Name_______________________________

EET 2261 Lab #1
Introduction to CodeWarrior and the Dragon12-Plus 2

1. Some Practice Converting Numbers

For the rest of this semester you will often need to convert numbers between binary, decimal, and hex. Recall that a subscript after a number tells whether the number is in binary (subscript 2), decimal (subscript 10), or hex (subscript 16). For example,

$$1101_2 = 13_{10} = D_{16}$$

Instead of using subscripts, there are other common ways of indicating binary, decimal, and hex. The way that we'll use most often in this course is to place a % symbol before a number to show that it's in binary and a $ before a number to show that it's in hex. (No symbol before the number means that it's in decimal.) Using this notation,

%1101 = 13 = $D

From now on you should use this notation instead of subscripts.

Do the following conversions. In each row, you're given a number in binary, hex, or decimal, and you must convert it to the other two notations.

Binary	Hex	Decimal
%1111		
	$10	
		255
%0001 0000 0000		
	$3FF	
		1024
		2047
	$800	
%0010 0000 0000 0000		

2. Getting Started with CodeWarrior

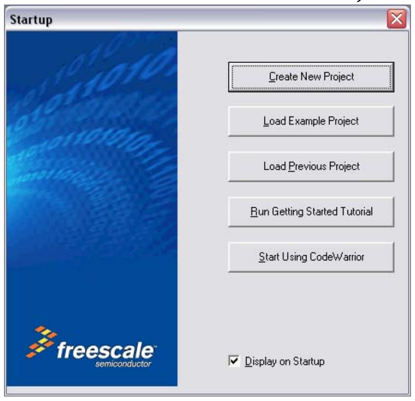
Freescale CodeWarrior is a very powerful piece of software that lets you:

- Examine and change the contents of the registers and memory locations inside the HCS12 chip.
- Write and test programs for the HCS12.
- Translate these programs into the binary code that the HCS12 understands.
- Download your translated programs to the HCS12 chip.
- Run your downloaded programs, and monitor the execution of the running programs.

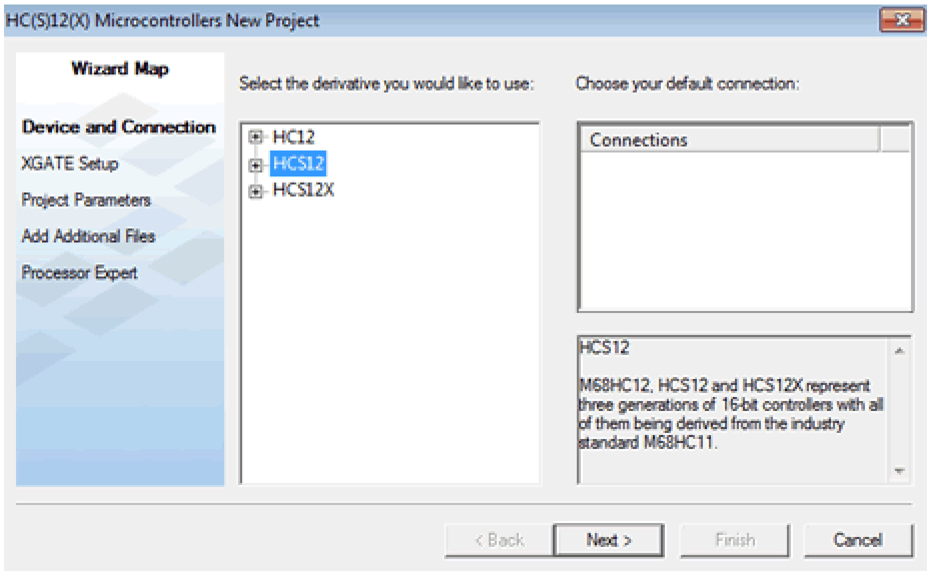
In the old days, you would need several pieces of software to perform these different tasks. Because CodeWarrior lets you perform all of these tasks, it's called an **Integrated Development Environment** (abbreviated **IDE**). In this course you'll learn how to use CodeWarrior to do all of the things listed above. This first lab will focus on the first item in the list: Examine and change the contents of the registers and memory locations inside the HCS12 chip.

1. Connect your Dragon12-Plus2 board to your computer's USB port.

2. In the Windows Start menu, select **CodeWarrior IDE**. You'll see the following:



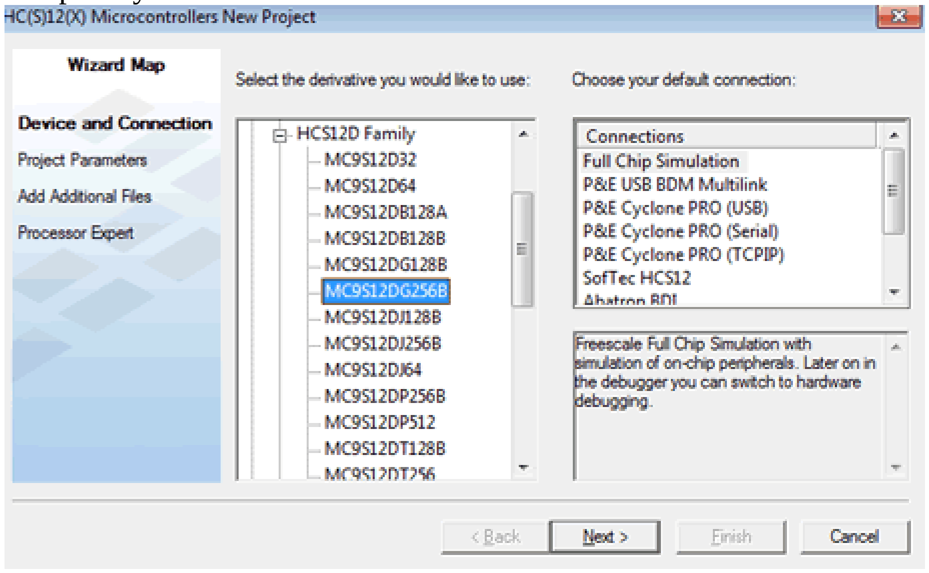
3. Click the **Create New Project** button. CodeWarrior starts up its New Project Wizard, whose first screen looks like this:



HCS12

M68HC12, HCS12 and HCS12X represent three generations of 16-bit controllers with all of them being derived from the industry standard M68HC11.

