

Written Assignment #3

CPEN 432: Real-time System Design

1. Determine if the following task set can be scheduled using EDF with SRP to control resource access.

Task	e_i	P_i	Resources used
T_1	4	10	R_1, R_2
T_2	5	20	R_2, R_3
T_3	2	40	R_1
T_4	10	35	R_3

The duration for which each resource is used by the tasks is specified in the following table. You may assume that a task locks only one resource at a time.

Resource	Duration
R_1	2
R_2	1
R_3	2

2. Suppose that recurrent tasks are scheduled according to a fixed-priority scheme. Give examples to illustrate that (a) PCP is better than SRP and (b) SRP is better than PCP, when performance is measured in terms of blocking times. Explain why such an example (or examples) cannot exist if you cannot find one (or both) of the examples.
3. Consider a task set with three periodic tasks: $\tau_1 = (P_1 = 7, e_1 = 1)$, $\tau_2 = (14, 2)$, $\tau_3 = (28, 3)$. Assume that all tasks release a job at time $t = 0$. An aperiodic job arrives at $t = 5$ and has an execution time requirement of 2. This aperiodic job is followed by another aperiodic job that releases at time $t = 9$ and requires 3 units of execution. Using the following policies and servers, determine the completion time of the two aperiodic jobs.
 - (a) Rate monotonic scheduling with a **polling** server of period 7 and budget 2.
 - (b) Rate monotonic scheduling with a **sporadic** server of period 7 and budget 2.
4. Consider the following three implicit-deadline recurrent tasks: $T_1 = (P_1 = 10, e_1 = 2)$, $T_2 = (14, 3)$, and $T_3 = (21, 4)$. A periodic server of period 6 is used to schedule aperiodic requests. These tasks are scheduled, along with a server, using EDF.
 - (a) What is the maximum server size if the server is a deferrable server? Is this size a function of the period of the server? If not, why not? If yes, what is the best choice of server size?

- (b) Suppose that the server is a **total bandwidth server**. The description of total bandwidth servers is in the text, section 6.4. What would the maximum server size be if the server is a total bandwidth server?
- (c) Consider two aperiodic jobs J_1 and J_2 with execution times 1.0 and 2.0, and arrival times 2 and 5, respectively . What are their response times for the servers in the two previous parts?