SAARLAND UNIVERSITY
COMPUTER SCIENCE

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Verification of Real-Time Systems SS 2015

Assignment 12

Deadline: July 23, 2015, before the lecture

Exercise 12.1: Scheduling (1+2=3 Points)

1. Explain the difference between offline and online scheduling.
2. What are the advantages and disadvantages of preemptive and non-preemptive scheduling?

Exercise 12.2: Earliest-Due-Date (2+2+2=6 Points)

Consider the problem of scheduling a set of synchronous tasks on a uniprocessor machine. It was shown in the lecture that Earliest-Due-Date (EDD) minimizes the maximum lateness. Does EDD also minimize the following metrics?

(a) the average response time

(b) the total completion time

(c) the number of late tasks

Justify your answer.

Exercise 12.3: Aperiodic Scheduling (6+4+2=12 Points)

Assume you are given the following set of tasks:

						EDF					SJF				
	a_j	C_j	d_j	D_j	X_j	s_j	f_j	R_j	L_j	E_j	s_j	f_j	R_j	L_j	E_j
J_1	3	5	12												
J_2	0	4	5												
J_3	2	1	4												
J_4	5	3	15												
J_5	7	2	9												

1. Determine whether the task set is schedulable under EDF and SJF, and fill out the missing entries in the table.
2. Compute the average response time, the total completion time, the maximum lateness, and the number of late jobs for both scheduling algorithms.
3. Is the task set schedulable if preemption is not allowed?

Exercise 12.4: Shortest-Job-First (8+2=10 Points)

Prove that preemptive SJF as presented in the lecture is optimal w.r.t. the average response time when scheduling a set of asynchronous tasks on a uniprocessor machine. Under which additional assumption does the statement also hold for non-preemptive SJF? Justify your answer.

Exercise 12.5: Periodic Scheduling (3+6+3=12 Points)

Assume you are given the following three sets of tasks, where $\phi_i = 0$ and deadlines are implicit.

1. Compute the hyperperiod, the system utilization, and the Liu-Layland bound for each task set. What can you infer from the results regarding schedulability for RM and EDF?
2. Are the task sets schedulable by RM?
3. If they are not schedulable by RM, are they schedulable by (a) another static priority algorithm, (b) any other scheduling algorithm?

	τ_1	τ_2	τ_3
T_i	4	5	10
C_i	2	2	1

	τ_1	τ_2	τ_3
T_i	3	6	24
C_i	1	3	2

	τ_1	τ_2	τ_3	τ_4
T_i	2	5	8	20
C_i	1	1	2	1