Lab 5

Question 2

Disclaimer: I had some problems while trying to compile and run the programm. Hereby I leave some screenshots and commands used so you can replicate the results.

- I'm using ubuntu 20.04
- I installed the openmpi-bin and libopenmpi-dev packages for Debian based systems as requested.
- To compile I used `mpicc ex2.c -o ex2` and it workded perfectly.
- When trying to run the programm with the suggested command `mpirun -np 7 ./ex2` the following occured

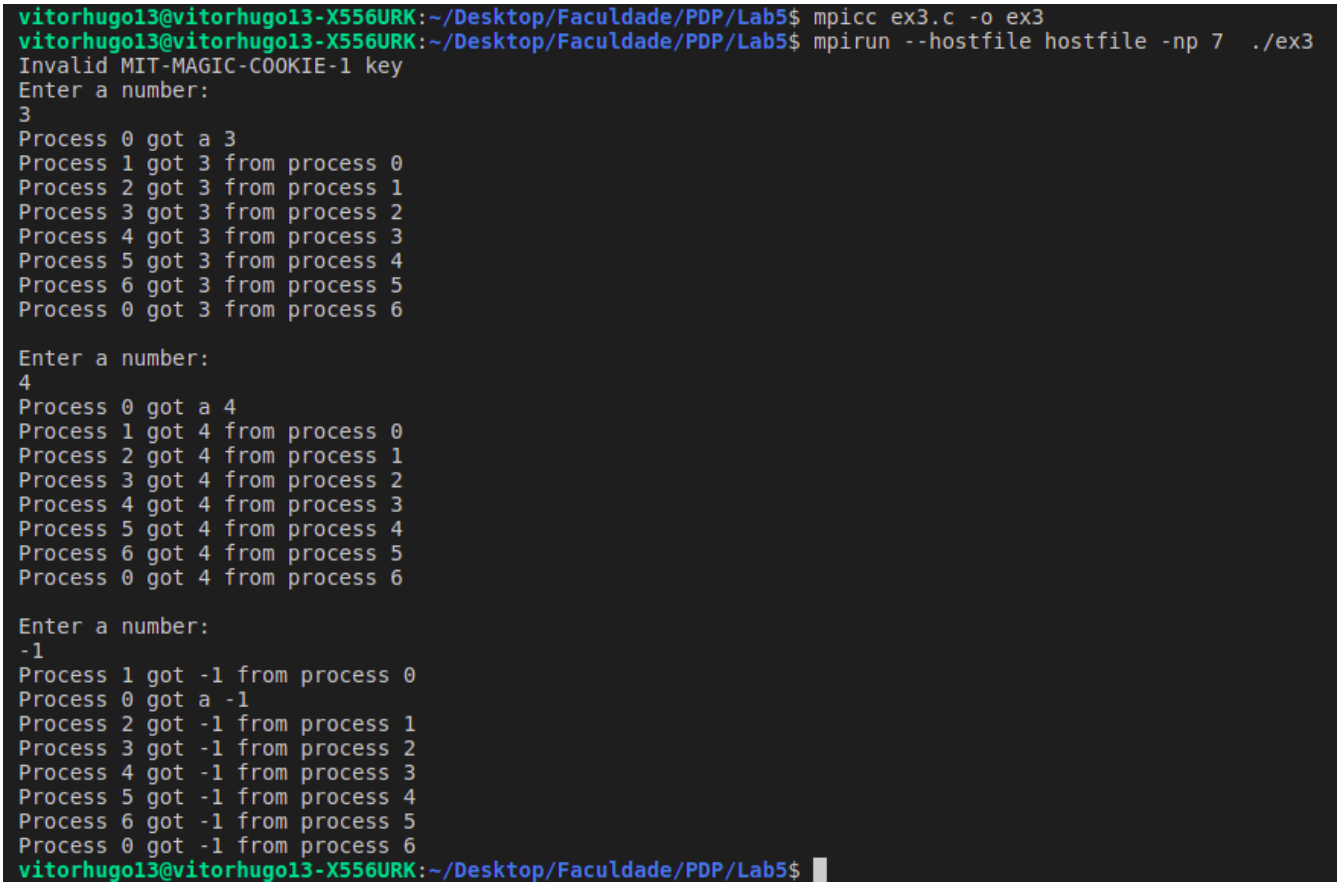
```
vitorhugo13@vitorhugo13-X556URK:~/Desktop/Faculdade/PDP/Lab5$ mpirun -np 7 ./ex2
Invalid MIT-MAGIC-COOKIE-1 key--------------------------------------------------------------------------
There are not enough slots available in the system to satisfy the 7
slots that were requested by the application:

  ./ex2

Either request fewer slots for your application, or make more slots
available for use.

A "slot" is the Open MPI term for an allocatable unit where we can
launch a process.  The number of slots available are defined by the
environment in which Open MPI processes are run:

  1. Hostfile, via "slots=N" clauses (N defaults to number of
     processor cores if not provided)
  2. The --host command line parameter, via a ":N" suffix on the
     hostname (N defaults to 1 if not provided)
  3. Resource manager (e.g., SLURM, PBS/Torque, LSF, etc.)
  4. If none of a hostfile, the --host command line parameter, or an
     RM is present, Open MPI defaults to the number of processor cores

In all the above cases, if you want Open MPI to default to the number
of hardware threads instead of the number of processor cores, use the
--use-hwthread-cpus option.

Alternatively, you can use the --oversubscribe option to ignore the
number of available slots when deciding the number of processes to
launch.
--------------------------------------------------------------------------
```

- As suggested I created an hostfile file indicating the number of slots to be available
- After compiling again and use `mpirun --hostfile hostfile -np 7 ./ex2` to run the code, I was able to check how the programm works

```
vitorhugo13@vitorhugo13-X556URK:~/Desktop/Faculdade/PDP/Lab5$ mpirun --hostfile hostfile -np 7  ./ex2
Invalid MIT-MAGIC-COOKIE-1 keyData to process 4 recieved from 0 on vitorhugo13-X556URK
Data to process 5 recieved from 0 on vitorhugo13-X556URK
Data to process 2 recieved from 0 on vitorhugo13-X556URK
Data to process 6 recieved from 0 on vitorhugo13-X556URK
Data to process 1 recieved from 0 on vitorhugo13-X556URK
Data to process 3 recieved from 0 on vitorhugo13-X556URK
```

Question 3

- Output of the programm can be seen in image below.



- As in exercise 2, I created an hostfile file indicating the number of slots to be available. (this number can be varied in order to test the programm with more ranks instead of only 7).

Question 4

- For this question I'll be using the information present here `https://delta.pk.edu.pl/pluginfile.php/91736/mod_resource/content/2/PaDP_Lecture_6.pdf` , particularly slides 9 and 10.

- In a nutshell, it was necessary to replace the functions MPI_Recv by MPI_Irecv and MPI_Send by MPI_Isend. In the new functions, the last argument &value was replaced by &request. After MPI_Irecv it was also needed to call MPI_Wait.

- To test the programm I run the same commands as the ones present in exercise 3.