

**CENG 5434 Microcomputer Systems Design HW7**  
**DUE: November 27 (2 weeks – do a good job!)**  
Homework Fall 2017

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(NOTE: For problems that require outside reading, *references with comments* are required.)

**Keep improving you PROJECT! This leaves 2 weeks to finish. Final Presentation Dec 11.**

We have studied the criteria for **choosing a microcontroller** for various applications. See what some manufacturers have chosen.

1. Pick a few popular personal computers (PC, Apple, etc.) and one of the latest “gadgets” such as the iPad and list the processors that they use. Try to find a technical article that discusses the choices made by the manufacturer to select the chip. (15 Points for the report)
2. For the choices in Problem 1, give references and write a brief summary of the reference. Is it good or not? How well does it cover the material? Did it help you? (5 Points)
3. Single-board computers are very useful for developing a prototype of a system or product. (20 Points)

Write a brief essay on the use of single-board computers for development. Cite a few examples.

4. FPGAs have come a long way since they were just “Gate Arrays” of logic elements. They now can contain Analog elements. Look up information on FPGAs of today and contrast them with microprocessors or microcontrollers. (20 Points)

Be sure to point out the USES and ADVANTAGES of FPGAs as opposed to processors. Some examples for you:

- Xilinx FPGAs (Used in National Instruments RIO units)
- Altera FPGAs (Now Intel has bought them)
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The current capabilities of FPGA architectures allow not only implementation of simple combinational and sequential circuits, but also the inclusion of high-level soft processors. The use of integrated processors holds many exceptional advantages for the designer, including customization, obsolescence mitigation, component and cost reduction and hardware acceleration. FPGA

**embedded processors** use FPGA logic elements to build internal memory units, data and control busses, internal and external peripheral and memory controllers. **Both Xilinx and Altera** (the two market leaders in the FPGA industry) provide FPGA devices that embed physical core processors built inside the FPGA chip. This type of processors are called **hard processors**.

5. We have discussed programming evaluation boards and target hardware with various languages such as assembly, C, python, etc. Another approach is given by the Mathworks who supply MATLAB. This higher-level programming language and its simulation package Simulink is well suited to development of more sophisticated products since MATLAB has a many powerful mathematical routines that the other languages normally do not have.

***Here is the information from Mathworks :***

**<http://www.mathworks.com/hardware-support/home.html>**

***Connect MATLAB and Simulink to Hardware***

Connect MATLAB® and Simulink® to hardware platforms for project-based learning, signal processing, computer vision, communications, data acquisition, instrument control, embedded systems, and more. Use low-cost hardware platforms like Arduino® and Raspberry Pi™, embedded systems like ARM®- and Zynq®-based architectures, or high-end systems for real-time testing. Find the right solution to help you prototype and implement your applications with MATLAB and Simulink.

Select either the Arduino or Raspberry Pi evaluation board and do the following:

- a. Describe briefly the hardware capability of the board you choose as we have done for the Microchip MPLAB boards such as the PIC explorer board.
- b. Describe briefly the support that MATLAB and Simulink give to the board you choose. (20 Points)