Mittuniversitetet
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Theory assignment: Processes

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Contents

1 Aim

The aim of the assignment is, first, to aid your understanding of the treated content by providing questions and problems which inspire reflection. Completing these exercises will help ensure:

- That you can analyze the problems faced by a scheduling algorithm and other problems in a time-sharing environment.
- That you know how to solve these problems, i.e. know some common scheduling algorithms.
- That you can analyze a situation and choose among scheduling algorithms and what advantages or disadvantages certain adaptions to them might have.
- That you can analyze a situation with regard to synchronization and apply a correct solution to avoid race conditions and deadlocks.

2 Prerequisites

This assignment covers part two in the course book [2; 3]. As such, before attempting this assignment you should have read chapters 3–7, these cover process management and process coordination.

3 Tasks

1. Define the terms
   (a) process, and
   (b) thread.
   (What is the difference between them?)
2. Define the different levels of process scheduling,
   (a) short-term,
   (b) medium-term, and
   (c) long-term.
   (What is the difference between them?)
3. Describe how the following scheduling algorithms work and their advantages and disadvantages:
   (a) first-come first-served (FCFS),
   (b) shortest-job-first (SJF),
   (c) priority,
   (d) round-robin (RR),
   (e) multi-level queue (MLQ), and
   (f) multi-level feedback queue (MLFQ),
4. Given this variant of the round-robin scheduling algorithm, where the entries in the ready queue are pointers to the PCBs, what would be the effect of putting two entries of the same PCB in the ready queue?
5. Consider a short-term scheduling algorithm which favours processes that have used the least processor time in the recent past. Why will this algorithm favour I/O-bound processes and yet not starve CPU-bound processes?
6. Describe the different ways of implementing threads, e.g. user threads and kernel threads. (What is the difference between them, what advantages and disadvantages are there with the different methods?)
7. State and explain the requirements for solutions to the critical-section problem.
8. Describe the problems which need to be handled for multi-processor and multi-core processor systems.
9. State and explain the requirements for a deadlock to occur.

10. Consider a system of four resources, all of the same type, that are shared by three processes, each of which needs at most two of the resources. Show that the system cannot enter a deadlock.

4 Examination

These exercises are provided solely to assist you in studying the concepts of operating systems covered within the course. You are not required to submit anything for these exercises.

References

[1] Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts*. John Wiley & Sons Inc, Hoboken, N.J., 8 edition, 2009. International Student Version.

[2] Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts*. John Wiley & Sons Inc, Hoboken, N.J., 9 edition, 2013. International Student Version.

[3] Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts*. John Wiley & Sons Inc, Hoboken, N.J., 9 edition, 2013.