

### 1. Floating point conversion

m.mmmmeee

0x6f = 0110 1111

$0.1101 \times 2^7$

$(2^{-1} + 2^{-2} + 2^{-4}) \times 2^7$

$2^6 + 2^5 + 2^3 = 104$

0110 - 1000

2 to the number is the bit that is on so  $2^3$  is the 3rd bit on

### 2. Vref, voltage, number of bits. Find hex output

Vref = 1v = 1000mv Input = 750 mv Bits = 8  Input / (Vref / $2^8$ ) = Output	$750 / (1000 / 2^8) = 192 = 0xC0$
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### 3. Vref, number of bits, digital value. Find voltage range

Vref = 8v = 8000mv Bits = 8 Digital Val = 23  Find Range	$23 / 2^{11} \times 8v = 11.2 \text{ mv}$ $24 / 2^{11} \times 8v = 11.7mv$  [ 11.2mv, 11.7mv )
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Vref = 8v Bits = 8 Digital Value = 3	$\frac{3}{4} \times 8v = 6$ $\frac{4}{4} \times 8v = 8$  [ 6, 8 )
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#### 4. Interrupt Trivia

- RETI = set interrupt flag to 1 when return after it pulls 2 bytes off the stack
- Needs special hardware'
- Within an ISR you cannot be interrupted until you turn on the flag
- Timers has the interrupt flag built in
- External interrupts (ex ultrasonic)

#### 5. Given a clock speed, delay. What goes into the timer

Clock = 5mhz Delay = 3 ms	$3 \times 10^{-6} / (1 / 5 \times 10^6) = 15 \text{ clock}$  Tcount = 256 - 15 = 241
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#### 6. Manipulate register bits (LED on/off maybe)

AND	1101 - 1010 0000 - 1111 ← AND <hr/> 0000 - 1010
OR	1101 - 1010 0000 - 1111 ← OR <hr/> 1101 - 0000
XOR	LDI r16, 1 CLR r17  Loop:.... XOR r17,r16 toggles the bits

XOR with 3 and 4 bit  swapp r17	ldi r16, 24 EOR r17, r16
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#### 7. Calc CheckSum

	AB	1010 1011
	CD	1100 1101
		_____
		0111 1000
	13	0111 1000
		0001 0011
		_____
		1000 1011
	5f	1000 1011
		0101 1111
		_____
		1110 1010
		Checksum
		2s complement
Check		0001 0101
		1
1110 1010		0001 0110 = 0x16
0001 0110 = 0000 0000		

8.  $2^n$  bits (Quiz 3)

Unsigned =  $0 - (2^{10} - 1)$

Signed =  $-2^9 - (2^9 - 1)$

9. Add regs tell the SREG Flags

ldi r16, 0xCD = 1100 1101

ldi r17, 0xAA = 1010 1010

0111 0111 = 0x77

H = 1

C = 1

N = 0

S = 1

V = 1

Z = 0

10. Timer/Counter trivia

Timer 0 = 8 bits (256 max)  
 Timer 1 = 16 bits (1024 max)  
 Timer 2 = 8 bits (256 max)  
 CTC = Count To Compare  
 Load \_\_\_\_\_ with (timermax - count)

#### 11. Assembly instructions to opcode

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#### 12. Opcode to assembly

1110 - 0000 - 0010 - 0001	ldi r18, 1
1110 - 0000 - 0011 - 0001	ldi r19, 1
1110 - 0000 - 0100 - 0001	ldi r20, 1
0000 - 1111 - 0011 - 0010	add r19, r18
0010 - 1111 - 0010 - 0011	mov r18, r19
1001 - 0101 - 0100 - 1010	dec r20
1111 - 0111 - 1110 - 0001	brne label (back 4) 111 -1100 000 - 0011
	inc 1 then move

#### 13. While / If to assembly

<pre>while (x &gt; 10) {   x = x - 2 }</pre>	<pre>loop: lds r16, x cpi r16, 10 brlt out breq out dec r16 dec r16 sts x, r16 rjmp loop  out: ret</pre>
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#### 14. Use LPM

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ldi r30, lo8(MYDATA)
ldi r31, hi8(MYDATA)
clr r17
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loop: lpm r16, z+
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```
add r17, r16  
cpi r16, 0  
brne loop  
(do stuff)
```

```
MYDATA: .asciz ("Pizza")
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