	C_i	T_i	D_i
J_1	1	3	3
J_2	2	4	4

Table 1:

1 Problem

Consider the two tasks J_1 and J_2 with computation times, periods and deadlines defined by Table 1. The tasks are executed on a preemptive CPU.

(a) [2p] Compute the utilization factor and the scheduling length.

(b) [3p] Are the tasks schedulable under the EDF algorithm? What is the worst-case response time for each task?

(c) [3p] Are the tasks schedulable under the RM algorithm? What is the worst-case response time for each task?

(d) [2p] We consider now the possibility of having aperiodic tasks. In order to handle aperiodic tasks, we run a polling server J_s with computation time $C_s = 3$ and period $T_s = 6$. Assume that an aperiodic task with computation time $C_a = 2$ asks for the CPU at time $t = 5$. Plot the time evolution when a polling server is used together with the two tasks J_1 and J_2 under the RM algorithm.

2 Solution

(a) The utilization factor is

$$U = \frac{C_1}{T_1} + \frac{C_2}{T_2} = \frac{1}{3} + \frac{2}{4} = \frac{5}{6}.$$

The scheduling length is $\text{lcm}(3, 4) = 12$.

(b) The tasks are schedulable under the EDF algorithm because $U < 1$. The execution is simulated in Figures 1 and 2. At time 9, J_1 and J_2 have the same priority, so both executions are possible. From Figures 1 and 2, we can see that the worst-case response times are 2 for J_1 and 3 for J_2.

(c) Since $2(2^{1/2} - 1) \simeq 0.82$, while $U \simeq 0.83$, we cannot conclude whether the tasks are schedulable under the RM algorithm. The execution is simulated in Figure 2. From Figure 2, we can see that the tasks are schedulable under the RM algorithm, and the worst-case response times are 1 for J_1 and 3 for J_2.

(d) The execution is shown in Figure 3.

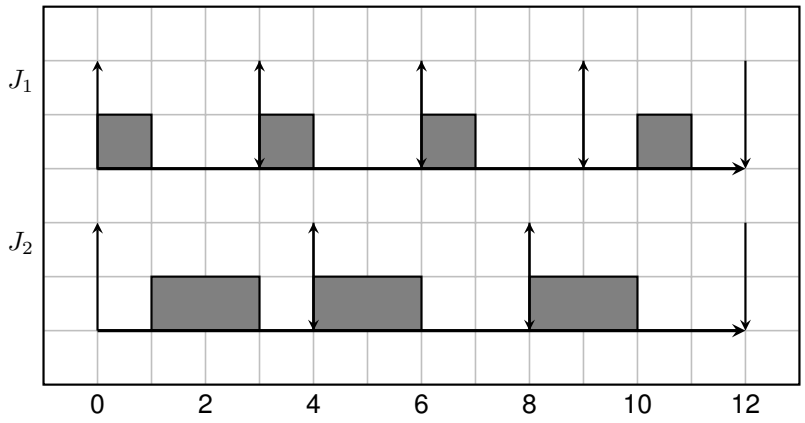

Figure 1:

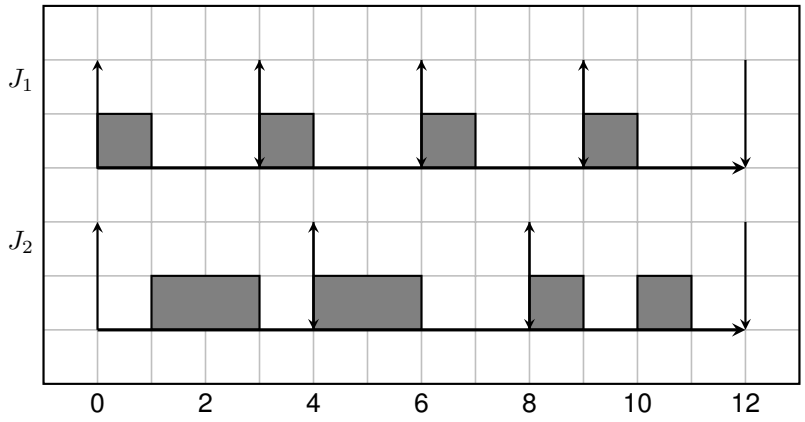

Figure 2:

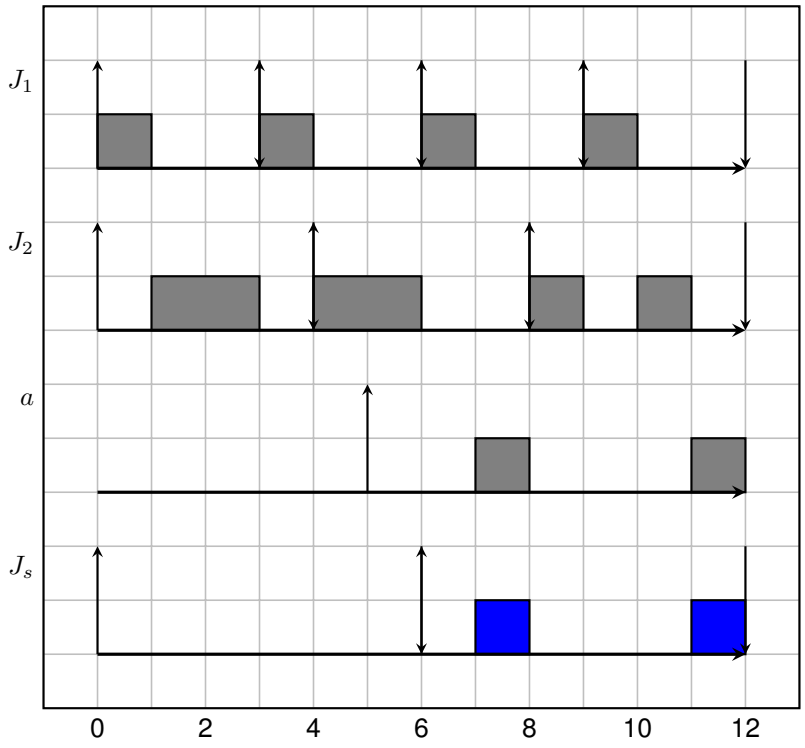

Figure 3: