

CECS 285

Hardware Test Lab

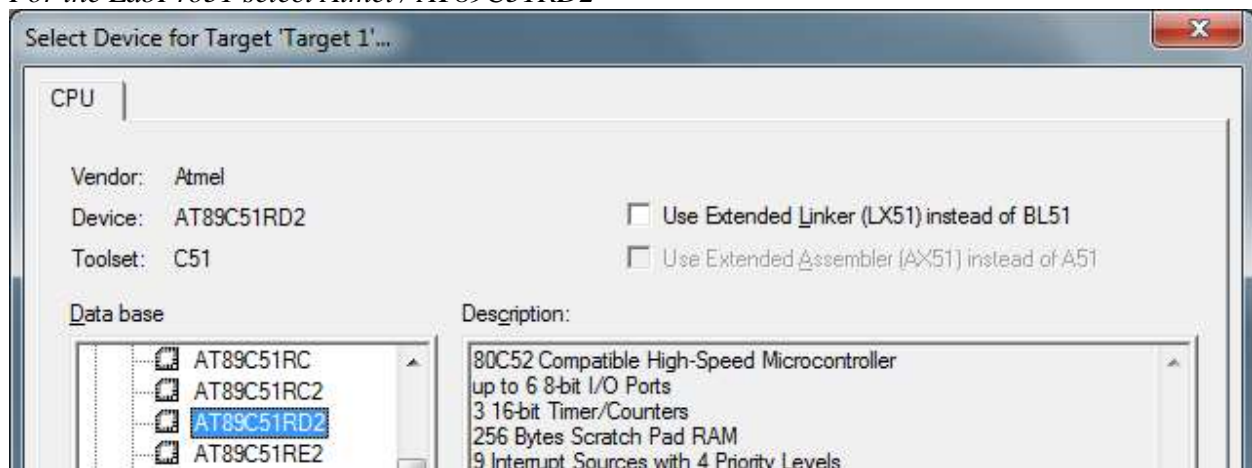
OBJECTIVES:

- Make a basic 8051 I/O program Configured to read switch positions as logic values and write the logic values to LEDs
- Use the Keil Debug peripherals to simulate port interfacing
- Load a program onto 8051 hardware

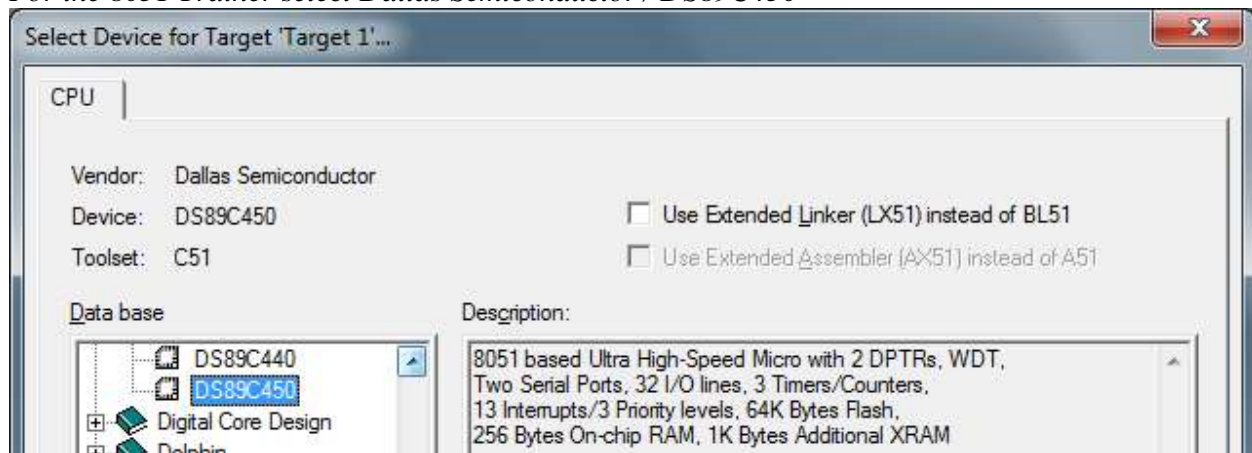
ACTIVITY 1

Create a new project. Select the device used on your version of 8051 development platform in the 'Device for Target' window (this can be changed later if an incorrect device is selected).

