

Exercise Sheet 11 (Theory)

(11 Points)

Please note: Solutions must be submitted (individually or in pairs) until 17.01.2020 at 10:00 AM (mailbox in OH16, ground floor, in front of room E16). Submitting solutions via mail is *not* possible. Discussion: 20.-24.01.2020.

1 Scheduling and Resource Access (4 Points)

- (a) What is Priority Inversion?
- (b) Explain why the Priority Ceiling Protocol (PCP) is deadlock free.
- (c) Mr. Smart wants to use PCP in his system, which uses dynamic-priority scheduling. Is this possible? Which problems may occur?
- (d) Explain *shortly* the difference between global and partitioned multiprocessor scheduling.

2 RM Scheduling (3 Points)

Consider the given sporadic real-time tasks with implicit deadlines (i.e., $D_i = T_i$). When answering the following questions, always indicate, which lemmata you use.

	τ_1	τ_2	τ_3
C_i	1	2	3
T_i	4	6	10

- (a) What are the priority levels of the tasks?
- (b) Show formally if a rate-monotonic (RM) schedule is feasible.
- (c) Show formally if a rate-monotonic (RM) schedule is feasible, when the minimum inter-arrival time T_i of task τ_3 is changed from 10 to 8 time units.

3 Harmonic Task Systems (2 Points)

Consider the given periodic tasks with implicit deadlines (i.e., $D_i = T_i$). When answering the following questions, always indicate, which lemmata you use.

	τ_1	τ_2	τ_3	τ_4	τ_5	τ_6	τ_7
C_i	0.2	2	2	1.5	1	14	28.8
T_i	2	6	12	24	24	72	288
D_i	2	6	12	24	24	72	288
U_i	0.1	$\frac{1}{3}$	$\frac{1}{6}$	0.0625	0.0417	0.195	0.1

- (a) Show formally if a rate-monotonic (RM) schedule is feasible.
- (b) Show formally if an earliest deadline first (EDF) schedule is feasible.

4 Least Laxity Scheduling (2 Points)

Consider a system with 3 tasks:

- Task T1 is released at time 0, has an execution time of 9 time units and a deadline at time 35.
- Task T2 is released at time 5, has an execution time of 3 time units and a deadline at time 27.
- Task T3 is released at time 6, has an execution time of 10 time units and a deadline at time 29.

Draw a schedule for this task system using the least laxity scheduling policy.