Name: **Id#**

COE 306, Term 161

Introduction to Embedded Systems

Quiz# 1 Solution

Date: Tuesday, Oct. 11, 2016

Q1. List three characteristics of embedded systems.

1. Sophisticated functionality
2. Real-time operation
3. Low manufacturing cost
4. Low power
5. Designed to tight deadlines by small teams

Q2. List the steps followed in the embedded system design process.

1. Requirements
2. Specification
3. Architecture
4. Component design
5. System integration

Q3. Explain the difference between functional and non-functional requirements and give an example of each.

Functional requirements express the expected functionality of the system by expressing the output as a function of input. However, non-functional requirements express system constrains such as time required to compute output, cost, size, weight, power consumption, reliability; etc.

Q4. Briefly explain the main difference between requirements and specification.

Specification is a formal more precise description of the system that reflects the customer's requirements in a way that can be clearly followed during design. It provides input to the architecture design process. Requirements do not provide all the details needed by the architect to design the architecture of the system.

Q5. List two challenges in embedded system design.

1. Testing for real-time characteristics and testing on real data
2. Limited observability and controllability; no keyboard and screen
3. Restricted development environments
4. Support of multiple versions/generations using the same hardware while meeting required performance

Q6. Consider the design of an embedded thermostat system. The system should regulate the temperature of a house. Suppose electronic temperature gauges will be deployed throughout the house to provide the system with a temperature map so that it can properly adjust heating and cooling systems on a per-room basis. The electronic temperature gauges will act as I/O devices in the system. Discuss how the information on the design of the electronic temperature gauges will affect how they are integrated into the system and may be useful in refining the architectural design.

The information on the electronic temperature gauges design will affect how they are integrated into the system. For instance, will they return raw or processed data, is there a limit to how many can be in a single system (leading to a maximum number of rooms), how much power does each one draw, etc. With this in mind, if the designers opt to use the LM335A, an analog temperature sensor, they will have to design both a hardware and a software method for translating its analog output to a digital value, and then communicating that digital value to the CPU. The LM335A acts like a Zener diode, so it will have to be the main part of a subsystem, rather than a subsystem itself. The designers could decide to search out a pre-fabricated subsystem, like some Bluetooth thermometer, instead; which would have different design implications.