

TRACCIA 2

Question 1 (9 points)

One of the Principal Investigators of the Theoretical Physics group wants to make publicly available a prototype simulation code developed by their students. They ask for your help in reshaping the code so that it is more robust, scalable, and maintainable. The code is intended to run on a HPC cluster and is written in a single C file more than 4000 lines long. The file contains 20 functions. Simulation parameters are read interactively from the standard input and the output is written on a text file called sim.out.

From the given information, describe what you think are the problems with the current version of the code and what information is missing that you need to ask the original authors. Describe how you would change the code in order to make it maintainable; how you would identify performance issues and possible runtime problems; the workflow you would follow together with the scientists in order to reshape the code and make it distributable.

Question 2 (9 points)

A University department plans to purchase 20 compute nodes to add to an HPC cluster. The aim is to make these computational resources available also to cluster users who are not members of the department and, at the same time, ensure that jobs queued by users of the department have a higher priority. This priority can also be implemented as a maximum waiting time of 10 hours for the execution of jobs of the department users, to allow for the completion of the other users' jobs. Provide a configuration, possibly based on 2 or more queues, that can meet the requirements described above. Any limitations in terms of resources that may become necessary must be assigned to users not belonging to the department while the Department users should be able to operate without any resource restriction.

Question 3 (3 points)

A python script has to calculate two series and subtract the results. A student wrote the following code. Tell what number is printed and why.

```
import numpy as np
a1 = np.arange(10) # array([ 0,1,2,...9])
a2 = a1
for i in range(10):
    a1[i] = a1[i]*a1[i]
    a2[i] = a2[i] / 2
a1s = a1.sum() # sum all elements of the array
a2s = a2.sum()
print(a1s - a2s)
```

Question 4 (3 punti)

Consider the following C function. Write what it does.

```
int *ilt (int n1) {
    int *p, *a;
    int i;
    if ((p = (int *) malloc ((size_t) n1 * sizeof (int))) == NULL)
        exit(1);
    for (i = 0, a = p; i < n1; i++)
        *a++ = 0;
    return p;
}
```

Question 5 (1 point)

The mysql command GRANT UPDATE ON EXPERIMENT.RESULTS TO JOHN@'localhost'; :

- A) provides user JOHN permissions to extract data from table RESULTS of database EXPERIMENT
- B) provides user JOHN permissions to modify data from table RESULTS of database EXPERIMENT
- C) updates GRANT privileges of user JOHN for table EXPERIMENT of database RESULTS
- D) provides user JOHN permissions to modify data from table EXPERIMENT of database RESULTS

Question 6 (1 point)

What is the name of the standard global MPI communicator:

- A) MPI_COMM_WORLD
- B) MPI_GLOBAL_COMM
- C) MPI_COMM
- D) MPI_DEFAULT_COMM

Question 7 (1 point)

In the event of a personal data breach, the GDPR requires that the Data Controller (il titolare del trattamento) shall report the violation to the Data Subject (l'interessato):

- A) in any case and within 72 hours
- B) if the violation of personal data is likely to result in a high risk to the rights and freedoms of natural persons
- C) if the breach of personal data has been reported to the supervisory authorities
- D) if the violation of personal data has been reported to the public security bodies

Question 8 (1 point)

Executing the Unix command:

```
ls -lS | tail -5
```

The result will be:

- A) the list of files in the current directory that contain character 5
- B) the last 5 files in the current directory, in alphabetical order, which contain the S character
- C) the list of files in the current directory, sorted by size, which contain the character 5
- D) the last 5 files in the current directory, sorted by size

Question 9 (1 point)

What will be printed by the following code?

```
my_tuple = (1, 2.19, "ciao", [0, 1, 2] )
my_tuple[-1][0] = 1
a=[1,2,3,4,[1,2,3]]
b=a[-1]
b[0] = 10
print(a)
```

- A) [1,2,3,4,[1,2,3]]
- B) [1,2,3,4,[10,2,3]].
- C) Nothing, it will raise an IndexError exception.
- D) None of the above.

Question 10 (1 point)

The Unix command:

```
cat file1 >> file2
```

- A) saves the error messages of the cat command in file2
- B) saves the text lines of file1 in file2 but in reverse order
- C) copies the contents of file1 into a new file named file2
- D) appends the contents of file1 to the contents of file2