



Schedule of lectures, assignments, project.

Contents and Teaching Format

We use a combination of lectures, exercises and self-driven project work in this course:

Within the teaching weeks of block 1, 2015/16, weeks 36-41 and 43-44 (Sept.1 - Oct.29th), we will offer

- Two Lectures of 2 hours per week;
- One Lab session of at least 2 hours per week held on Thursday:
 - will teach and demonstrate CUDA and if time permits MPI programming
 - will help with assignments and project work

All Lectures and Lab session in this course will be delivered in English.

The assignments and projects will be posted in English, and while you can chose to hand in solutions in either English or Danish, English is preferred.

Lectures

- Tuesday, 10.15 - 12.00 in Aud 09 (HCØ).
- Thursday, 13.00 - 15.00 in Aud 09 (HCØ).

Lab Sessions

- Thursday, 15:00-17:00 in Aud 09 (HCØ) or later if needed, i.e., for as long as it takes.
- Login to GPU & 16 multicore machines will become operational after 1st of September:
 - `$ ssh -l <ku_id> ssh-diku-apl.science.ku.dk`
 - `$ ssh gpu04-diku-apl`
or `gpu02-diku-apl` or `gpu03-diku-apl` or `gpu01-diku-apl`,
but expect a 30 seconds waiting time for the first login.
- While you are on one of the `gpu01/4-diku-apl` machines add the two lines below at the end of your `.bashrc` file:
 - `export PATH=/usr/local/cuda/bin:$PATH`
 - `export LD_LIBRARY_PATH=/usr/local/cuda/lib64:$LD_LIBRARY_PATH`
- Also check that you are in the video group and if not please let me know
- `$ groups <ku_id> | grep "video"`

Lecturers & Lab Sessions

Cosmin Oancea (course responsible)	e-mail: cosmin.oancea@diku.dk
Troels Henriksen	e-mail: athas@sigkill.dk

Teachers will be available for questions after the lectures and during Lab hours, but you are also encouraged to use the [Discussion Forum](#) for questions.

Course Resources, Organization, and Literature

All students will be provided individual accounts on a multi-core and GPGPU machine that supports multi-core programming via C++/OpenMP and CUDA programming.

The course is organized in **three tracks**:

- **The hardware track** covers (lecture) topics related to processor, memory and interconnect design, including cache coherency and sequential memory consistency, which were selected from the book [Parallel Computer Organization and Design](#), by Michel Dubois, Murali Annavaram and Per Stenstrom, ISBN 978-521-88675-8. Cambridge University Press, 2012.
The above mentioned book is available at the local bookstore (biocenter), but it is not mandatory to buy it (the lecture notes should be self contained.)
- **The software track** covers (lecture) topics related to parallel-programming models and recipes to recognize and optimize parallelism and locality of reference. It demonstrates that compiler optimizations are essential to fully utilizing hardware, and that some optimizations can be implemented both in hardware and software, but with different pro and cons.

I do not have yet a precise schedule on how exactly the lectures on the hardware and software tracks are going to be interleaved. A tentative schedule is displayed under the Course Motivation and Organization page, but we will figure out as we go what interleaving makes most sense.

- **The lab track** is to be held on Thursday starting at 15:00 for as long as it takes. It

teaches GPGPU
hardware specifics and programming in CUDA, OpenMP and if time permits MPI.
The intent is that
the lab track applies in practice some of the parallel programming principles and
optimizations techniques
discussed in the software/hardware tracks.

The lecture slides of all three tracks are the only material that is required that you read (and understand)!

[Additional Teaching Material/Literature](#) may be provided after each class, e.g., book chapters
or research papers that complement or were partially covered in the lectures (slides).

Type of Assessment & Assignments & Project

The course uses a continuous evaluation format, where the final mark will be composed from solutions to

4 **individual** week assignments (32%) and a **group** project with **individual** presentation (68%).

Each individual assignment will be published after the class on Thursday, and the solution should be
submitted by next Thursday. If the solution is not satisfactory, we will ask you to resubmit, i.e., extra week.

It follows that the first assignment should be delivered by the end of week 37, the second by the end of week 38, the third by the end of week 39, and the fourth by the end of week 40.

The project will be published at the beginning of week 41st and solutions need to be submitted by the
end of week 44th (week 42 is holiday).

- Four (small) individual "week-assignments" (**W-assignments**) with one week editing time, will be
published and handed in through Absalon after the class on Thursday. The solution should be
submitted by the next Thursday, i.e., ~7 days. If a serious attempt was made but the solution is
not satisfactory (or simply if you want to improve your assignment, hence mark), an updated solution
can be resubmitted until the following Thursday (but you will also have to solve the next assignment
in the same time window).
It follows that the first assignment should be delivered by the end of week 37, the

second by

the end of week 38, the third by the end of week 39, and the fourth by the end of week 40.

Please note that **all** 4 assignments need to be satisfactory solved to pass the course.

- A "**G-assignment**" (group assignment, Godkendelse-opgave) which spans three weeks, will be published and handed in through Absalon at the beginning of Week 41st, i.e., **6th of October**.

A (group) solution need to be submitted by the end of the week 44th, i.e., **31st of October**.

You will receive a sequential C++ program and will be asked to parallelize and optimize it

for multi-core execution, i.e., using OpenMP, and for many-core execution, i.e., using CUDA.

Groups are composed from up to three students and a written report must describe and evaluate the solution.

- The final individual evaluation will be held in week 45. You are asked to prepare a concise (<10 minutes) individual presentation that describes your contribution to the project. In addition you may be asked several questions related to the assignments, project or to the material covered in the lectures.