4. Click the + next to **HCS12**. Then click the + next to **HCS12D Family**. Then select **MC9S12DG256B**, which is the version of the HCS12 chip on our Dragon12 board. Whenever you start a new project in CodeWarrior, you must always select this chip. At this point your screen will look like this:



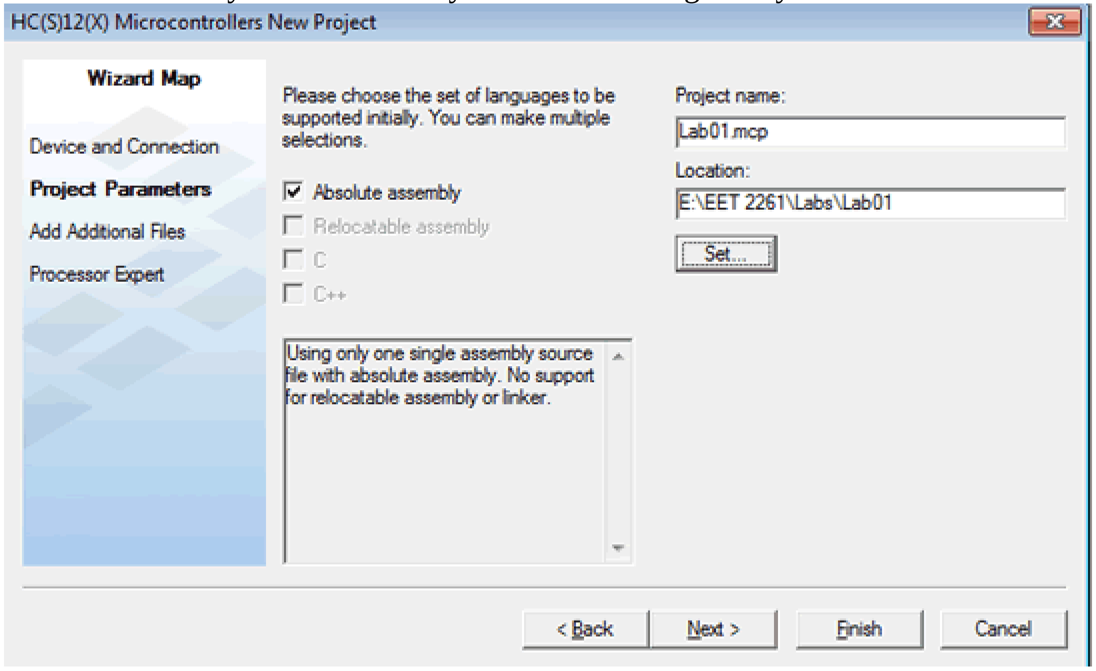
Freescale Full Chip Simulation with simulation of on-chip peripherals. Later on in the debugger you can switch to hardware debugging.

5. You'll see about ten choices in the **Connections** box on the right-hand side. The only ones that you'll ever use are the first one (**Full Chip Simulation**) and the last one (**HCS12 Serial Monitor**).
   - You'll use **Full Chip Simulation** to write and test a program without actually downloading it to the HCS12 chip.
   - You'll use **HCS12 Serial Monitor** whenever you want to communicate with the actual chip.

   For this lab, select **HCS12 Serial Monitor**, and then click **Next >.**

6. The next screen lets you do three important things:
   - Tell CodeWarrior what type of program you're writing. We'll write absolute assembly programs, so you must first uncheck **C** and then check **Absolute Assembly**.
   - Give your project a name, which should always end in **.mcp**. Let's call this first project **Lab01.mcp**.
   - Tell CodeWarrior where to save your project files. You'll always want to save to your flash drive, in a folder whose name is the same as your project. In the screen below, I'm saving to a folder named **Lab01** inside some other folders on my flash

drive. Of course you'll decide for yourself how to organize your flash drive.



Please choose the set of languages to be supported initially. You can make multiple selections.

- [✓] Absolute assembly
- [ ] Relocatable assembly
- [ ] C
- [ ] C++

Using only one single assembly source file with absolute assembly. No support for relocatable assembly or linker.

