

EE371 First Semester Test - Thursday September 29, 2005  
40 Points, 16.667% of Final Grade

Please put your name on the outside of the paper also.  
Hand in the test folded so your name shows on the outside.

Name: \_\_\_\_\_

1. Assume the following information in the HC12 registers for each of the following instructions.  
A = \$00 B = \$01 X = \$0800 Y = \$0810  
The data in memory locations \$0800 - \$080F is:  
0800 11 23 42 00 - 60 00 65 02 - 11 22 48 65 - 6c 70 4d 65 .#B..'.e..''HelpM

Give the addressing mode used, the effective address for the source data, and the results for each of the following instructions: (13 points)

Instruction	Addressing Mode	Effective Address	Results
ldab 3,X	<b>Indexed</b>	<b>\$0803</b>	<b>B = \$00</b>
ldab \$080a	<b>Direct/Extended</b>	<b>\$080A</b>	<b>B = \$48</b>
ldab -1,Y	<b>Indexed</b>	<b>\$080F</b>	<b>B = \$65</b>
ldab 1,X+	<b>Indexed</b>	<b>\$0800</b>	<b>B = \$11, X = \$0801</b>

2. For each of the program design needs in Column A, enter in Column B the number of the instruction category from Column C. **You do not need to give the instruction and there may be more than one answer (but you only need one.)** (10 points)  
For example: For the design need “Initialize a loop counter”, the instruction category number would be 1 - Load Register

A. Design Need	B. Category to use	C. Instruction Category
<b>Initialize a loop counter</b>	<b>1</b>	1. Load Registers
Get a value from an A/D converter	<b>1, 4</b>	2. Store Registers
Initialize a pointer register	<b>1</b>	3. Transfer/Exchange Registers
Save A/D value to use later	<b>2, 3, 4</b>	4. Move Memory Contents
Turn off all LEDs connected to a port	<b>2, 4, 6</b>	5. Decrement/Increment
Multiply contents of a register by 4	<b>7, 9</b>	6. Clear/Set
Set the most significant nibble of a register to %0000 while leaving the least significant nibble unchanged.	<b>8, 9</b>	7. Arithmetic
Decrement a loop counter	<b>5, 7, 12</b>	8. Logic
Transfer to a subroutine	<b>13</b>	9. Rotate/Shifts
Save registers in a subroutine.	<b>2</b>	10. Data Test
Branch if a value is zero.	<b>11, 12</b>	11. Conditional Branch
		12. Loop Primitive
		13. Jump and Branch

3. Write HCS12 instruction(s) for each of the following program design comments: (10 points)

LOOP:

; Initialize an index register pointing to DATA1

**ldx #DATA1**

; Load accumulator A with the byte at memory location DATA1

**ldaa DATA1 or ldaa 0,x**

; Load accumulator A with the byte at memory location DATA1+1

**ldaa DATA1+1 or ldaa 1,x**

; Load Y index register from DATA2

**ldy DATA2 or ldy 3,x**

; Branch to LOOP if the value in the A registers is equal to \$06

**cmpa #\$06**

**beq LOOP**

; Data values

DATA1: DC.B 00, 01, 02

DATA2: DC.B 03, 04

4. Suppose the instruction LDAA (DATA2-DATA1),X is included in program in question 3.

What is the offset that is calculated by the assembler? (2 points)

**DATA2-DATA1 = 3**

5. Draw the programmer's registers model for the HC12 microcontroller. (5 points)

**Show A, B, D, X, Y, SP, PC, CCR**