

RDCS423 Extra Tutorial Problems #1 - Real-Time Scheduling Theory

1. Consider a more comprehensive industrial example (from Briand & Roy, 1999) for a new vital signs medical monitoring instrument. The plan is to use an off-the-shelf VMTR2a-100 board (PowerPC 604). The Ada code is compiled with Alsys Ada V5.7.2, and the Ada runtime will run on LynxOS 2.4. The task characteristics are:

Task t_1 : $C_1 = 2.0$ ms; $T_1 = 10$ ms

Task t_2 : $C_2 = 3.0$ ms; $T_2 = 11$ ms

Task t_3 : $C_3 = 2.0$ ms; $T_3 = 36$ ms

Task t_4 : $C_4 = 7.5$ ms; $T_4 = 40$ ms

For this system, the overhead for the runtime and operating system is measured at 19% per KHz which translates to an execution time loss of 0.19 msec for every task.

Apply the Utilization Bound Theorem (UBT) to determine if these tasks are schedulable using a rate monotonic scheduling strategy and, if not, apply the less conservative Completion Time Theorem (CTT).

2. Suppose that another task has to be added to check the hardware periodically, and this task has an execution time of 1 ms. What is the maximum invocation rate of this task so that the task set is still schedulable.
3. Suppose further that the rate determined above for the monitoring task isn't high enough and there is some concern about timely fault detection. What can be done to maintain schedulability of the task set when the additional monitoring task must have a minimum rate of 200Hz.