CS 503/591c: Quiz 2
Solution Set

November 7, 2003

Question 1: Work

Explain in terms of work why varying the duty cycle of a PWM signal that is used to drive an LED affects its apparent brightness. (1-2 sentences)

Work is manifested in the LED in terms of the number of emitted photons per unit time. Because we are driving the LED with a PWM signal, we are only doing work during the high-phase of the signal. Thus, with a lower duty cycle we are emitting on average fewer photons per unit time (which appears dimmer).

Question 2: Synchronous Serial Communication

List three properties that the SPI and I2C standards have in common

1. Both are serial bus standards
2. Communication occurs between a master device and a slave device.
3. The master controls the shared clock and the addressing of the slave.

List three ways in which the SPI and I2C standards differ

1. SPI is a single master standard; I2C allows multiple masters.
2. Data in SPI is sent bidirectionally; in I2C, data is sent unidirectionally.
3. Slave addressing in SPI is performed with separate chip select signal lines; in I2C, addresses are sent as data (as the first 1 or 2 bytes in a packet).

Question 3: Critical Sections

Within the PIC architecture, how do we implement a critical section inside of an ISR?

Interrupts are disabled as we enter the global ISR. So - any specific ISR can assume that it owns the CPU and will not be interrupted.

How do we implement a critical section outside of the ISR?

Disable either the global interrupt or the specific interrupt with which there may be a conflict; perform the atomic action; and re-enable the interrupts.