Some Useful Parallel I/O Details

W. Barnes, 2006 fall
Rev’d, 07f
Parallel Ports

- Used for Input and Output
  - Controlled through software with Data Direction Registers
  - Hardware consists of tri-state buffers

- Next slide shows a hypothetical 2-bit port
  - One bit configured for input and connected to a switch
  - One bit configured for output and connected to a LED
  - Notice the left side is the microcontroller and right side is the external hardware
  - Also notice the DDR and Port registers inside the microcontroller
Simple 2-bit Port

PortX0

PortX1

DDRX0

DDRX1

PortX

DDRX

MicroController

"Outside World"
## Dragon12 Port Use Information

<table>
<thead>
<tr>
<th>Port</th>
<th>Port Address</th>
<th>Data Direction Register Address (DDRx)</th>
<th>Connected Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>$0001</td>
<td>$0003</td>
<td>8 LEDs and 7-seg LEDs</td>
</tr>
<tr>
<td>H</td>
<td>$0261</td>
<td>$0262</td>
<td>8 switches in a DIP and four push buttons</td>
</tr>
<tr>
<td>J</td>
<td>$0268</td>
<td>$026A</td>
<td>PJ1 = 1 enables 7-segment while PJ0 = 0 enables LEDs</td>
</tr>
<tr>
<td>P</td>
<td>$0258</td>
<td>$025A</td>
<td>PP0 thru PP3 enable/disable 7-seg LED</td>
</tr>
</tbody>
</table>
Input Switches Section of Dragon12

All these switches are connected Port H. The *four push buttons* are connected to PH0 – PH3 and are active low (note Vcc connected through the 100k) while the *eight dip switches* are connected to PH0 PH7. Shown below are one push button and one dip switch.
Program on Next Slide

• Problem: Develop a program which continuously monitors the dip switches on the Dragon12 and echos the switches on the LEDs

• Algorithm:
  1. Initialize necessary registers for I/O
  2. Read switches at port H
  3. Send number from switches to LEDs at port B
  4. Go back to (2)
Ignoring bounce issues, echo switch value on LEDs
PJ1 = 1 enables 7-segment while PJ0 = 0 enables LEDs
PH0 thru PH7 connected to DIP switches
but also PH0 thru PH3 are pushbuttons (in parallel)

; LEDs and 7-seg LED port (Refer back to Port Use Slide)
portb   equ  $0001
; 7-segment and LEDs Enable/Disable
portj   equ  $0268
; push button and rocker/DIP switches
portp   equ  $0261
; connected to cathodes of 7-segments (DIG0 – DIG3)
ddrb    equ  $0003
ddrh    equ  $0262
ddrj    equ  $026A
ddrp    equ  $025A
output  equ  $FF
input   equ  $00
org     $2000
movb    #output,ddrj
movb    #output,ddrb
movb    #output,ddrp
movb    #input,ddrh
movb    #00,portj ; enables LEDs
movb    #$FF,portp ; turns off 7-seg LED display using DIG0–DIG3

poll
  ldaa porth
  staa portb
  bra poll ; never ends
end