Math 181 F1 Exam 2 Version C Name:

5 pages. 10 problems. 100 points. No calculators. Show all work.

Problem 1 (5 points each).

(a) Convert 74_{10} to base-2.

$74 = 64 + 10 = 64 + 8 + 2$

$2^6 \quad 2^3 \quad 2^1$

$74_{10} = 1001010_2$

(b) Convert 11010_2 to base-10.

$0\times1 + 1\times2^1 + 0\times2^2 + 1\times2^3 + 1\times2^4$

$2 + 8 + 16 = 26$

So $11010_2 = 26_{10}$

Problem 2 (15 points). *Most credit cards implement the Luhn Algorithm (patented in 1960), which works as follows (let's use the example 4485723586944236):*

1. *Remove the last digit, which is the checksum (6, leaving 448572358694423).*
2. *Double every other remaining digit (8,4,16,5,14,2,6,5,16,6,18,4,8,2,6).*
3. *Add up all the* digits *($8+4+1+6+5+1+4+2+6+5+1+6+6+1+8+4+8+2+6 = 84$).*
4. *Take the last digit of your sum (4) and subtract it from 10 (6). That is the checksum from 1.*

Is 59240473 a valid credit card number? Why?

1. Leave 5924047 (checksum is 3).
2. Double: 10, 9, 4, 4, 0, 4, 14
3. Add: $1+0+9+4+4+4+1+4 = 27$
4. Last digit is 7, and $10-7=3$

~~Since 7≠3, this is not a valid credit card number, it doesn't fit the algorithm.~~

So the checksum should be 3, and it is 3.

So the card is valid.

Problem 3 (5 points each).

(a) Write out the multiplication table mod 8.

	1	2	3	4	5	6	7	8
2	4	6	0	2	4	6		
3	6	1	4	7	2	5		
4	0	4	0	4	0	4		
5	2	7	4	1	6	3		
6	4	2	0	6	4	2		
7	6	5	4	3	2	1		
8								

(b) Which numbers don't have square roots?

~~0~~ ~~1~~ 2, 3, ~~4~~ 5, 6, 7

(c) Which numbers are zero divisers?

2, 4, 6

(d) Find all solutions to $2x = 4$ mod 8.

$x = 2, 6$

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Problem 4 (1 points) Decode the shift cipher after guessing the shift

[illegible]

shift by 1 letter

THE ANSWER

Problem 5 (1 points) Write out the truth table for (A or B) and C

A	B	C	A or B	(A or B) and C
T	T	T	F	F
T	T	F	F	F
T	F	T	T	T → TFT
T	F	F	T	F
F	T	T	T	T → FTT
F	T	F	T	F
F	F	T	F	F
F	F	F	F	F

Problem 6 (1 points) Find all the prime numbers up to 50

1 2 3 4 5 6 7 8 9 10

11 12 13 14 15 16 17 18 19 20

21 22 23 24 25 26 27 28 29 30

31 32 33 34 35 36 37 38 39 40

41 42 43 44 45 46 47 48 49 50

2, 3, 5, 7, 11, 13, 17, 19, 23, 29,

31, 37, 37, 41, 47

Problem 7 (5 points each). *Let A be "Charlie likes pool and basketball, but not volleyball".*

(a) What are the three pieces of A? Call them B, C, and D.

B = "Charlie likes pool"
C = "Charlie likes BBall"
D = "Charlie likes volleyball"

(b) Write A as a Boolean expression involving B, C, and D.

A = B and C and (not D)

(c) Negate the Boolean expression from (b) and simplify.

not (B and C and (not D))

(not B) or (not C) or D

(d) Write out "not A" in words, based on your answer in part c.

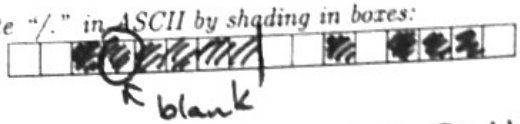
several options: Charlie does not like pool, or basketball, or he does like volleyball.

Charlie likes volleyball, or dislikes pool or basketball.

ASCII Chart

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
2	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	DEL

Problem 8 (15 points). *Write "/." in ASCII by shading in boxes:*



Show your work below:

/ ⇒ 2F = 2×16+15 = 32 + 8+4+2+1
00101111_2

. ⇒ 2E = 2×16+14 = 32 + 8+4+2
00101110_2

Problem 9 (5 points). *What is the difference between http and https?*

https encrypts the data sent to/from a website.

Problem 10 (5 points). *Answer in 20 words or less: what was your favorite Engineering Open House exhibit, and why?*

The Occulus Rift demo (3D goggles), because 3D vision is cool.