

CS-C3140 Operating systems

The exam contains five questions. The maximum points for each question are listed in the beginning of the questions. Read the questions carefully. Give clear and compact answers. Remember to write the name of the course and your own personal information on each of your answer papers. No extra appliances are allowed in the exam.

- 1 (10p) Answer *shortly* with clear definitions and descriptions. (Max. two points per subquestion.)
 - a) What is an OS kernel?
 - b) What is a condition variable?
 - c) What is batch processing?
 - d) What is polling (in I/O systems)?
 - e) What is internal fragmentation?
- 2 (6p) Considering the dining philosophers problem (assume $N \geq 4$ philosophers), give a solution that implements mutual exclusion by using *semaphores*. Present your solution as a piece of pseudo code and explain it.
- 3 (6p) Describe how virtual memory is typically implemented in operating systems? What hardware support is typically available in modern processors for virtual memory implementation?
- 4 (6p) How remote procedure calls are implemented and what phases a typical remote procedure call processing has? In our answer, remember to address the situations, where the machines are significantly different or errors occur.
- 5 (6p) Write an essay that is not longer than 50 lines on scheduling.