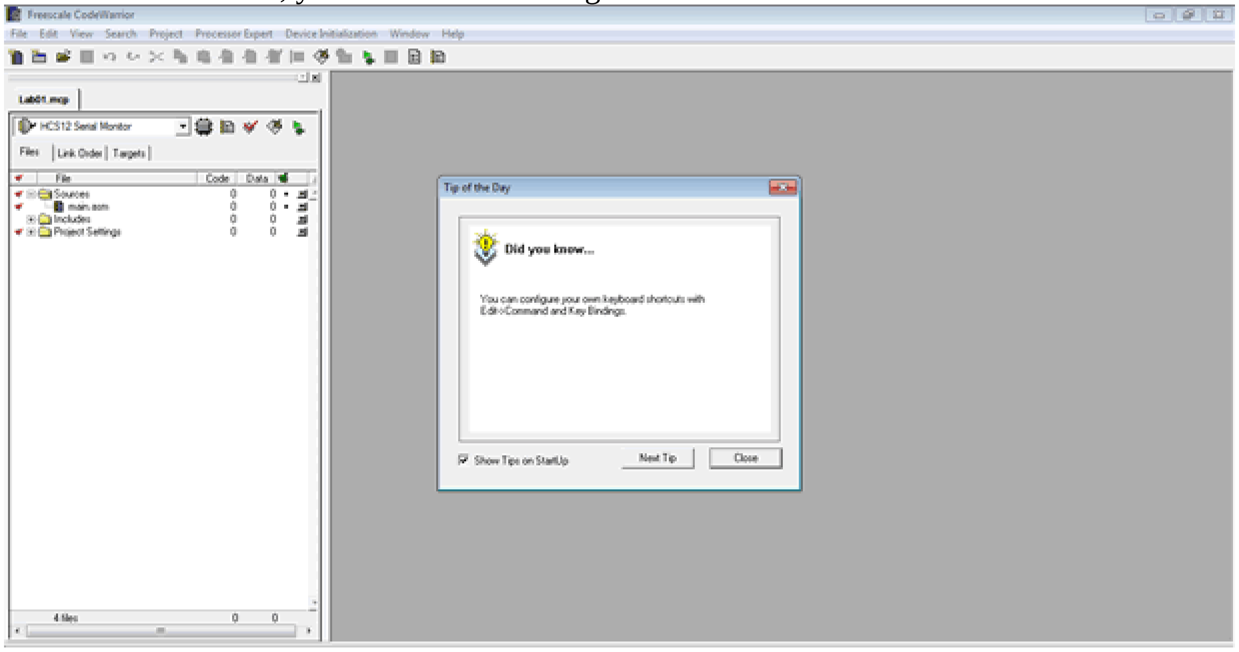
Project name: Lab01.mcp

Location: E:\EET 2261\Labs\Lab01

7. There are two more screens in the New Project Wizard that you could get to by clicking **Next >**. But we won't make any changes to those screens, so you can skip them by clicking **Finish** now.

8. Using Windows My Computer, take a look at the files on your flash drive. You should see that CodeWarrior has already created many files and folders inside the **Lab01** folder. Do not move, rename, or delete any of those files. CodeWarrior uses them all.

9. Back in CodeWarrior, you'll see the following screen:



You can configure your own keyboard shortcuts with Edit->Command and Key Bindings.

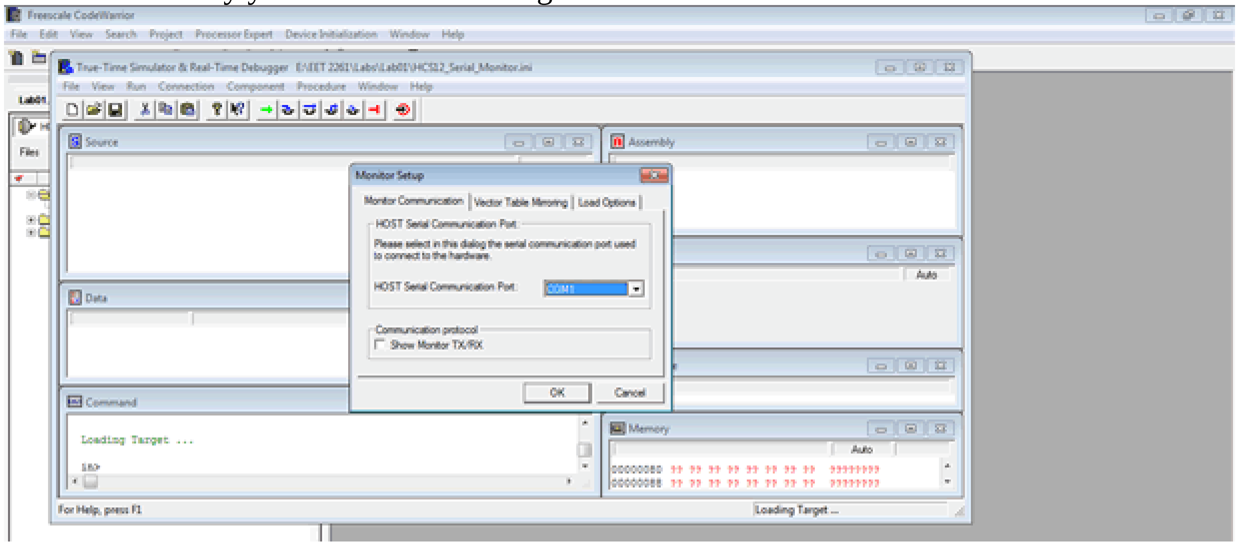
Some people like getting a random Tip of the Day every time they start the program, but some people don't. If you don't want to see these tips in the future, remove the checkmark next to **Show Tips on StartUp**. Then, whether or not you removed the checkmark, click **Close**.

3. CodeWarrior's Debugger

If you were writing a program, there are some other steps that you would do now. You'll learn those steps in future labs. But today we want to go right to CodeWarrior's debugger, which lets us examine the registers and memory inside the HCS12 chip.

1. To start CodeWarrior's debugger, either:
   - Select **Project > Debug** from the menus
   - Or press the F5 key on your keyboard
   - Or click the green arrow/bug button in the toolbar

2. After a brief delay you'll see the following screen:



Freescale CodeWarrior

True-Time Simulator & Real-Time Debugger E:\EET 2261\Labs\Lab01\HCS12_Serial_Monitor.ini

Monitor Setup

HOST Serial Communication Port

Please select in this dialog the serial communication port used to connect to the hardware.

