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Exercises for Lecture
Real-Time Systems and Applications
Summer Semster 15

Exercise Sheet 4

(10 Punkte)

Exercise Due at Wednesday, May 27, 2015, 12:00 Uhr

Hinweise: Gruppenarbeit von bis zu drei Personen aus der gleichen Übungsgruppe ist möglich. Bitte vergessen Sie nicht Ihre Namen und Ihre Matrikelnummern auf die Lösung zu schreiben. **Die Abgaben können in den beschrifteten Briefkasten vor dem Sekretariat des LS12 (OH16/E22) eingeworfen oder per Mail (PDF Format) an georg.von-der-brueggen [☺] tu-dortmund.de abgegeben werden.**

Note: It is allowed to work in a group of up to three persons, if these persons are from the same practice group. Please do not forget to write your name and your Matrikelnummer on the solutions. **The solutions can either be placed in the mailbox in front of the secretary's office of LS 12 (OH/E22) or sent by mail (PDF format) to georg.von-der-brueggen [☺] tu-dortmund.de**

Exercise Sessions:

Do, 10:15 - 11:45	OH16/E18
Do, 14:15 - 15:45	OH16/E18

4.1 EDF and DM Scheduling (3 Punkte)

Suppose that we are given the following 3 sporadic real-time tasks with constrained deadlines.

	τ_1	τ_2	τ_3
C_i	2	2	4
T_i	6	8	12
D_i	5	4	12

1. Is the deadline-monotonic (DM) schedule feasible? Is the EDF schedule feasible? Construct the schedules of DM and EDF by assuming that all the tasks arrive at time 0
2. Suppose that the system has only two priority levels by using fixed-priority scheduling. How do you assign the priority levels of these three tasks? Can you think of a general method to handle such a problem when the available priority levels are less than the number of the tasks when considering task sets with constrained deadline?

4.2 PCP Example (2 Punkte)

Draw the current priority ceiling $\Pi'(t)$ of the system and the current priority of the jobs in the two examples of PCP (i.e., x axis with respect to time and y axis with respect to the priority levels) given in the lecture (i.e., Pages 26 and 27 in 08-Resource.pdf).

4.3 Reservation Servers (3 Punkte)

Consider the following case with two sporadic tasks and 1 server (to be defined later):

	τ_1	τ_2
C_i	0.2	6
T_i	2	12
D_i	2	12

	Server
C_s	1.6
T_s	4

Can we guarantee that task τ_2 always meets its deadline in the following settings? Explain your answer. If the answer is “no”, what is the maximum capacity (C_s) of the server to ensure that τ_2 can meet its deadline.

(a) setting the above server to a constant bandwidth server (CBS) and using EDF

(b) setting the above server to a polling server and using RM

(c) setting the above server to a deferrable server and using RM

(d) setting the above server to a sporadic server and using RM

4.4 Reservation Server Designs (2 Punkte)

When designing the constant bandwidth server (CBS), we have the following description:

- When the server is idle at time t and a job arrives, if $t < D_{S_i}$ and $\frac{b_{S_i}}{D_{S_i}-t} < \frac{C_{S_i}}{T_{S_i}}$, the server becomes active with the same budget and server deadline; otherwise, D_{S_i} is set to $t + T_{S_i}$ and b_{S_i} is set to C_{S_i}.

What happens if we change the description to the following statement?

- When the server is idle at time t and a job arrives, if $t < D_{S_i}$, the server becomes active with the same budget and server deadline; otherwise, D_{S_i} is set to $t + T_{S_i}$ and b_{S_i} is set to C_{S_i}.

Hint: Explain the link to the self-suspension behaviour.

General Hints: