

Tárgytematika / Course Description Introduction to HPC

GKNM_MSTA088

Tárgyfelelős neve /

Teacher's name: dr. Környei László

Félév / Semester: 2023/24/1

Beszámolási forma /

Assesment: Vizsga

Tárgy heti óraszám /

Teaching hours(week): 2/2/0

Tárgy féléves óraszám /

Teaching hours(sem.): 0/0/0

OKTATÁS CÉLJA / AIM OF THE COURSE

The aim of the course is to acquire the basic skills necessary to develop programs in a high performance computing environment and learn some basic parallelization techniques, including OpenMP

TANTÁRGY TARTALMA / DESCRIPTION

Scalable solutions for IT problems. Accessing supercomputing systems at the university.

Computer and HPC hardware and architectures. Basic LINUX commands.

The LINUX system environment. LINUX command line tools: editors, cut, grep, sed, awk, etc.

Programming in BASH: data types, execution control, environment variables. Running script in the LINUX CLI.

Programming in C: Basic program layout and I/O. Compiling and running in command line interface.

Programming in C: basic data types and execution control.

Programming in C: Advanced data structures. Debugging, profiling, instrumentation. Implementing simple algorithms.

Numerical linear algebra packages. Installing and configuring external libraries. Using linear algebra tools for solving linear equations.

Simulating physical systems. Physical, mathematical and numerical modelling. Implementing numerical models for solving differential equations.

Measuring, modelling and estimating runtime. Visualizing results and plotting of simple graphs efficiently.

Job and resource management in SLURM. Basic job management commands and tools. Setting up and running serial jobs on a computer cluster.

Parallel programming with OpenMP: programming model, basic directives and clauses. Running an OpenMP job with SLURM. Measuring runtime.

Parallel programming with OpenMP: data types and controlling number of threads.

Parallel programming with OpenMP: loop parallelization, scheduling and reduction.

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESMENT'S METHOD

1. Weekly and bi-weekly homework (30%, min 10%)
2. Individual or Group project with documentation and presentation. (30%, min 10%)
3. Oral exam. (30%, min 10%)
4. Attendance (10%)

Marks:

0 - 49%: insufficient (1)

50-64%: sufficient (2)

65-79%: average (3)

80-89%: good (4)

90-100%: excellent (5)

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL

The lecture notes are available online.

AJÁNLOTT IRODALOM / RECOMMENDED MATERIAL

[1] William Shotts: The Linux Command Line. <https://linuxcommand.org/>

[2] Suzanne J. Mathews, Tia Newhall, Kevin C. Webb: Dive into Systems. <https://diveintosystems.org/book/>

[3] Blaise Barney, Lawrence Livermore National Laboratory, Introduction to OpenMP. <https://hpc-tutorials.llnl.gov/openmp/>