HOST Serial Communication Port: COM1

Communication protocol

Show Monitor TX/RX

```
Loading Target ...
```

```
00000080  ?? ?? ?? ?? ?? ?? ?? ??  ????????
00000088  ?? ?? ?? ?? ?? ?? ?? ??  ????????
```

For Help, press F1

Loading Target ...

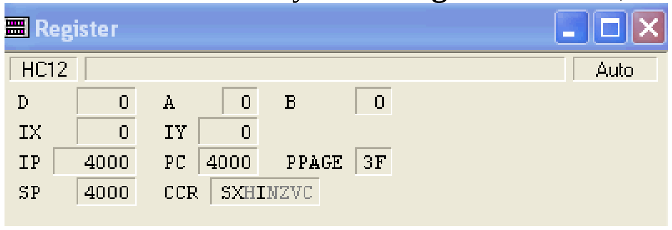
File Edit View Search Project Processor Expert Device Initialization Window Help
File View Run Connection Component Procedure Window Help
Source
Assembly
Data
Command
Memory
Auto
Monitor Communication
Vector Table Mirroring
Load Options
OK
Cancel

In the **HOST Serial Communication Port**, you must choose the right COM port for the USB port on your computer. In our labs, this is **COM4:**, so choose this now. Then click **OK**.

3. You'll now see the main debugger screen, which has seven windows:
   - **Source**, which we'll care about when we're writing and testing programs, but we'll ignore for now.
   - **Data**, which we'll usually ignore.
   - **Command**, which we'll usually ignore.
   - **Assembly**, which we'll care about when we're writing and testing programs, but we'll ignore for now.

- **Registers**, which shows the contents of the registers inside the HCS12. This is an important window that we'll use frequently.
- **Procedure**, which we'll usually ignore.
- **Memory**, which shows the contents of the HCS12's thousands of memory locations. This is an important window that we'll use frequently.

4. Let's look more closely at the **Register** window, which should look like this:



```
Register
HC12                                  Auto
D        0   A      0   B      0
IX       0   IY     0
IP    4000   PC  4000   PPAGE 3F
SP    4000   CCR SXHINZVC
```

As you'll learn in class, the HCS12's central processing unit contains seven (or eight, depending on how you count them) registers that are central to the HCS12's operation. Most of the instructions in HCS12 programs use or change the values in these registers. The registers are called:
- Accumulator A (abbreviated **A**)
- Accumulator B (abbreviated **B**)
- Accumulator D (abbreviated **D**), which is actually just Accumulators A and B combined together.
- Index Register X (abbreviated **IX**)
- Index Register Y (abbreviated **IY**)
- Program Counter (abbreviated **PC**)
- Stack Pointer (abbreviated **SP**)
- Condition Code Register (abbreviated **CCR**)

The Register window also shows the contents two other registers. These are for advanced features that we won't use in this course, so we'll ignore these registers:
- Program Page Register (abbreviated **PPAGE**).
- Instruction Pointer (abbreviated **IP**). For us, the contents of this register will usually be the same as the contents of the Program Counter.

5. CodeWarrior has a special way of displaying the contents of the Condition Code Register. This register holds eight bits, and each bit has its own name: for example, the S bit, the X bit, the H bit, and so on. Each bit can have a value of 1 or 0. If its value is 1, CodeWarrior displays its name in black. If its value is 0, CodeWarrior displays its name in gray. Looking at your screen right now, record the value of each bit:

S = ___ X = ___ H = ___ I = ___ N = ___ Z = ___ V = ___ C = ___

6. By default, CodeWarrior displays the contents of the other registers in hex. That's usually what we want, but occasionally it's more useful to see the contents displayed in binary or in decimal. To change the display, place your mouse anywhere inside the Register window and right-click. Then roll over **Format** in the pop-up menu, and you'll

see several choices. Click **Bin**, and you'll see the registers contents displayed in binary. This lets us see how many bits each registers holds. (You may have to scroll to the right to see some of the bits.) Recalling that one byte equals eight bits, complete the following table:

Register	Number of Bits	Number of Bytes
A		
B		
D		
IX		
IY		
PC		
SP		
CCR		

7. Now change the Format back from Binary to Hex.

8. The Register window not only lets us see what values are currently in the registers. It also lets us change these values. To change a value, simply double-click it and then type the new value. (The CCR is a little different. To change a bit's value from 0 to 1 or from 1 to 0, double-click the bit's name.) To practice doing this, set the register values to:

   A = $10, B=$1F, IX=$1000, IY=$2000, PC=$5000, SP=$3000,

   CCR: S = 0, X = 1, H = 1, I = 1, N = 1, Z = 0, V = 1, C = 0.

   Notice that D holds the combined values of A and B. As mentioned above, Accumulator D is actually just Accumulators A and B combined together. So you will always find that the value in D is just the combined values in A and B.

Call me over to check your work.____________________

4. The HCS12's Memory Map

Now let's turn our attention from the **Register** window to the **Memory** window. First we need to know a little about how the HCS12's memory is organized. The HCS12's memory has thousands of memory locations. Each location has an address. The addresses range from $000000 to $3FFFFF, but in this course we will never use addresses beyond $FFFF. **So as far as we're concerned, the addresses range from $0000 to $FFFF.** (Recall that the $ symbol indicates hex.) Given this restriction, how many memory locations (in decimal) do we have?

____

The HCS12 chip contains three different kinds of internal memory:

- Electrically erasable programmable read-only memory (**EEPROM**)
- Random-access memory (**RAM**)
- Flash memory

It also contains hundreds of internal registers called **special-function registers**, which have addresses and are treated a lot like memory locations.

