Exam 1 Review

Exam Format
- Similar to Quiz 1 & 2, combined
- 15-20 Short Answer (T/F, multiple choice, matching, fill in blank)
- 5-10 Problems covering 230 review, microcontroller architecture, ASM instructions
- Formula sheet (Boolean logic properties, powers of 2)

Material Covered
- All lecture notes and handouts through Fri Feb 22
- Textbook: App D, App E, Ch 1, Ch 2, Ch 3 (partial), Ch 5 (partial)
- Homeworks 1, 2, 3, 4, 5, 6, 7
- Labs 1, 2, 3, 4, (no specifics from lab, only general issues related to lecture topics)

Students bring to the exam:
- Handout 4 (ASM Instruction Set) with no additional information added to the handout! (highlighting is fine)
- No calculators

Mid-Term Exam Objectives (bold/colored items covered on Quiz1-2)
Objectives: At the time of the Mid-Term Exam, students should be able to:

ECE230 Review (Appendix D & E)
- Perform number base conversions for Dec, Hex, Bin
- Identify value range as \( f(# \text{bits}) \) and out of range overflow
- Express numbers in S2C form, perform 2C operation, and evaluate subtraction using S2C.
- Identify value range in S2C and determine 2C overflow
- Perform minimization of logic expressions using minimax terms, K-maps, and Boolean arithmetic
- Identify gate symbol and truth table for basic logic gates
- Describe operation of tri-state, mux, decoder
- Identity active low vs. active high logic
- Describe operation of flip flops
- Explain operation of sequential logic circuits including shift registers and counters
- Utilize DeMorgan's relations to implement logic circuits using only NAND (or NOR) gates

Microcontroller Architecture (Ch. 1-2, notes)
- Define important events/times in computer history
- Define and differentiate microprocessor, microcontroller, embedded system
- Describe and identify components in general computer architecture
- Draw and label general computer architecture
- Draw and label connections of CPU components
- Evaluate address and data bus size (# bits/signals) for a given memory size
- Identify architectural components of HC12/S12 block diagrams
- Identify components in programmers model
- Identify and describe main flags in CCR
- Determine which CCR flag results from specific arithmetic operations

ASM Instruction Execution (Ch. 2-3)
• Describe ASM instruction format
• Describe instruction execution cycle
• Identify the six main groupings of ASM instructions
• Describe operation/function of primary ASM instructions
• Identify instruction information from HC12 Instruction Set tables
• Identify which CCR flags can change for each ASM instruction
• Prepare and use mask bytes in instruction like BCLR/BSET
• Identify and list address modes for HC12 instruction set
• Describe and write ASM code using inherent and immediate address modes
• Describe and write ASM code using direct and extended address modes
• Describe and write ASM code using indexed-immediate address mode
• Use ASM Instruction Chart to map results of ASM instructions
• List and identify assembler directives
• Describe the steps in the assembly process
• Determine the hex machine code (op-code) for any instruction using HO_4
• Explain simple ASM code and .LST output files
• Identify address, data, and program information within .LST and .S19 assembly output files
• Differentiate between data and program bytes stored in memory

ASM Programming (Ch. 2-3)
• Use ASM simulator program to test and debug HC12 ASM code
• Write short ASM instruction blocks to achieve specific program tasks
• Describe the steps in the programming process
• Describe basic program structure and their implementations in ASM code.
• Prepare pseudocode and flowcharts to describe an algorithm
• Identify and code looping constructs
• Describe ASM examples on page 1-4 of HO_5
• Describe the branch concept and branching instructions
• Identify the correct branch instruction to implement a conditional program structure
• Describe and write ASM code using relative address modes
• Calculate relative offsets for branch instructions
• Code test and branch operations using BRSET and BRCLR instructions
• Implement (in ASM code) conditional operations using branch instructions
• Calculate relative offset (# bytes) for branch instructions
• Calculate number of clock cycles and instruction time for blocks of ASM code
• Write code for ASM loops constructs with specific delay times
• Write, simulate and debug simple ASM programs with branches

Memory and Peripherals (Ch. 5)
• Explain the memory map concept
• Define ‘peripheral hardware’ and identify key peripheral blocks on the case study microcontroller
• Describe I/O addressing modes for peripheral hardware (memory mapped vs. isolated)
• Explain how data memory, program memory, configuration registers and I/O devices are mapped to addresses in stored-program computer organization
• Read and write microcontroller bi-directional digital I/O ports using ASM code