

Exercises 2IN60.7

Today we will analyze the schedulability of a real-time application implemented in the μ C-OS-II real-time operating system.

7.1 Analyzing the schedulability of a real-time system

In this exercise you will gain insight into the schedulability analysis of a real-time system. You can assume deadlines equal to periods, i.e. $\forall i : D_i = T_i$. The CodeWarrior project for this exercise is in the directory `exercise7_1`. *Note that the RTI interrupt frequency is set to 1 kHz, meaning that the tick period is 1ms. Keep this in mind in your timing analysis.*

1. Study the code. **Which utilization based analysis applies to this system (i.e. for dependent or independent tasks)? Motivate your answer.**
2. **Determine the blocking time for each task and the ISR.**

Assume that the critical section inside of the `ATDReadChannel()` function takes 2.162ms.

3. **Compute the utilization of the complete system (including the tick ISR overhead, but excluding the context switching and the `TaskStart`). Based on this utilization, is the system schedulable? Motivate your answer.**

Assume the following execution times:

τ_i	C_i (ms)
<code>OSTimeTick()</code>	0.009
<code>Task1</code>	2.163
<code>Task2</code>	2.163
<code>Task3</code>	2.163

4. **Add a fourth task with the lowest priority, which reads the analogue input connected to the ATD converter on port `PAD14` with $\varphi_4 = 3\text{ms}$ and $T_4 = 20\text{ms}$ and turns on the `D26` led if and only if the value exceeds the `PAD14Threshold`. Compute the utilization of the new system. Based on this utilization, is the new system schedulable? Motivate your answer.**

Assume that $C_4 = 2.163\text{ms}$.

5. **Compute the worst-case response time for all the four tasks and the tick ISR. Is the system schedulable? Motivate your answer.**