The table below is a simplified "memory map" for our system, showing the address ranges (in hex) assigned to the special-function registers and the different kinds of memory. Notice that the special-function registers are located at the low end of the system's memory space, from address $0000 to $03FF. And the Flash memory is located at the high end of the memory space, from address $4000 to $FFFF. In between are the EEPROM and RAM.

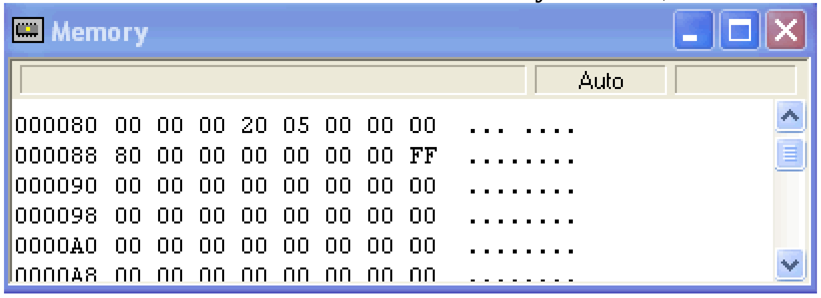
Address Range	**Description**
$0000 to $03FF	Special-function registers
$0400 to $0FFF	EEPROM
$1000 to $3FFF	RAM
$4000 to $FFFF	Flash

Using the numbers from the memory map, answer the following questions. For each question, give your answer in both hex and decimal. I've answered the first question for you. Be sure you understand why the answer to this first one is $400 and not $3FF.

	Answer in hex	**Answer in decimal**
1. How many addresses are assigned to special-function registers?	_____$400______	______1024_____
2. How many addresses are assigned to EEPROM?	_______________	_______________
3. How many addresses are assigned to RAM?	_______________	_______________
4. How many addresses are assigned to Flash?	_______________	_______________

5. Viewing the Contents of Memory

1. Now let's look at CodeWarrior's **Memory** window, which looks something like this:



```
000080  00 00 00 20 05 00 00 00   ... ....
000088  80 00 00 00 00 00 00 FF   ........
000090  00 00 00 00 00 00 00 00   ........
000098  00 00 00 00 00 00 00 00   ........
0000A0  00 00 00 00 00 00 00 00   ........
0000A8  00 00 00 00 00 00 00 00   ........
```

In the picture shown above, we're viewing the contents of the chip's memory locations from address $0080 through address $00AF. The first column in each row contains the starting address (in hex) of the locations displayed on that row. Following this address are the contents (in hex) of eight memory locations. Each memory location holds one byte, so we need two hex digits to show the contents of each memory location.

For example, reading across the first row in the picture, we can see that:

- Memory location $0080 holds the value $00 (or %0000 0000 in binary)
- Memory location $0081 also holds the value $00
- Memory location $0082 also holds the value $00
- Memory location $0083 holds the value $20 (or %0010 0000 in binary)
- Memory location $0084 holds the value $05 (or %0000 0101 in binary)
- Memory locations $0085, $0086, $0087 all hold the value $00.

Question: In the picture above, what hex value does memory location $0088 hold? ______

What hex value does memory location $008A hold? ______

What hex value does memory location $008F hold? ______

2. Just as we saw above how to view the register contents in binary or decimal instead of hex, we can do the same thing with memory. To change the display, place your mouse anywhere inside the Memory window and right-click. Then roll over **Format** in the pop-up menu, and you'll see several choices. Click **Bin**, and you'll see the memory contents displayed in binary. Because binary notation takes up a lot more space than hex notation, you'll probably now see only four memory locations listed on each row, instead of eight.

3. Change the Format back from Binary to Hex.

4. To view the contents of other memory locations, you can use the vertical scroll bar on the right side of the Memory window. But it's often easier to do the following:
   - Right-click anywhere inside the Memory window, and then click **Address...** from the pop-up menu.
   - Type in the address (in hex) of the memory location whose contents you want to display. For example, do it now and type **F810** to see the contents of memory

locations starting at address $F810. (When you type the address, you don't type the dollar sign.)

You should find that address $F810 holds the value $40. Remember: by default, the values that you see in the Memory window are in hex. In this example, CodeWarrior didn't display a special symbol to remind you that the 40 is a hex number, but it is; and if you mistakenly think that it is decimal 40 instead, you will quickly get confused. Convert this hex number to binary and to decimal:

$40 = %________________________ (binary) = ________________________(decimal)

Questions: After performing the previous steps, you should be able to answer the following questions based on what you see in CodeWarrior's Memory window without changing the address.

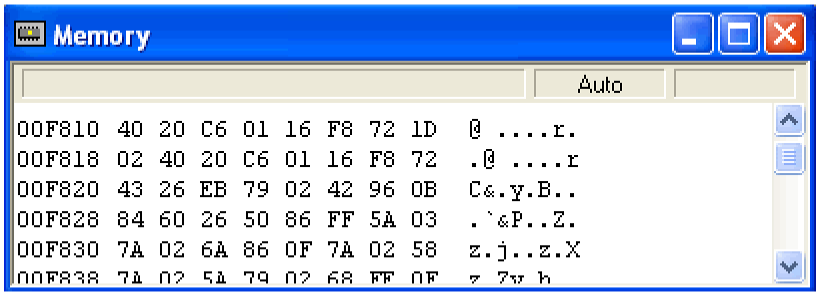
What hex value does memory location $F816 hold? ______

What hex value does memory location $F81C hold? ______

What hex value does memory location $F82E hold? ______

5. Here's another important point to remember: Every memory location holds one byte, or eight bits. So if you write out the contents of a memory location in hex notation, you will use two hex digits. **An address of a memory location is four hex digits long** (since we'll never go beyond address $FFFF), and **the value stored in a memory location is two hex digits long**.

