CS/ECE 252: INTRODUCTION TO COMPUTER ENGINEERING

UNIVERSITY OF WISCONSIN—MADISON

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Examination 1
In Class (50 minutes)
Friday, Feb 10, 2012
Weight: 17.5%

NO: BOOK(S), NOTE(S), CALCULATORS OF ANY SORT.

This exam has 9 pages, including a blank page at the end. Plan your time carefully, since some problems are longer than others. You must turn in pages 1 to 7.

LAST NAME: _____

FIRST NAME:_____

SECTION: _____

ID# _____

Question	Maximum Points	Points
1	8	
2	4	
3	4	
4	2	
5	2	
6	3	
7	3	
8	4	
Total	30	

Q1 (8 points)

a. Convert the ASCII string "**-9.75**" to its hexadecimal representation. Only represent the characters between the quotation marks and assume it is a null terminated string.

b. Convert the following binary code into an ASCII string:
0111 0000 0011 0001 0011 0011 0111 0011 0000 0000

c. Convert the decimal number **216** into its 4-digit hexadecimal representation.

d. Find the unsigned fixed point binary representation of the decimal number **128.125.**

Q2. (4 points)

Consider the 8-bit binary bit pattern **10101010.** What is its decimal (base ten) value if the bit pattern is interpreted as:

a. A **one's complement** integer?

b. A **two's complement** integer?

Q3 (4 points)

Consider the Octal number system (base 8) where only the digits 0-7 are legal.

a. What is the maximum unsigned decimal value that one can represent with **5** octal digits?

b. What is the maximum unsigned decimal value that one can represent with **n** octal digits?

Q4 (2 points)

Given the two 16-bit numbers expressed in hexadecimal representation: **xABCD** and **xFEED**, evaluate the following expression. Give your answer in **hexadecimal** (base 16).

xABCD AND (NOT(xFEED))

Q5. (2 points)

Add the following 6-bit two's complement binary numbers:

011010 + 100110

Express your answer in 6-bit two's complement. Explain why the output is correct or incorrect

Q6 (3 points)

Number the following in order of their levels of abstraction, where "1" represents the lowest level and "6" is the highest.

	Microprocessor
	Problem
	Logic gates
	Algorithm
	Instruction Set Architecture
	Java Code

Q7 (3 points)

Given the black boxes of Figure 1, show how to connect them together to calculate the following equation: $\mathbf{a^2 + b^2 + c^2 + 2ab + 2ac + 2bc}$. Assume that the output of a box may be connected to multiple inputs. Give an answer using **three** boxes. **Hint: Try factoring.**

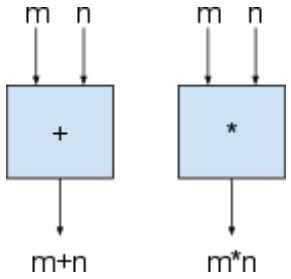
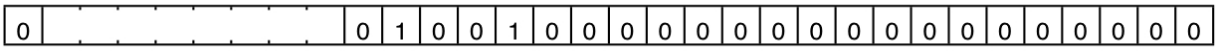


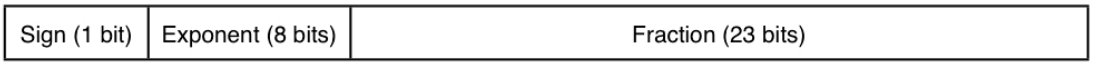
Figure 1. Addition and multiplication black boxes for Q7

Q8 (4 points)

Shown below is the floating point representation of a value. Note that the exponent bits have been left out.



a. Fill in the exponent bits so that the value being represented is an integer. If you feel there is more than one possible answer, then the correct answer is the integer having the smallest absolute value. Recall that the bits for an IEEE floating point number are allocated as follows:



where $N = (-1)^S \times 1.\text{fraction} \times 2^{\text{exponent}-127}$

b. What is the decimal value of the integer represented in part a?

Scratch page

ASCII Table

Character	Hex	Character	Hex	Character	Hex	Character	Hex
nul	00	sp	20	@	40	`	60
soh	01	!	21	A	41	a	61
stx	02	“	22	B	42	b	62
etx	03	#	23	C	43	c	63
eot	04	$	24	D	44	d	64
enq	05	%	25	E	45	e	65
ack	06	&	26	F	46	f	66
bel	07	‘ (*Apostr.)*	27	G	47	g	67
bs	08	(	28	H	48	h	68
ht	09	)	29	I	49	i	69
lf	0A	*	2A	J	4A	j	6A
vt	0B	+	2B	K	4B	k	6B
ff	0C	*, (Comma)*	2C	L	4C	l	6C
cr	0D	-	2D	M	4D	m	6D
so	0E	*. (Period)*	2E	N	4E	n	6E
si	0F	/	2F	O	4F	o	6F
dle	10	0	30	P	50	p	70
dc1	11	1	31	Q	51	q	71
dc2	12	2	32	R	52	r	72
dc3	13	3	33	S	53	s	73
dc4	14	4	34	T	54	t	74
nak	15	5	35	U	55	u	75
syn	16	6	36	V	56	v	76
etb	17	7	37	W	57	w	77
can	18	8	38	X	58	x	78
em	19	9	39	Y	59	y	79
sub	1A	:	3A	Z	5A	z	7A
esc	1B	;	3B	[	5B	{	7B
fs	1C	<	3C	\	5C	|	7C
gs	1D	=	3D	]	5D	}	7D
rs	1E	>	3E	^	5E	~	7E
us	1F	?	3F	_ *(Undrscre)*	5F	del	7F