

ECE 4680/6680L (Embedded Computing)

Lab #8: Real time scheduling using RMA

An Inertial Navigation System (INS) is a real-time shipboard avionic system. It has strict time constraints for providing information to other shipboard devices. Typically an INS system tracks attitude, geographic position, velocity, distance and displacement. It also responds to periodic test messages sent by an external computer for checking of communication links. You have received a design for an INS that has to comply with the following timing constraints:

Feature	Period (ms)
Compute attitude data	10.56
Compute velocity data	40.96
Compute position data	350.00
Display data	100.00
Run-time Built-In Test (BIT)	285.00
Compose attitude message	61.44
Compose navigation message	165.00
Compose test message	700.00

There are eight tasks. All tasks share the result table (write mode for computational tasks, read mode for all others). The attitude, navigation and test message composition tasks share the I/O channel and these messages are stored on a disk.

The system will run on a platform using a Motorola MC68302 microcontroller and a linux real-time kernel, which offers a priority ceiling protocol. The overhead for this system is 153 μ s per task. The estimated execution times and resource usage times for each of the tasks is as follows.

Task	Run time (ms)	Result table usage (ms)	I/O channel usage (ms)	Disk usage (ms)
attitude	1.30	0.20	-	2.00
velocity	4.70	0.20	-	3.00
position	3.00	0.20	-	3.00
display	23.00	0.30	-	-
runtime BIT	10.00	-	-	1.00
att message	9.00	-	3.00	-
nav message	38.30	-	6.00	-
test message	2.00	-	2.00	-

Is this system schedulable?

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Write a program to perform RMA with overhead and blocking. Report your results by providing the values of (k,l) for which the theorem passes, or for which value of (i) the theorem failed. Your report should include a table of the data you used, and your code.

This lab is due by the due date posted at the course website. It must be completed by each individual student. There is to be NO collaboration on this problem.