# NTNU – Trondheim
## Norwegian University of Science and Technology

Department of Computer and Information Science

# Continuation exam for TDT4186 Operating Systems

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**Examination date: 13th of August 2015**

**Examination time (from-to): 15:00-19:00**

**Permitted examination support material:**

D: No printed or hand-written support material is allowed. A specific basic calculator is allowed.

**Other information:**

Short and concise answers are wanted for each exercise.
Read the text very carefully, and consider what is actually asked for in each exercise.
If you think that some information is missing in the text, describe the assumptions that you make.
Each of the six exercises counts equally, and each of the three sub-exercises counts equally.

**Language: English**

**Number of pages (front page excluded): 2**

**Number of pages enclosed: 0**

**Checked by:**

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Date                    Signature

## Exercise 1: Operating Systems

a) Indicate shortly which goals are targeted when developing operating systems

b) Compare singleprocessor systems and multiprocessor systems with respect to functionality and implementation

c) Discuss advantages and disadvantages of multicore architectures and multiprocessor architectures

## Exercise 2: Processes and Threads

a) Indicate shortly differences between processes and threads in operating system context

b) Illustrate with figures and text different ways of combining processes and threads in existing operating systems

c) Compare the usage of user-level threads and the usage of kernel-level threads in software

## Exercise 3: Process Synchronization

a) Explain shortly what semaphores are in operating system context

b) Indicate how semaphores are formally defined for process synchronization purposes

c) Describe with code and comments at least two examples where semaphores are used to solve actual challenges in software

## Exercise 4: Memory Management

a) Describe shortly what working sets are in operating system context

b) Indicate how working sets theoretically may be used for memory management purposes – and discuss whether working sets practically may be used for memory management purposes

c) Illustrate with figures and text deliberations having to be made to decide how many processes/threads that may be kept in primary memory and how much code and data each of these processes/threads may keep in primary memory at any given time

## Exercise 5: Process Scheduling

a) Explain shortly the importance of deadlines in operating system context

b) Illustrate with figures and text how the earliest deadline first algorithm may work well for some process scheduling cases – and not that well for other process scheduling cases

c) Compare effect and efficiency of the earliest deadline first algorithm versus some other relevant algorithms with respect to different forms of process scheduling with deadlines

## Exercise 6: I/O Management

a) Indicate shortly differences between buffering and caching in operating system context

b) Compare effect and efficiency of different variants of buffering with I/O management – and compare effect and efficiency of different variants of caching with I/O management

c) Discuss the usage of different forms of buffering and / or caching with respect to different types of I/O units