ECE568/CS 590/ECE 495/CS 490 (Spring 2011)

Quiz 1 (January 20, 2011)

Time limit: 15 minutes

Name: _SOLUTIONS_____

[1] A brown out reset (BOR) circuit inside an MCU monitors which of the following:

(a) Clock Frequency
(b) Temperature
(c) Supply Voltage
(d) Current Draw

Answer: (c) Supply Voltage

[2] Which of the following are essential features in a regular home thermostat?

(a) High throughput MCU
(b) Very low sleep power
(c) Wake-up time of 1 microsecond
(d) Fast radio interface

Answer: (b) Very low sleep power.

[3] Which among the following statements are **NOT TRUE?**

(a) Embedded systems need not contain only hardware.
(b) A digital alarm clock with snooze functionality is an embedded system.
(c) For all embedded systems, the latency for computation of the result is not a problem as long as it is correct.
(d) For all embedded systems, the correctness of the result is not a problem as long as the latency is minimal.
(e) RAM and ROM are typically integrated on-chip in a microcontroller
(f) Very few microcontrollers are sold per year compared to general-purpose microprocessors
(g) A microcontroller has higher computing power than a typical microprocessor
(h) A microcontroller has a rich set of on-chip peripherals

Answer: (c), (d), (f), (g)

[4] In relation to embedded systems, what does CPS stand for?

(a) Complex Peripherals Systems
(b) Cyber Programmable Systems
(c) Cyber Peripherals Systems
(d) Cyber Physical Systems
(e) Complex Physical Systems

Answer: (d) Cyber Physical Systems

[5] Give three examples of embedded systems that you own or have used.

Answer: Doesn't need a solution!

[6] An anti-lock braking system is a safety system in motor vehicles that allows the wheels of the vehicle to continue interacting tractively with the road while braking, preventing the wheels from locking up (that is, ceasing rotation) and therefore avoiding skidding. During braking, if the system detects that one wheel is spinning much slower than the others (a condition indicative of impending wheel lock), it releases the brake pressure to that wheel.

Is the anti-lock braking system an example of a real-time system? If yes, why, and if no, why not?

Answer: Yes, the anti-lock braking system is a real-time system. The reason is that it has to operate under a strict time (latency) constraint that is dictated by a real world process (the wheel locking up). The time constraint is that after detecting a slowly spinning wheel, the system has to release the brake pressure to the wheel before the wheel locks up.

[7] A professor at Purdue University has just invented a new file format for storing audio data, which requires much lesser disk space than the MP3 format. Apple and Motorola both decide to implement a decoder in their next-generation mobile phones that can decode and play the new audio format. Apple chooses a dedicated hardware approach and implements the decoder as an Application Specific Integrated Circuit (ASIC), while Motorola chooses a software approach and implements the decoder as a program executing on a small microcontroller unit (MCU).

List one advantage and one disadvantage that Apple's solution has over Motorola's.

Answer: The basic tradeoff here is one of flexibility vs. efficiency. Apple's dedicated hardware solution will be more efficient (e.g., lower power, thus leading to longer battery life) than Motorola's software-based solution. However, Apple's solution is not flexible. So, if the audio format is updated (or if a bug is found), Motorola's decoder will be much easier and less expensive to change/upgrade.