### Problem set 3

TDT4200, Fall 2016

**Deadline:** 05.10.2016 at 20.00 Contact course staff if you cannot meet the deadline.

Evaluation: Pass/Fail

**Delivery:** Use It's Learning. Deliver exactly two files:

- yourusername\_ps3.pdf, with answers to the theory questions
- *yourusername\_ps3.*{*zip* | *tar.gz* | *tar*} containing your solution to the programming tasks.

**General notes:** All problem sets are to be done **INDIVIDUALLY**. Code must compile and run on course servers. Do not add thrid party code or libraries.

# Part 1, Theory

#### Problem 1

- a) What is cache memory?
- b) What is the difference between spatial and temporal locality?
- c) What is cache coherence?
- d) What is false sharing?

#### Problem 2

In this porblem, you do not need to write complete, compilable programs, only the relevant lines.

- a) Write code to show how semahpores can protect a critical section, when using multiple threads. Explain how your code works.
- b) Write code using semaphores that may deadlock when using multiple threads. Explain why your code may cause a deadlock.

#### Problem 3

- a) What is the difference between OpenMP and pthreads?
- b) Show how the following code can be parallelized using OpenMP:

```
for(int i = 0; i < n; i++) {
    calculate(i);
}</pre>
```

## Part 2, Code

### Problem 1

- a) Parallelize the heat equation solver in *heat\_omp.c* using OpenMP.
- b) Parallelize the heat equation solver in *heat\_pthread.c* using pthreads.

Further details can be found in the recitation slides for this problem set.