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CprE 281 HW00
ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Initial Stuff and Basics
Assigned Date: First Week
Finish by Jan. 22, 2023

Instructions

Complete the question below to the best of your ability. Once complete, upload a PDF of your work to canvas. Problems 2-5 on separate pages

Questions

P1. (10 points) Define the following terms in no more than 2 sentences each.

A. CAD — Computer Aided Design
B. PLD — Programmable Logic Devices
C. FPGA — Field-programmable Gate Array
D. ASIC — Application-specific Integrated Circuits

P2. (10 points) In the development process initial design-simulation-verification is one loop and prototype implementation-testing-verification is another loop. Answer the following in 4-5 sentences.

A. Which loop is relatively more expensive, and why? answer below
B. Can any of these loops be avoided? If not, why not? If yes, what is the penalty? answer below

P3. (10 points) Convert the following numbers to decimal:

A. 1111010_2
B. 1101_2
C. 1110_8
D. 123_{16}
E. CAD_{16}

answers below

P4. (10 points) Convert the following numbers to binary:

A. 28
B. 115
C. 127
D. 271_8
E. $C0DE_{16}$

answers below

P5. (10 points) Consider this array of bytes: [48 $_{16}$ 65_{16} $6c_{16}$ $6c_{16}$ $6f_{16}$ 21_{16}].

A. Convert each byte of the array to a binary number (e.g 32 $_{16}$ = 00110010_2).
B. Convert each binary number to an ASCII character (Refer to section 1.5.3 on pgs 14 - 16). What does it spell?

answers below

P6. (20 points) Consider the following statement: Consider the following statement: "Today is Taco Tuesday, and you are considering ordering tacos from your favorite taco shop in Ames. If you have your mask and you **don't feel sick**, you will order takeout and eat your tacos on the way home from class. Since you love tacos, you consider ordering

tacos for delivery in the evening as well. However, due to an unreasonably high minimum order you can only order with your roommates. If your roommates are hungry, and you can order before the taco shop closes, you will order delivery."

- Let the variable M represent if you have your mask.
- Let the variable S represent if you feel sick.
- Let the variable R represent if your roommate is hungry.
- Let the variable T represent if you can order before the taco shop closes.

Write all combinations of variables which will allow you to have tacos on Taco Tuesday.
An example answer (use 0 for false and 1 for true):
M=?, S=?, R=?, T=?
M=?, S=?, R=?, T=?
...
and M=?, S=?, R=?, T=? will allow me to have tacos.

MUST MUST

	M	S	R	T	
1	0	0	0	0	
2	0	0	0	1	
3	0	0	1	0	
4	0	0	1	1	✓
5	0	1	0	0	
6	0	1	0	1	
7	0	1	1	0	
8	0	1	1	1	✓
9	1	0	0	0	
10	1	1	0	0	
11	1	0	1	0	
12	1	0	0	1	
13	1	1	0	0	
14	1	0	1	1	
15	1	1	1	0	
16	1	1	1	1	✓

4 variables
each true/false
1 0
2 options

$4^2 = 16$ scenarios

MRST
0011
0111
1111

P2 a)

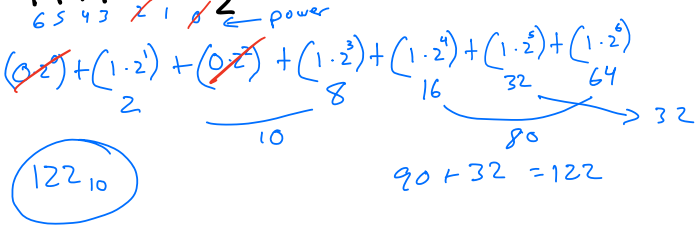
The prototype implementation testing and verification loop is more expensive, this means you are late in the process before manufacturing and after design. If something goes wrong, that means the product potentially has to be redesigned AND rebuilt for further prototype testing. These are usually found in the beginning of testing as requirement errors. If these errors were found during the design-simulation-verification stage, it would be far less costly.

b)

You can't really avoid the design loop, but of course you could avoid a prototyping stage, but that is not recommended. This does depend on what product you are making though. By avoiding the prototype stage, this means that you don't have enough testing to discover more errors or bugs that could be in your product. You could have these errors during development and not even know about it because you chose not to test your design through prototype testing.

P3

a) 1111010_2 → decimal



122_{10}

b) 1101_2

$(1\cdot2^0)+(1\cdot2^2)+(1\cdot2^3)$

1 4 8 = 13

13_{10}

c) 1110_8

$(1\cdot8^1)+(1\cdot8^2)+(1\cdot8^3)$

8 64 512 = 584

584_{10}

d) 123_{16}

$(3\cdot16^0)+(2\cdot16^1)+(1\cdot16^2)$

3 32 256 = 291

291_{10}

A B C D E F
10 11 12 13 14 15

e) CAD_{16}

$(13\cdot16^0)+(10\cdot16^1)+(12\cdot16^2)$

13 + 160 + 3072 = 3245

3245_{10}

P4

Convert to binary

a) 28_{10}

	28/2	14/2	7/2	3/2	1/2
remainder	0	0	1	1	1

11100_2

b) 115_{10}

	115/2	57/2	28/2	14/2	7/2	3/2	1/2
remainder	1	1	0	0	1	1	1

1110011_2

c) 127_{10}

	127/2	63/2	31/2	15/2	7/2	3/2	1/2
remainder	1	1	1	1	1	1	1

1111111_2

0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

d) 271_8

010 111 001

010111001_2

e) $C0DE_{16}$

1100 0000 1101 1110

1100000011011110_2

P5 a) $[48_{16}\ 65_{16}\ 6C_{16}\ 6C_{16}\ 6F_{16}\ 21_{16}]$

Convert to binary

Binary	Hex	Decimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

4 8
0100 1000 = 01001000_2

6 5
0110 0101 = 01100101_2

6 C
0110 1100 = 01101100_2

6 C
0110 1100 = 01101100_2

6 F
0110 1111 = 01101111_2

2 1
0010 0001 = 00100001_2

Bit positions 3210	Bit positions 654: 000	001	010	011	100	101	110	111
0000	NUL	DLE	SPACE	0	@	P	`	p
0001	SOH	DC1	!	1	A	Q	a	q
0010	STX	DC2	"	2	B	R	b	r
0011	ETX	DC3	#	3	C	S	c	s
0100	EOT	DC4	$	4	D	T	d	t
0101	ENQ	NAK	%	5	E	U	e	u
0110	ACK	SYN	&	6	F	V	f	v
0111	BEL	ETB	'	7	G	W	g	w
1000	BS	CAN	(	8	H	X	h	x
1001	HT	EM	)	9	I	Y	i	y
1010	LF	SUB	*	:	J	Z	j	z
1011	VT	ESC	+	;	K	[	k	{
1100	FF	FS	,	<	L	\	l	|
1101	CR	GS	-	=	M	]	m	}
1110	SO	RS	.	>	N	^	n	~
1111	SI	US	/	?	O	_	o	DEL

b)

Hello!