6. We've seen that each row in the Memory window starts with a hex address, followed by the hex contents of eight memory locations. But what is the additional information to the right of that? For example, in the picture below, what is the meaning of `@ ....r.` at the end of the first row?



```
00F810 40 20 C6 01 16 F8 72 1D  @ ....r.
00F818 02 40 20 C6 01 16 F8 72  .@ ....r
00F820 43 26 EB 79 02 42 96 0B  C&.y.B..
00F828 84 60 26 50 86 FF 5A 03  .`&P..Z.
00F830 7A 02 6A 86 0F 7A 02 58  z.j..z.X
00F838 7A 02 5A 79 02 68 FF 0F  z.Zy.h
```

Answer: These are the ASCII characters corresponding to the values in that row. For example, if you consult a table of ASCII codes, you'll find that $40 is the ASCII code for the `@` symbol. Also, $72 is the ASCII code for the letter **`r`**. Most of the values in this first row are not the ASCII code for any character, so they are displayed as a period (.) in this last part of the window. Most of the time we don't care about ASCII codes. If you find this information distracting, you can follow these steps to hide the ASCII characters:

- Right-click anywhere inside the Memory window, and then roll over **Display** in the pop-up menu. Notice that **ASCII** has a checkmark next to it.
- Click **ASCII** to turn off the ASCII display. You can always turn it back on by following these same steps.
- Notice that CodeWarrior also lets you turn off the display of the addresses in the Memory window, but that would not be a good idea, since then you wouldn't know which memory locations you're looking at.

7. You now know how to see the value stored in any of the HCS12's memory locations. Find and record the hex contents of the following memory locations:

Address	Contents (in hex)
$0000	_____________
$0100	_____________
$FCAE	_____________
$FFFF	_____________

6. Changing the Contents of Memory

1. The Memory window not only lets us see what values are currently stored in memory. It also lets us change these values. To change a value, double-click it and then type the new value. To practice doing this, set the following memory locations to the values shown:

Address	Value
$2200	$3D
$2205	%1000 1001
$221F	$4C
$2222	%1111 0000

Call me over to check your work.___________________

2. There will be times when we want to assign the same value to all of the memory locations in a range of addresses. To do this, right-click anywhere inside the Memory window, and then select **Fill…**. A dialog box will open, in which you can specify a beginning address, an ending address, and the value to be assigned to all of the locations in the range you've specified. To practice doing this, fill the following ranges with the values shown:

Address Range	Value
$1200 - $121F	$7E
$1750 - $179F	%1010 0110

Call me over to check your work.___________________

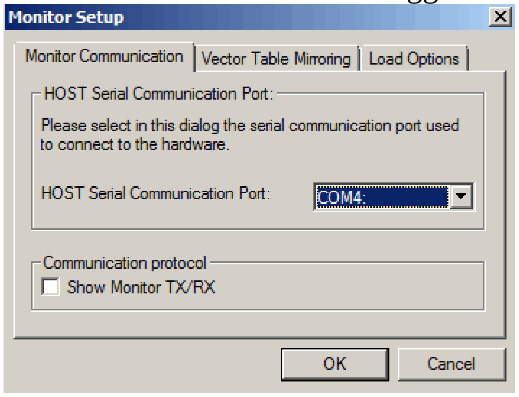
7. How Power Loss Affects the Contents of Registers and Memory

1. Let's see whether the values in the HCS12's registers and memory are lost when the chip loses power. In the table below, I've listed one CPU register (Accumulator A) and four addresses. One of these addresses is a special-function register, one is located in EEPROM, one is located in RAM, and one is located in Flash. Using the memory map from a few pages ago, identify which one is which, and record this information in the table's second column. Then go on to Step 2 below.

Register or Address	Description (for example, Flash, RAM, etc.)	Contents before cycling power	Contents after cycling power
Accumulator A	CPU Register	$33	
Address $3002		$33	
Address $0002		$33	
Address $0802		$33	
Address $5002		$33	

2. Use the debugger's Register window to set Accumulator A's value to $33, and use the Memory window to set the values of the four listed addresses to $33.

3. By default, CodeWarrior erases the HCS12's Flash and EEPROM whenever you start the debugger. For now, we want to disable this feature, so select **MONITOR-HCS12 > Communication…** in the debugger's menu bar. You'll see the dialog box below:



HOST Serial Communication Port:

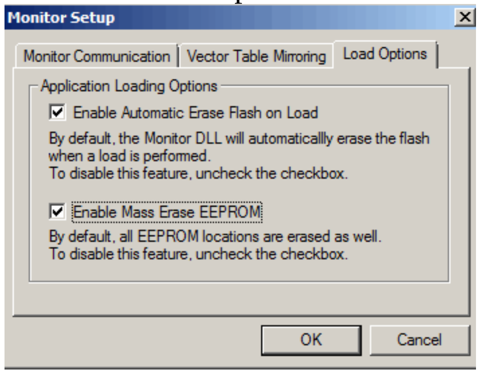
Please select in this dialog the serial communication port used to connect to the hardware.

HOST Serial Communication Port: COM4:

Communication protocol

☐ Show Monitor TX/RX

4. Select the Load Options tab in this dialog box, and you'll see the following:


Monitor Setup

Application Loading Options

☑ Enable Automatic Erase Flash on Load

By default, the Monitor DLL will automaticallly erase the flash when a load is performed.
To disable this feature, uncheck the checkbox.