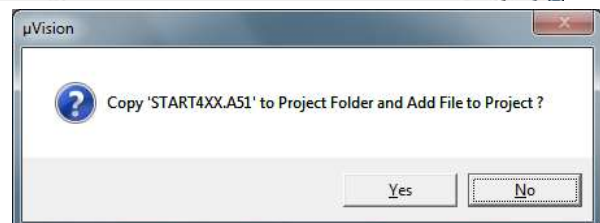
For the LabPro51 select Atmel / AT89C51RD2



For the 8051 Trainer select Dallas Semiconductor / DS89C450



Always select NO when prompted to add a startup file



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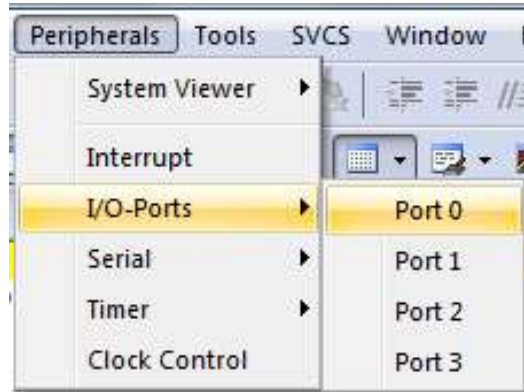
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Write a program according to the following source code:

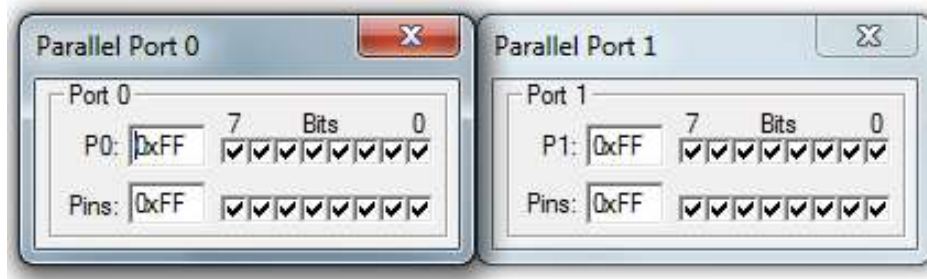
```
mov p1, #0x00    ;configure Port1 as output

L1: mov p1, p0    ;read Port0 value and write to Port1
    sjmp L1       ;repeat the previous instruction forever
```

Build your program (F7 keyboard shortcut) then start the **debugger** (CTRL + F5). Once the debugger has launched, go to the **Peripherals** menu and select **Port 0** then select **Port 1**



Once each of these Ports has been selected you will have access to two small pop up windows as shown in the image below. (one window for each port that has been selected in the previous step)



- The presence of a check within a box indicates a particular bit is at logic level 1. An empty check box will indicate the presence of logic level 0 in a position.
- The top row of check boxes represents the logic level for each pin on the port. (i.e. a value that can be read or some value that has been written)
- The bottom row of check boxes represents the logic level for the internal configuration latch of each pin on a port. This determines the directionality of the port (1 for input, 0 for output)
- When the 8051 first starts, by default all port pins are configured as input.

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Press the F5 button to RUN simulation. Use the bottom row of check boxes by clicking on them during simulation. You should notice the check boxes disappear from the bottom row of the Parallel Port 1 window.



When you click the input port bottom row check box...

The output port check boxes will be updated to match the input port status

Each check box represents a value found on a port. A box that checked represents logic level 1 (5 volts), a box that is not checked represents logic level 0 (0 volts). Each port pin's value is also represented in a register that corresponds to a port so the entire port can be read in parallel as an 8-bit hex quantity (this 8-bit hex quantity can be seen in the box labeled Pins in the above illustration)

The check boxes in simulation can be used to predict hardware functionality with some certainty. For an input port:

- An empty checkbox represents a switch in the OFF position
- A checkbox with a check inside represents a switch that is ON

For an output port:

- An empty checkbox represents an LED that is OFF
- A checkbox with a check inside represents an LED that is ON

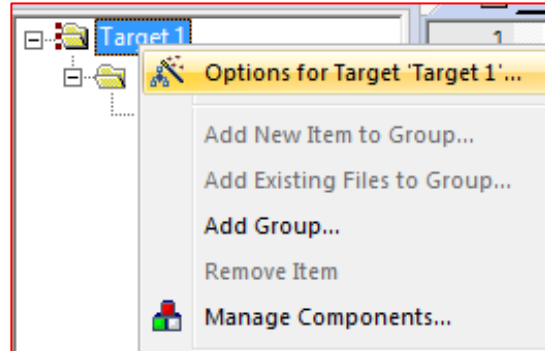
This concludes the software simulation of I/O port programming/interfaces. This Activity is provided for your own reference in doing debug simulation but

