

**CS/ECE 252: INTRODUCTION TO COMPUTER ENGINEERING
COMPUTER SCIENCES DEPARTMENT
UNIVERSITY OF WISCONSIN – MADISON**

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Midterm Examination 1
In Class (50 minutes)
Monday, October 1, 2007
Weight: 15%

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

The exam has **four** two-sided pages.

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 largest (most positive) integer that can be represented as an *unsigned* integer using 13 bits?

b) What is the largest (most positive) integer that can be represented as a *two's complement* integer using 13 bits?

Problem 2 (3 points)

Consider bitwise logical operations: Compute (1101 AND 0111) OR (NOT 0011)

Problem 3 (3 points)

Convert the number **-84** (base ten) into two's complement representation with 8 bits.

Problem 4 (4 points)

Consider the 8-bit binary bit pattern **10010010**. What is its decimal (base ten) value if the bit pattern is interpreted as:

(a) An unsigned integer?

(b) A two's complement integer?

Problem 5 (4 points)

(a) Add the following 5-bit two's complement binary numbers: **01111 + 01101**. Express your answer in 5-bit two's complement. Please indicate if there was an overflow.

(b) Add the following 5-bit two's complement binary numbers: **11110 + 01111**. Express your answer in 5-bit two's complement. Please indicate if there was an overflow.

Problem 6 (4 points)

(a) Convert the ASCII string "**F4n**" into binary. (See attached ASCII table. Only convert the characters between the quotation marks.)

(b) Convert the binary value **0010010001101011** into an ASCII string.

Problem 7 (4 points)

(a) What is the base ten (decimal) value represented by binary **110.101** ?

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

sign (1 bit)	exponent (8 bits)	fraction (23 bits)
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where $N = (-1)^S \times 1.\text{fraction} \times 2^{\text{exponent}-127}$

Convert **1 10000001 11000000000000000000000** to decimal.

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

I. Which of the following is a universal computing device?

- a. A 16-button(0-9, period, =/+/-/x/÷) calculator
- b. A laptop computer running Windows XP
- c. An ultrafast supercomputer
- d. All of the above
- e. Both (b) and (c)

II. When referring to an algorithm, definiteness means:

- a. Each step must be precisely defined
- b. The algorithm's variables must not overflow a fixed number of bits
- c. The number of unknowns and equations is the same
- d. None of the above

ASCII Table

<i>Character</i>	<i>Hex</i>	<i>Character</i>	<i>Hex</i>	<i>Character</i>	<i>Hex</i>	<i>Character</i>	<i>Hex</i>
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	'	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	,	2C	L	4C	l	6C
cr	0D	-	2D	M	4D	m	6D
so	0E	.	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	_	5F	del	7F

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