Laboratory Worksheet #04
Hardware: Digital Input and Output Exercise

When complete, insert Worksheet 04 in your laboratory notebook. Worksheets are required when the notebooks are graded. Perform any necessary calculations on the left page of the notebook where the worksheet is placed. Keep individual copies of the worksheet for your own records. This worksheet is a pre-lab exercise to be done before starting Lab 1-1 and should not be confused with the lab.

One of the important aspects of the software is initializing Special Function Registers (SFRs). In Laboratory 1, you will create initialization functions for Port I/O, which involves setting the correct SFR bits to 0 or 1, as needed. The logic assignment operations developed in Worksheet 2 are used to set the appropriate bits without changing the other bits.

Additionally, using the sbit command to assign a variable name to a single bit in the SFR can make programming and code execution much simpler. You will read from or write to individual bits when performing Input/Output operations on the Port pins. These read and write operations will be performed using the sbit labels assigned to the specific Port pins.

As an example problem, Port 2 will be configured for both input and output. Note, this is an example problem and is not to confused with Laboratory 1. The followed Port bits will be assigned as inputs or outputs:

P*n.m* (Port *n*, bit *m*)	Description	Bit Label
P2.1	Input bit for doorbell	**DB**
P2.3	Input bit for an alarm clock	**AC**
P2.5	Output bit for a porch light	**Porch**
P2.6	Input bit for a garage door	**GD**

All other bits are considered previously assigned and should not be changed.

Refer to the manual section *Input/Output Ports on the C8051* or the course slides to determine the syntax. The memory locations for Port 2 bit 0 is 0xA0, Port 2 bit 1 is 0xA1, through Port 2 bit 7 at 0xA7. Complete the following four lines of code to assign the labels to the appropriate bit using the sbit command.

__sbit __at 0x A1 DB ; // remember to include the double "__"

__sbit __at 0xA3 AC;

__sbit __at 0xA5 Porch;

__sbit __at 0xA6 GD;

In the following SFR data tables, indicate whether the bit should be set high (1), low (0), or undetermined/unchanged (X).

P2MDOUT (input bits are set to 0, output bits are set to 1, unchanged bits are indicated with an X)

bit	7	6	5	4	3	2	1	0
	X	0	1	X	0	X	0	X

Determine the bit mask for setting the appropriate bits high (logic 1) P2MDOUT | = 0x20;

Determine the bit mask for setting the appropriate bits low (logic 0) P2MDOUT & = 0xB5;

P2 (input bits are set to 1 which is a high impedance state, all other bits are unchanged X)

bit	7	6	5	4	3	2	1	0
	X	1	X	X	1	X	1	X

Determine the bit mask for setting the appropriate bits high (logic 1) P2 | = 0x4A;

In summary, using the above definitions, complete the Port_Init() function for this example.

```
Port_Init()
{
    P2MDOUT &= 0xB5;    //configure Port 2 bits as inputs
    P2MDOUT |= 0x20;    //configure Port 2 bits as outputs
    P2 |= 0x4A;         //set Port 2 input bits to a high impedance state
}
```

When complete, include Worksheet 4 with your Laboratory 1-1 Pre-lab submission.