permission to read and write the file, but not to execute it.
- The following three explain the group permissions: group has the permission to read the file, but not to write and execute it.
- The last three explain the global permissions: global users has the permission to read the file, but not to write and execute it.

✗ b) >> chmod 622 run_test.sh ✗

✗ c) -rwxr--r-- for run_test.sh ✗

r → 4
w → 2
x → 1
→ 755

5. **(4 points) Python Algorithms**
The Mexican hat function, also known as the Ricker wavelet, is often used in signal processing and data analysis. The function can be defined as:

$$f(x,y) = \left(1 - (x^2 + y^2)\right) e^{-\frac{x^2+y^2}{2}}$$

where x and y are the coordinates in a 2D space.

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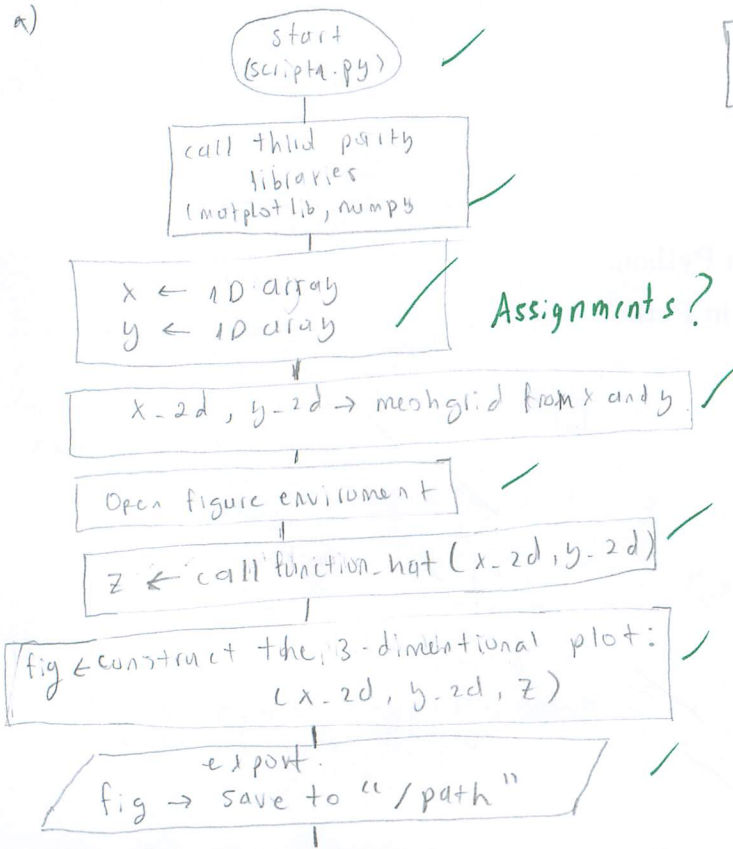
(a) Sketch an algorithm workflow to generate and save a plot of $f(x,y)$ in Python.

(b) Provide the overall syntax of a Python function that evaluates and returns $f(x,y)$.

a)



Assignments?

b)

```
import numpy as np.
def function_hat(x,y):
    '''
    inputs: independent variables (x,y). ✓ 1D or 2D?
    output: Mexican hat function value.
    Author: Alan Palma
    '''
    z = (1-(x**2+y**2))*
        np.exp(-(x**2+y**2)/2)

    retur z
```