

Final Review

Fall 2015

Final Exam Format: Open book exam. Similar to midterm exam. Textbook/lecture notes/Lab manual are allowed. No discussion is allowed. The test has to be completed independently.

1. True or False 16%
2. Answer questions (calculations, determine code results, determine register values, etc) 34%
3. Coding 50% (troubleshooting and modify codes to implement the required functions)
Please remember to bring your kit for the programming problem.

Contents covered: Lectures 1- 8 and Labs 1-5. Make sure you understand all homework assignments and laboratory requirements.

- Microcomputer and microcontroller fundamentals
 - What is embedded system? -- An embedded system is an electronic system that contains at least one controlling device or an information processing device but is not a general-purpose computer. A combination of hardware and software which together form a component of a larger product.
 - Basic elements of microcomputer and microprocessors
 - Difference between microcomputer and microcontroller
 - Design Methodology and Challenges (lifecycle: requirements -> specifications -> architecture design->development -> testing and integration -> then back)
 - Tools used to help design: block diagram, **flow chart**, state diagram, etc
 - Two different architecture (Von Neumann vs. Harvard)
 - Memory terminologies (capacity, cell, SRAM, DRAM)
- Numbering system
 - Understand 2's complement representation
 - Understand floating point number representation (need to know how to convert)
- Arduino UNO board and the robot shield
 - Understand the basic functions and pin assignment
 - Understand how the servo motors works (standard servo motors vs. continuous rotation servo motors)
- Standard C programming
 - Flow control, commonly used functions (such as sprintf, etc), logic and arithmetic operations, bitwise operations, Serial monitor
 - Should be able to troubleshooting both syntax (compile) error and logic (runtime) errors.
 - Module design, the use of functions and flowchart
- Architecture of ATmega328P
 - Basic functions and components
 - Memory types and capacities
 - Register sessions and their functions

- **General purpose input/output in ATmega328P**
 - Electrical characteristics
 - Registers related to GPIO and how to access them
 - Programming (both input and output part) **!important!**
- **Timers/Counters in ATmega328P**
 - The type and functions of timers/counters in ATmega328P
 - Understand different type of operations (normal, CTC, fast PWM, phase-correct PWM)
 - Determine the register values for given design requirements and programming in C (Timer0/1/2) **!important!**
- **Interfacing with analog inputs**
 - Fundamentals (different types of ADCs)
 - The ADC function of ATmega328P
 - Determine the register values for given design requirements and programming in C **!important!**
- **Lab contents are included in the final exam. Make sure you understand all lab requirements.**

- **Commonly used symbols for flowchart**

