CS/ECE 252: INTRODUCTION TO COMPUTER ENGINEERING
COMPUTER SCIENCES DEPARTMENT
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Midterm Examination 1
In Class (50 minutes)
Monday, February 18, 2008
Weight: 15%

CLOSED BOOK, NOTE, CALCULATOR, PHONE & COMPUTER

The exam consists of **four two-sided pages** and **one scratch sheet** at the end.

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

NAME: _____KEY_____

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 10 bits?

2^10 – 1 = 1023

b) What is the largest (most positive) integer that can be represented as a *two's complement* integer using 10 bits?

2^{10-1} – 1 = 511

Problem 2 (3 points)

Consider bitwise logical operations: Compute **`(1011 AND 0101) OR (NOT 1011)`**

1011 and 0101 = 0001 , not 1011 = 0100 , ans= 0101

Problem 3 (3 points)

Convert the number `-91` (base ten) into two's complement representation with 8 bits.

91 = 01011011 , -91 = 10100100 +1 = 10100101

Problem 4 (4 points)

Consider the 8-bit binary bit pattern `11000101`. What is its decimal (base ten) value if the bit pattern is interpreted as:

a) An unsigned integer?

197

b) A two's complement integer?

00111010 + 1 = 00111011 = -59

Problem 5 (4 points)

a) Add the following 5-bit two's complement binary numbers: **`01111 + 00110`**. Express your answer in 5-bit two's complement. Please indicate if there was an overflow.

01111 + 00110 = 10101, 15 + 6 = -11, overflow

b) Add the following 5-bit two's complement binary numbers: **`10110 + 01101`**. Express your answer in 5-bit two's complement. Please indicate if there was an overflow.

10110 + 01101 = 00011, -10 + 13 = 3, no overflow

Problem 6 (4 points)

a) Convert the binary value **`011000010011001000000000`** into an ASCII string.

`0110 0001 0011 0010 0000 0000 = 0x613200 = "a2"`

b) Convert the null-terminated string "**mP3**" into binary. (See attached ASCII table.)

0x6D503300 = 0110 1101 0101 0000 0011 0011 0000 0000

Problem 7 (4 points)

a) What is the base ten (decimal) value represented by binary `110.1011`?

4 + 2 + 0 + ½ + 0 + 1/8 + 1/16 = 6.6875

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 2exponent-127

Convert `1 10101001 10100000000000000000000` to decimal.

-1 * e{169-127} * 1.101 = -1.625 * 2^42

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

I. Which of the following does the definition of a Turing machine include?

- **a. A set of states.**
- b. A monitor.
- **c. A set of input/output symbols.**
- d. A fan.
- e. A hard disk.
- **f. One or more halting states.**
- g. A printer.
- h. A unit which takes two 32-bit integers as input and writes the sum at the output.
- i. A mop.
- **j. One initial state.**
- k. A power supply unit.
- **l. A state transition table.**
- m. Random access memory (RAM).

II. Pair each level of abstraction with its definition.

- a. Problem.
- b. Algorithm.
- c. Language.
- d. Instruction set architecture.
- e. Microarchitecture.
- f. Circuit.
- g. Device.

1) An interface between the program and the underlying computer hardware.
2) A precisely stated step-by-step procedure that is guaranteed to terminate.
3) An unambiguous, artificial system of symbols and rules that controls the behavior of a computer.
4) A network of "black boxes" which evaluate logic expressions.
5) A pMOS transistor.
6) The organization of the hardware resources in a specific processor.
7) A description, in natural language, of a series of steps.

A	B	C	D	E	F	G
7	2	3	1	6	4	5

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	'	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)