

CPE/EE 323 Introduction to Embedded Computer Systems

Homework I

Problem #1 (20 points)

Fill in the following table. Show your work as illustrated for (a).

	Decimal	32-bit binary	Hexadecimal number (8 hex digits)	4-byte packed BCD number
(a)	12,348	0000.0000.0000.0000.0011.0000.0011.1100	0000_303C	00. 00.30.3?
(b)			CA03_2F0D	
(c)	3,845			
(d)		0110.1011.0010.1100.1011.0100.0010.1101		
(e)				43.28.99.89

(a)
 $12348/16 = 771 \lfloor 12$
 $771/16 = 48 \lfloor 3$
 $48/16 = 3 \lfloor 0$
 $3/16 = 0 \lfloor 3$

$12348_{10} = 303C_{16} = 0000_303C_{16} = 0000_0000_0000_0000_0011_0000_0011_1100_2 = 00.00.303?$
 (“?” marks an illegal BCD digit).

Problem #2 (20 points)

Consider the following 16-bit hexadecimal numbers (second column). Each of these values can be interpreted as an unsigned 16-bit integer, a signed 16-bit integer represented in 2's complement, or as a sign-and-magnitude integer. Provide the decimal value for each number and interpretation. Show your work as illustrated in (a).

	16-bit hex	Unsigned int	Signed int	Sign-and-magnitude
(a)	A223	41507	-24029	-8739
(b)	01A2			
(c)	4089			
(d)	22FF			
(e)	FF00			

(a) unsigned: $A223_{16} = 10 \cdot 16^3 + 2 \cdot 16^2 + 2 \cdot 16^1 + 3 \cdot 16^0 = 41507_{10}$

signed: $A223_{16} = 1010.0010.0010.0011_2 \Rightarrow$ this is a negative number;

two's complement is: $0101.1101.1101.1101 = 5DDD_{16} = 24029_{10} \Rightarrow A223_{16} = -24029$

sign-and-magnite: $-2223_{16} = -8739$

Problem #3 (20 points)

Consider the following arithmetic operations. Find the results and set the flags C, V, N, and Z accordingly.

(a) 8-bit, two's complement
 $45_{10} + 88_{10}$

(b) 8-bit, two's complement
 $(-35)_{10} - 88_{10}$

(c) 16-bit, two's complement
 $-35_8 - 88_{16}$

(d) 16-bit, two's complement
 $-AF_{16} + 34_{10}$

Problem #4 (20 points)

(a) Convert the following number from decimal to the IEEE 32-bit floating point.
 98.03125_{10}

(b) Convert the following number from the binary IEEE floating point to decimal.
 $60E3AB00_{16}$