☑ Enable Mass Erase EEPROM

By default, all EEPROM locations are erased as well.
To disable this feature, uncheck the checkbox.

5. Remove both check-marks, so that the HCS12's Flash and EEPROM won't be erased whenever you start the debugger. Then press **OK**.

6. Cycle the Dragon12 board's power by unplugging the USB cable for a few seconds and then plugging it back in. <u>When you do this, CodeWarrior will lose communication with the board, so you'll have to close the debugger and then open it again.</u>

7. Using the debugger's Register and Memory windows, find the contents of Accumulator A and the four listed addresses, and record the values in the table's last column.

8. What can you conclude about whether the contents of the CPU registers and the various kinds of memory are retained when power is lost? *Use complete sentences in your answer.*

9. You're finished with CodeWarrior for now, so close the debugger and then close CodeWarrior.

8. Getting to Know the Dragon12-Plus2 Board

Next, let's start to get familiar with the features of the Dragon12-Plus2 trainer board. This board contains many input-output (I/O) devices connected to the HCS12 microcontroller. In future labs you will program the HCS12 to communicate with these devices, so you'll need to be able to identify the devices, such as switches, LEDS, temperature sensor, speaker, keypad, and so on.

1. On the last page of this lab is a silkscreen diagram showing the layout of the Dragon12-Plus2 board. (This page comes from one of the reference documents that I recommended you download to a flash drive, except on this copy I've added a coordinate grid—the letters running across the top of the diagram and numbers running down the left side.) Compare the diagram to a real Dragon12-Plus2 board, and notice that the labels on the diagram will help you to identify the components on the real board.

2. On your computer, open the Dragon12-Plus2 user's manual. This file, named dragon12-plus2_hcs12_manual.pdf, is another one of the reference documents that I recommended you download to your flash drive.

3. Go to Chapter 4 (Hardware Descriptions), which begins on page 24 of the manual. The short sections of this chapter describe components on the Dragon12-Plus2 board. Most of these descriptions contain technical terms that you won't understand yet, but skim each description now and use the silkscreen diagram to locate each component on the real Dragon12 board. In the table below, record the grid coordinates of each component as you locate it on the board. I've done the first one for you. (I wrote B3 because most of the LEDs lie within B3, although a couple of them lie within A3 or C3. Use your judgment for components that don't fall entirely within one coordinate cell.)

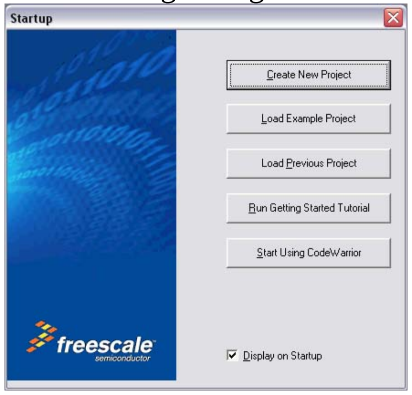
Component	**Section of Manual**	**Location on diagram**
Eight LEDs	4.1	B3
Eight-position DIP switch and four pushbuttons	4.2	
Four 7-segment LED displays	4.3	
Keypad with 16 keys	4.4	
Liquid-crystal display (LCD)	4.5	
Logic probe	4.6	
Trimmer potentiometer	4.7	
Two digital-to-analog converters (DACs)	4.8	
Speaker	4.9	
Infrared (IR) detector	4.10	
Two serial communication interface (SCI) ports, labeled SCI0 and SCI1.	4.11	
RS485 port	4.12	
Serial peripheral interface (SPI) port	4.13	
Inter-integrated circuit (I^2C) port	4.14	

Red-green-blue (RGB) LED	4.15	
VGA camera interface		
Reset switch		
Temperature sensor		
Relay output		
Four servo motor outputs		
Light sensor		
Two mode-select switches		
Bluetooth interface		
Abort switch		
H-bridge outputs		
Capacitive touch switch		

9. The Reset Switch

One important feature that you located above is the Dragon12 board's Reset switch. In future weeks there will be times when you need to reset the board using this switch. Let's look at some of the effects of pressing this switch.

1. Connect your Dragon12 board to your computer and then start CodeWarrior. You'll see the following dialog box:



2. You didn't save anything important in the project that you created near the beginning of this lab, but let's open that project rather than creating a new project. Either:
    - Press the **Load Previous Project** button in the dialog box shown above, then select **Lab01.mcp**, and then press **Open Project**.
    - Or close the dialog box shown above and select **File > Open…** in CodeWarrior's menu bar. Then navigate to the Lab01 folder on your flash drive and open the file named **Lab01.mcp**.

3. Let's see whether the values in the HCS12's registers and memory are lost when you reset the chip. In the table below, I've listed one CPU register and four addresses. In the second column, say whether each address is a special-function register, EEPROM, RAM, or Flash. Then go on to Step 4 below.