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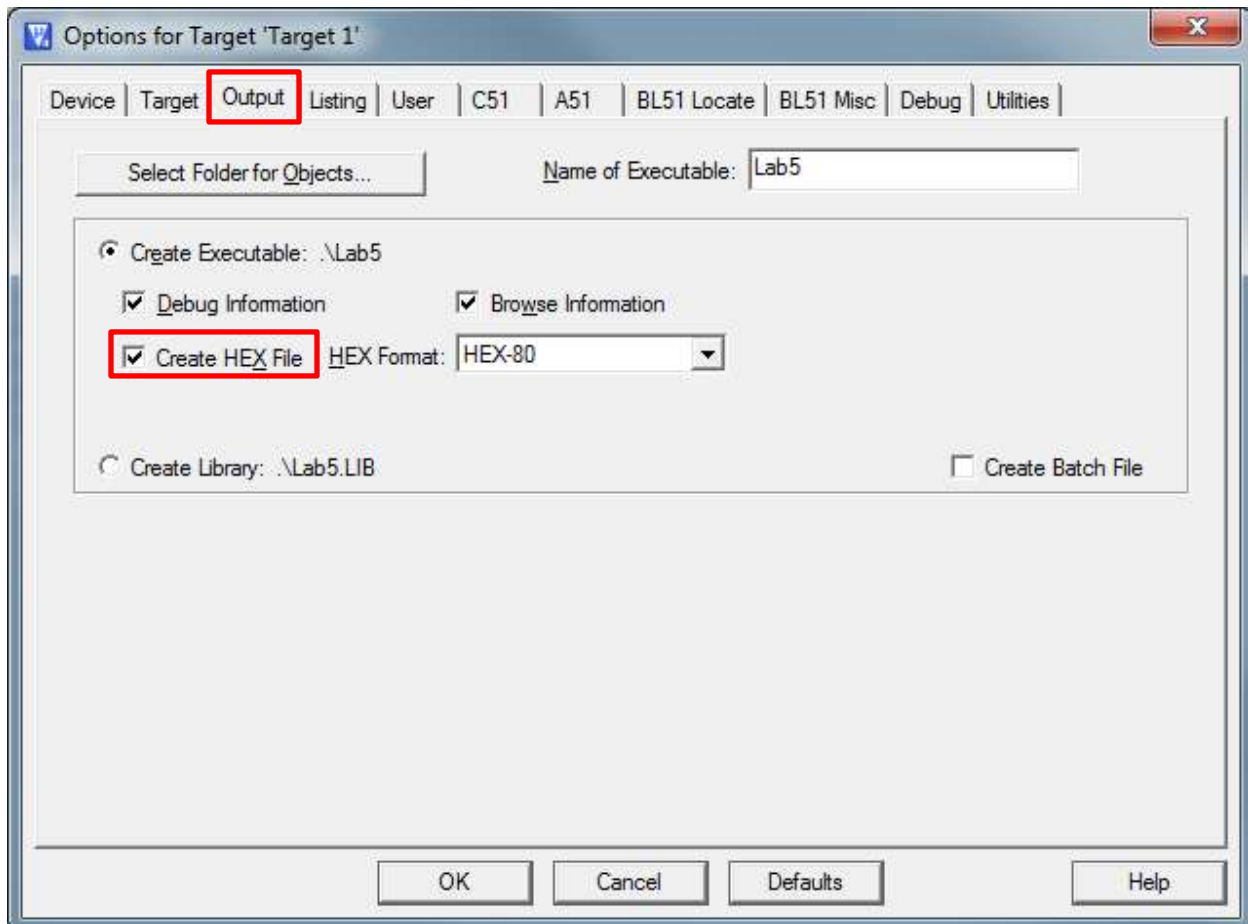
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ACTIVITY 2

Load your program onto your 8051 development hardware. To do this you must generate a hex file. A hex file can be generated by Right clicking the Target1 item in your project window then selecting **Options for Target 'Target 1'...**



In the Options window that appears go to the **Output** tab and check the box next to **Create HEX File**. Do not change any other options, then click **OK**.



Build your program. In the console window you should see the following messages. One of which indicates that a hex file has been created.

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```
Build Output
Build target 'Target 1'
linking...
Program Size: data=8.0 xdata=0 code=24
creating hex file from "Lab5"...
"Lab5" - 0 Error(s), 0 Warning(s).
```

The hex file will be placed in the directory where your project is located on your computer.

This is the file that will be used to program your 8051 hardware development platform.

The process to load your hex file into your 8051 depends on your version of the 8051 hardware development platform [if you need assistance please see the instructor or a reputable student]

Once the hex file is loaded onto your hardware, demonstrate proper functionality of your program for the instructor.

The 8051 Trainer must also have its port pins connected to switches and LEDs manually using jumper wires.