# SF2568 Parallel Computations for Large- Scale Problems 7.5 credits

## Parallella beräkningar för storskaliga problem

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

## Establishment

The course syllabus is valid from Spring 2022 according to the school principal's decision: S-2022-0529 Decision date: 2022-02-24

## Grading scale

A, B, C, D, E, FX, F

## Education cycle

Second cycle

## Main field of study

Mathematics,Technology

## Specific prerequisites

- English B / English 6
- Completed basic course in numerical analysis (SF1544, SF1545 or equivalent) and

- Completed basic course in computer science (DD1320 or equivalent).

## Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

## Intended learning outcomes

The goal of the course is to provide a basic understanding of how to develop algorithms and how to implement them in distributed memory computers using the message-passing paradigm.

After completion of the course components the student shall be able to:

- select and/or develop algorithms and data structures for solving a given problem after having analyzed and identified properties of the problem which have the potential for an efficient parallelization;
- theoretically analyze a given parallel algorithm with respect to efficiency and afterwards experimentally evaluate a program for parallel computing by running it on a high-performance computer;
- implement a given algorithm on a distributed-memory computer using the message passing library MPI;
- independently solve a more complex problem and present the results both orally and in writing in a scientific manner;
- identify challenges of Green Computing in HPC.

## Course contents

- Basic ideas including hardware architectures, memory hierarchies, communications, parallelization strategies, measures of efficiency;
- HPC and Green Computing;
- Introduction to MPI, the Message Passing Interface;
- Simple numerical algorithms including matrix operations, Gaussian elimination;
- Algorithms on graphs including graph partitioning problems;
- Parallel sorting;
- More advanced parallel algorithms;
- Standard libraries;

## Examination

- HEMA - Assignment, 4.5 credits, grading scale: A, B, C, D, E, FX, F
- PROA - Project, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

## Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.