MECH 423 Lecture 10

ADC

- 10 bit ADC

$$N = 1023 \cdot \frac{(V_{in} - V_{R-})}{(V_{R+} - V_{R-})}$$

Typically,
$V_{R-} = 0V$
$V_{R+} = 3.3V$
2.5V
1.5V

Key issue: ADC conversion is not instantaneous!

Key bits:
- ADC10ON
- ADC10ENC — Enable conversion
- ADC10SC — start conversion
- ADC10IFG0

→ Wait for conversion to finish:

Method 1: `while (ADC10CTL1 & ADC10BUSY);`

Method 2: `while ((ADC10IFG & ADC10IFG0)==0);`

Method 3: — set up interrupt service routine

Retrieve result: `Result = ADC10MEM0`

If 8 bit result is desired:

`Result = ADC10MEM0 >> 2`

right shift 2 places →

Variables

	Unsigned	Signed
8 bit — char	0..255	-128...127

-128 1 0 0 0 0 0 0 0
-1 1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 1

16 bit — int

0 0000 0000 127 0111 1111
255 1111 1111

int x

* Always declared unsigned explicitly

Unsigned int x = 0;

Global Variables

```
int global_var;
int main (void)
    {
    }
int myISR( )
    {
    }
```

- Variables can fail to update across subroutines because of compiler optimization.
- Define as "volatile"
  - turn off compiler optimization

volatile unsigned int global_var=0;

MCU Programming Structures

1. Polling — constantly checking

```
int main ( )
    { while (1)
        {
            If (P1IN & BIT3)
                // do something
        }
```

- Can still miss events.

2. Interrupt - driven Programming

```
int main ( )
```

// Set up registers ← { Enable global interrupts
while (1);

#pragma ...
// ISR ← most of your code.

Problem: While ISR is executing, no other interrupts can be serviced.

For example, UART at 9600 band
1 bit = 833 clock cycles (clock = 8 MHz)
1 byte ≈ 8400 clock cycles

Event-driven Programming

#pragma ...
// ISR ← keep minimal
e.g. for UART Rx — get byte from Rx buffer
// Set a software flag

```
int main()
    // Set up registers
    // Enable interrupts
    while (1)
        { If (flag == True)
            {// Event handler
             // Flag = 0;
        If (flag2 = True)
            :
    }
```

} can be interrupted.

Lab #2 Exam

5 Exercises ——— Yes/No outcome

Total time: 2.5 hours Open Computer.

	Completion Grade	Time Grade
1	20%	20%
2	40%	20%
3	60%	20%
4	80%	10%
5	90%	10%

① Be organized

② Don't panic