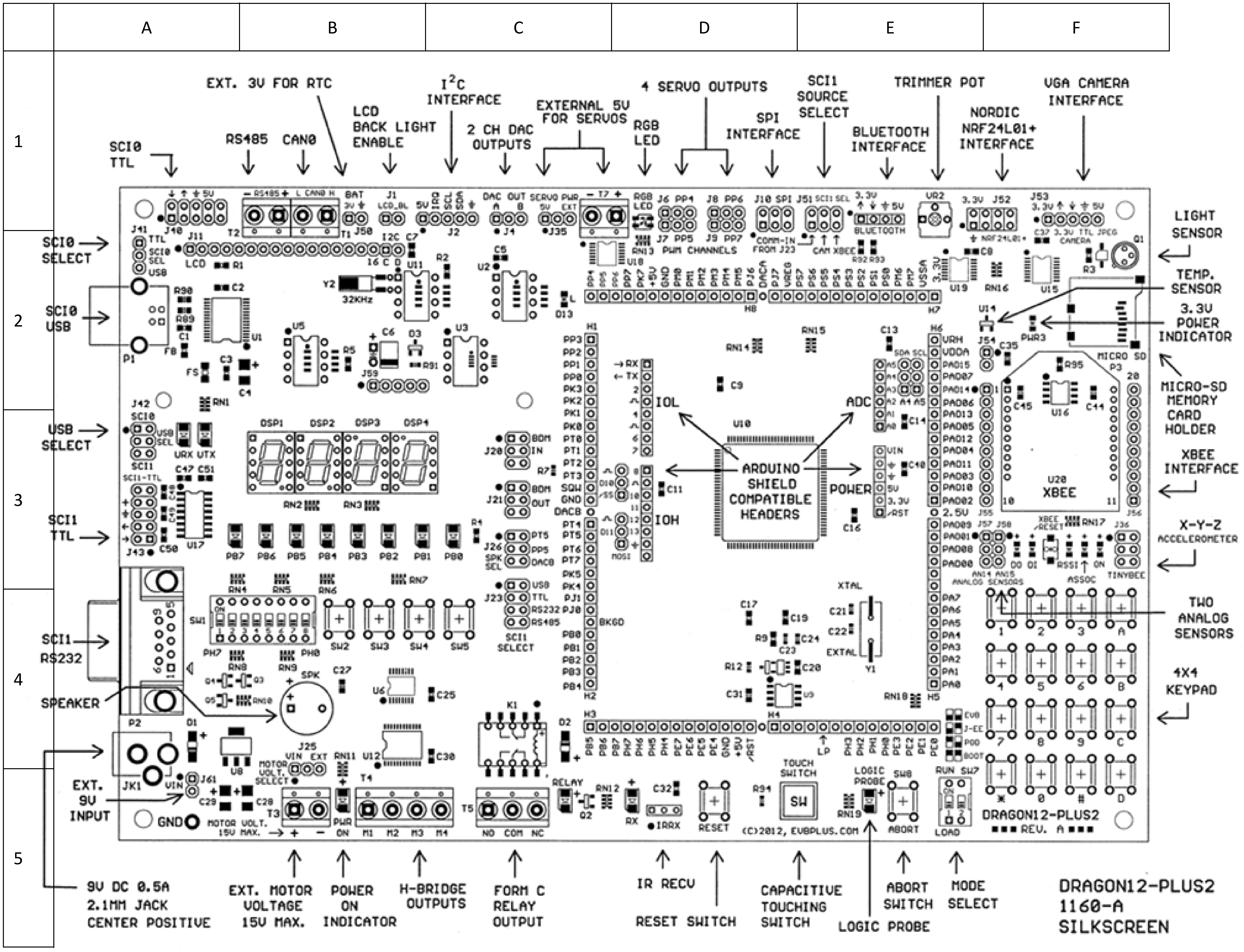
Register or Address	**Description (for example, Flash, RAM, etc.)**	**Contents before pressing Reset**	**Contents after pressing Reset**
Accumulator B	CPU Register	$66	
Address $0603		$66	
Address $5003		$66	
Address $0003		$66	
Address $2003		$66	

4. Use the debugger's Register window to set Accumulator B's value to $66, and use the Memory window to set the values of the four listed addresses to $66.

5. Press the Dragon12 board's Reset switch. When you do this, CodeWarrior will lose communication with the board, so you'll have to close the debugger and then open it again.

6. Using the debugger's Register and Memory windows, find the contents of Accumulator B and the four listed addresses, and record the values in the table's last column.

7. What can you conclude about whether the contents of the CPU registers and the various kinds of memory are retained when you reset the chip? *Use complete sentences in your answer.*


A
B
C
D
E
F
1
2
3
4
5
SCI0 TTL
RS485
CAN0
EXT. 3V FOR RTC
LCD BACK LIGHT ENABLE
I²C INTERFACE
2 CH DAC OUTPUTS
EXTERNAL 5V FOR SERVOS
RGB LED
4 SERVO OUTPUTS
SPI INTERFACE
SCI1 SOURCE SELECT
BLUETOOTH INTERFACE
TRIMMER POT
NORDIC NRF24L01+ INTERFACE
VGA CAMERA INTERFACE
LIGHT SENSOR
TEMP. SENSOR
3.3V POWER INDICATOR
MICRO-SD MEMORY CARD HOLDER
XBEE INTERFACE
X-Y-Z ACCELEROMETER
TWO ANALOG SENSORS
4X4 KEYPAD
SCI0 SELECT
SCI0 USB
USB SELECT
SCI1 TTL
SCI1 RS232
SPEAKER
EXT. 9V INPUT
9V DC 0.5A 2.1MM JACK CENTER POSITIVE
EXT. MOTOR VOLTAGE 15V MAX.
POWER ON INDICATOR
H-BRIDGE OUTPUTS
FORM C RELAY OUTPUT
IR RECV
RESET SWITCH
CAPACITIVE TOUCHING SWITCH
LOGIC PROBE
ABORT SWITCH
MODE SELECT
ARDUINO SHIELD COMPATIBLE HEADERS
IOL
IOH
ADC
POWER
DRAGON12-PLUS2 1160-A SILKSCREEN
DRAGON12-PLUS2 REV. A
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