Lilled? - due 6 9 Aprill 2017

YOUR NAME HERE

References in your solutions

Please add references to any external material that you base your answers on.

Typesetting

Please put your answers in a LaTeX document and submit both a pdf and the LaTeX source. Try to keep a similar template to the one given. You may find it helpful to use sharelatex or install a LaTeX distribution and editor, such as texworks. Some documentation on LaTeX can be found at https://en.wikibooks.org/wiki/LaTeX.

Study material

- EGI - European grid infrastructure
  http://www.egi.eu

- Grid acronyms and definitions can be found at EGI Glossary.
  http://www.egi.eu/about/glossary/

- EGI central operations tools
  https://wiki.egi.eu/wiki/Tools

- TÜ cloud
  http://portal.hpc.ut.ee/web/guest/openstack

- GDB
  http://www.gnu.org/software/gdb/documentation/

- IDB

- GPROF

- IPM
  http://ipm-hpc.org/

- 2decomp&fft
  http://www.2decomp.org/index.html

- Klein Gordon simulation installation and execution instructions
  http://parallel.computer/compilation-execution.html

- LaTeX

- https://en.wikibooks.org/wiki/LaTeX
# Productivity tools and debugging

## Homework question 1

a) Summarize a recent paper on a productivity tool (eg. a debugger, profiler, memory leak detector) that could be used or is used in high performance or distributed computing.

**ANSWER**

**COMMENT**

**GRADE**

b) Explain whether you think research funding support of open source productivity tools makes commercial development of productivity tools economically unattractive?

**ANSWER**

**COMMENT**

**GRADE**

## Homework question 2

a) The program MM_With_Bugs.c contains a few bugs. It is easy to find them just by looking at the code but use the debuggers in order to find them and correct them.

The program multiplies two matrices A*B=C.

- The matrix A is of dimension N*N, which is given by the user. All the elements of A have the value 2.0.
- The matrix B is of dimension N*N.

The final matrix C should contain elements with value equal to N*12.

In this exercise you will debug the program using gdb and idb.

Compile the program MM_With_Bugs.c with the -g compiler option. Launch the gdb/idb debuggers using the commands:

- gdb YourExecutable
- idb YourExecutable

Set up breakpoints in the program.

Run the program.

Use the gdb/idb commands to locate where are the problems in the code. Give a list of the bugs that you found, the solution and what gdb/idb commands did you use to find the bugs. Explain the results received from gdb and idb after each command that you used. Do also upload a screenshot showing your usage of the debugger.

**ANSWER**

**COMMENT**

**GRADE**

b) What is the difference between the gdb commands 'next' and 'step'?

**ANSWER**

**COMMENT**

**GRADE**

c) How does the 'backtrace' command work?

**ANSWER**

**COMMENT**

**GRADE**

d) How are breakpoints used?

**ANSWER**

**COMMENT**

**GRADE**
Homework question 3
Use the profiler gprof on your corrected version of MM_With_Bugs.c or another matrix multiplication program. Report and interpret the performance information you get.
ANSWER
COMMENT
GRADE

Homework question 4
What is PAPI (http://icl.cs.utk.edu/papi/) and why are performance counters useful?
ANSWER
COMMENT
GRADE

Homework question 5
a) Run the installation script to install IPM and profile the timing code in 2decomp&fft (you are also welcome to use the Klein Gordon code described in the reading material). Explain the output you get on 64 cores on Vedur. Include appropriate graphs in your writeup.
ANSWER
COMMENT
GRADE

b) Profile the code on 128 and 256 cores as well. Explain how the results differ. Include appropriate graphs in your writeup.
ANSWER
COMMENT
GRADE

c) The installation of 2decomp&fft uses the generic FFT library. How might you modify the installation to use a different one dimensional FFT library to improve performance?
ANSWER
COMMENT
GRADE

TÜ HPC cloud

Homework question 6
What is grid computing? What resources are offered through the European Grid Infrastructure?
ANSWER
COMMENT
GRADE

Homework question 7
What is cloud computing? What resources are offered through the TÜ HPC cloud?
ANSWER
COMMENT
GRADE

Homework question 8
How do grid, cloud and fog computing differ?
ANSWER
Homework question 9
What is OpenStack and give examples of alternatives to OpenStack?

Homework question 10
Deploy two cloud applications on separate instances. Document the procedure you followed, and give internet addresses of where they are located. Please use the university internal network provider_64_net. You may use (and hopefully update) the example installation procedures provided for Dudle, Etherpad, Gitlab, Mediawiki, Chamilo, Friendica, Wordpress and Mattermost. If you wish to deploy something else, please check with me first.

Homework question 11
For the cloud applications you deployed on TÜ HPC openstack, perform an internet search to find out if there have been any security breaches associated with the application. If so briefly describe these breaches, be sure to include (a) reference(s). Also discuss whether it would be better to write your own (possibly less full featured) application to have better security.

Homework question 12
What is Let’s Encrypt and how might this be of use to you when deploying cloud applications? What other alternatives are there to Let’s Encrypt?

Project
Homework question 13
What will you do for your project and how will you title it?
Acknowledgements

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