

HW1

1.  $10101111_{1's\ comp} \rightarrow \text{Dec. ?}$

$$\rightarrow 01010000 \rightarrow -(64+16) = \boxed{-80}$$

2.  $10101111_{2's\ comp} \rightarrow \text{Dec. ?}$

$$\rightarrow (01010001) \rightarrow \boxed{-81}$$

3.  $10101111_{sm} \rightarrow \text{Dec. ?}$

$$\rightarrow -(00101111) \rightarrow -(32+15) = \boxed{-47}$$

4.  $10101111_{us} \rightarrow \text{Dec. ?}$

$$\rightarrow (128+32+15) = \boxed{175}$$

5.  $79_{10}$  as BCD #?

$$\downarrow \downarrow \quad \boxed{0111\ 1001}_{BCD}$$

6.  $1010101010101010 \rightarrow \text{Dec. ?}$

$$2^{11} + 2^9 + 2^7 + 2^5 + 2^3 + 2^1 = 2048 + 512 + 128 + 32 + 8 = \boxed{2730.625}$$

7.  $6052_{10} \rightarrow \text{hex} = \boxed{17A4}_{16}$

$$\begin{array}{r} 6052 \div 16 = 378 \text{ r } 4 \\ 378 \div 16 = 23 \text{ r } 10 \\ 23 \div 16 = 1 \text{ r } 7 \\ 1 \div 16 = 0 \text{ r } 1 \end{array}$$

$$\begin{array}{r} 6052 \\ -4800 \\ \hline 1252 \\ -1120 \\ \hline 132 \\ -128 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 378 \\ -320 \\ \hline 58 \\ -48 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 23 \\ -16 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 1 \\ -0 \\ \hline 1 \end{array}$$

8.  $6052_{10} \rightarrow \text{Binary}$

given hex  $\rightarrow 17A4_{16}$

$$\boxed{0001\ 0111\ 1010\ 0100}_2$$

9.  $6052_{10} \rightarrow \text{Octal}$

given bin.  $\rightarrow$

$$\begin{array}{cccc} 001 & 011 & 101 & 0100 \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 1 & 3 & 6 & 4 \end{array}$$

$$\boxed{1364}_8$$

10. Hex values of ASCII code Dr. Schwartz

D r . S c h w a r t z

44 72 2E 53 68 68 77 61 72 74 7A

32

11. How many possible combinations in 4 bits? (a) 7? (b) 7? (c) 10?

(a)  $(2)(2)(2)(2) = \boxed{16} = 2^4$

(b)  $2^7 = \boxed{128}$

(c)  $2^{10} = \boxed{1024}$

12. What are largest possible unsigned binary #'s for bit lengths in #11?

(a)  $(1111)_2 = \boxed{31} = 2^5 - 1$ , if  $n = \# \text{ bits}$ ,  $\text{MAX} = 2^{n+1} - 1$

(b)  $2^{7+1} - 1 = \boxed{255}$

(c)  $2^{10+1} - 1 = \boxed{2047}$

13. 2 ex. of adding 45 8-bit bin #s that result in a carry

$$\begin{array}{r} 1000\ 0000 \\ + 1000\ 0000 \\ \hline (1)0000\ 0000 \end{array}$$

$$\begin{array}{r} 1\ 100\ 0000 \\ + 0100\ 0000 \\ \hline (1)0000\ 0000 \end{array}$$

14. 1 ex of adding 2 signed 8-bit #'s w/ overflow

$$\begin{array}{r} 0100\ 0001 \\ + 0100\ 0000 \\ \hline (1)000\ 0001 \end{array}$$

15. 1 ex of sub. 2 signed 8-bit #'s that result in overflow

$$\begin{array}{r} 1000\ 0000 \\ - 0000\ 0001 \\ \hline = 1111\ 1111 \\ (1)0111\ 111 \end{array}$$

16. (13)  $1000\ 0000\ 0000\ 0000 + 1000\ 0000\ 0000\ 0000 = (1)0000\ 0000\ 0000\ 0000$   
 (14)  $1100\ 0000\ 0000\ 0000 + 0100\ 0000\ 0000\ 0000 = (1)0000\ 0000\ 0000\ 0000$   
 (14)  $0100\ 0000\ 0000\ 0001 + 0100\ 0000\ 0000\ 0000 = (1)0000\ 0000\ 0000\ 0001$   
 (15)  $10000000\ 0000\ 0000 - 0000\ 0000\ 0000\ 0001 = (1)0111\ 1111\ 1111\ 1111$

17. Name & desc. 4 spec. internal func. units in Atmel X MEGA

- ① Analog to Digital Converter (ADC) - convert analog voltage to digital value
- ② Cyclic Redundancy Check (CRC) Generator - error detection for finding accidental errors in data
- ③ AES & DES Crypto Engines - Two commonly used standards for cryptography, used by CPU for fast encrypted communication & secure data storage
- ④ USART (Universal Synchronous & Asynchronous serial, Receiver & Transmitter) - serial communication module