Embedded Real-Time Systems (AME 3623)
Homework 6

April 25, 2006

This homework assignment is due on Tuesday, May 2nd at 5:00pm. Your work may be handed in electronically (use the Homework 6 digital dropbox on D2L) or in hardcopy form (in person or to my office).

This assignment must be done individually: do not share/discuss your answers with others or look at the answers of others.
**Question 1**

Consider the following circuit in which three digital outputs \((C0, C1, C2)\) drive an analog circuit. For bit values 0 and 1, each pin will be driven at 0V and +5V, respectively.

\[
\begin{align*}
C0 & \quad 4R \\
C1 & \quad 2R \\
C2 & \quad R \\
\end{align*}
\]

\(Vout\)

(20pts) Starting from Kirchoff’s law, derive an equation for \(Vout\) in terms of the three digital signals.
(10pts) For each possible combination of boolean values for the $C_i$’s, give the actual value of $V_{out}$.

**Question 2**

(10pts) Give two disadvantages for performing I/O through polling.

(10pts) Explain (in brief) how the use of *interrupts* solves these two problems.
(10pts) List two necessary conditions for there to be a shared data problem.

(15pts) Suppose we want a small segment of code – called \textit{donow()} – to be executed precisely once every 5.12\textit{ms}. What is the timer0 prescalar configuration and the (pseudo)code for the interrupt routine?
Question 3

Consider a hybrid priority and round-robin scheduler that is non-preemptive. Consider also three regularly-scheduled processes:

Task 1 executes at 2Hz/priority 2 and requires 50ms of processing time (it moves from the waiting to the ready state at $t = 0, .5s, 1s, 1.5s,$ etc.).

Task 2 executes at 4Hz/priority 2 and requires 100ms of processing time (and moves from waiting to ready at $t = 0.01, .251s, .501s, .751s, 1.01s,$ etc.).

Task 3 executes at 1Hz/priority 1 and requires 300ms of processing (and moves from waiting to ready at $t = 0, 1s, 2s,$ etc.).

Assume that priority 2 is the highest priority (this is not the case for all OS’s).

(20pts) At 50ms intervals, show which process is occupying the processor at any given time for the interval $t = [0s, 1.5s]$.

Question 4

How much time did you spend on this assignment?