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);
}
```

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.