CS/ECE 252: INTRODUCTION TO COMPUTER ENGINEERING UNIVERSITY OF WISCONSIN—MADISON

Prof. Parmesh Ramanathan & Mark D. Hill

TAs Kasturi Bidarkar, Ryan Johnson, Jie Liu, & Ramachandran Syamkumar

Midterm Examination 1

In Class (50 minutes)

Friday, September 25, 2009

Weight: 15%

CLOSED BOOK, NOTE, CALCULATOR, PHONE, & COMPUTER.

The exam has four two-sided pages. Circle your final answers.

Plan your time carefully, since some problems are longer than others.

NAME:

SECTION:

ID#_____

Problem Number	Maximum Points	Actual Points
1	4	
2	3	
3	3	
4	4	
5	4	
6	4	
7	4	
8	4	
Total	30	

Problem 1 (4 points)

a) What is the greatest magnitude negative number that can be represented in *two's complement* using 9 bits? Specify your answer as a base 10 number.

 $-2^8 = -256$

b) What is the largest positive number that can be represented as an *unsigned* integer using 9 bits? Specify your answer as a base 10 number.

 $2^9 - 1 = 511$

Problem 2 (3 points)

Compute (NOT 1101) AND (1010 OR 0101)

1010 OR 0101 = 1111

NOT 1101 = 0010

Answer = 0010 AND 1111 = **0010**

Problem 3 (3 points)

Consider the octal number system (base 8) where only the digits 0-7 are legal. Convert the decimal number **78** into an octal number.

 $78 = 1*8^2 + 1*8^1 + 6*8^0$

Answer = 116

Problem 4 (4 points)

Consider the 8-bit binary bit pattern **11011100**. What is its decimal (base ten) value if the bit pattern is interpreted as:

(a) An unsigned integer?

4 + 8 + 16 + 64 + 128 = 220

(b) A two's complement integer?

Two's complement of the given number = $0010\ 0011 + 1 = 0010\ 0100$

Answer = -36

Problem 5 (4 points)

(a) Add the following 5-bit two's complement binary numbers: 11111 + 11101. Express your answer in 5-bit two's complement. Please indicate if there was an overflow.
Sum = 111100; Ignoring the overflowing bit, Answer = 11100
No overflow (since carry into MSB is equal to carry out of MSB)

(b) Add the following 5-bit two's complement binary numbers: **00100** + **01111**. Express your answer in 5-bit two's complement. Please indicate if there was an overflow.

Sum = **10011**

Overflow (since carry into MSB is not equal to carry out of MSB)

Problem 6 (4 points)

(a) Convert the ASCII characters a!B into binary. (See attached ASCII table.)

a = **0110 0001**

 $! = 0010 \ 0001$

 $B = 0100 \ 0010$

(b) Convert the binary value 0101 0010 0111 0010 into an ASCII string.

Rr

Problem 7 (4 points)

(a) What is the base ten (decimal) value represented by binary 101.110?

5.75

(b) The bits for an IEEE floating point number are allocated as follows:

sign (1 bit)	exponent (8 bits)	fraction (23 bits)

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

Sign = 1; Exponent = 129; Mantissa = 0.5

Answer = $-1.5 * 2^2 = -6$

Problem 8 – Circle the correct answer (2 points each)

(a) What can binary 10000 represent? Answer (d)

- a. Decimal 16
- b. Decimal -16
- c. The rectangular shape
- d. Any of the above

(b) Which of the following statements is/are true? Answer (b)

a. It is impossible to add two negative numbers that are represented in signed magnitude form.

b. Signed magnitude form has two zeroes.

c. Two's complement is preferred to signed magnitude because arithmetic is more accurate in two's complement than signed magnitude.

d. Both (b) and (c)

ASCII Table

Character	Hex	Character	Hex	Character	Hex	Character	Hex
nul	00	sp	20	@	40	*	60
soh	01	!	21	А	41	a	61
stx	02		22	В	42	b	62
etx	03	#	23	С	43	с	63
eot	04	\$	24	D	44	d	64
enq	05	%	25	E	45	e	65
ack	06	&	26	F	46	f	66
bel	07	•	27	G	47	g	67
bs	08	(28	Н	48	h	68
ht	09)	29	Ι	49	i	69
1f	0A	*	2A	J	4A	j	6A
vt	0B	+	2B	К	4B	k	6B
ff	0C	,	2C	L	4C	1	6C
cr	0D	-	2D	Μ	4D	m	6D
so	0E		2E	N	4E	n	6E
si	0F	/	2F	0	4F	0	6F
dle	10	0	30	Р	50	р	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	Т	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	у	79
sub	1A	:	3A	Z	5A	Z	7A
esc	1B	;	3B	[5 B	{	7B
fs	1C	<	3C	X	5C	1	7C
gs	1D	=	3D]	5D	}	7D
IS	1E	>	3E	^	5E	~	7E
us	1F	?	3F	_	5F	del	7 F

Scratch Sheet (in case you need additional space for some of your answers)