

### CDS130 Mid-term exam

- Be sure your exam booklet has 6 pages.
- Write your name at the top of the front page.
- This is a closed book exam.
- You may not use a calculator.
- You may not use MATLAB during exam except the last two problems.
- Absolutely no interaction between students is allowed.
- Each problem is worth 5 points unless indicated otherwise. Partial credit may be awarded **ONLY** if work is shown.
- Duration for this exam: 75 minutes.

**Q1.**  $(-12)_{10} = ( )_2$  (using the excess-127 method) .

Answer:

**Q2.** Convert 8-bit binary number (1110 1110) using the Sign-and-magnitude method .

Answer:

**Q3.** Convert decimal 63.125 into binary.

Answer:

**Q4.**  $(A1)_{16} = ( )_2$

Answer:

**Q5.** What is the minimum number of bits needed for multiplying a 6-bit integer and a 7-bit integer without overflow? State your reasoning.

Answer:

**Q6.** In two's complement method, what is the largest decimal number that 8-bit bit pattern can represent?

**Q7.** How many bits are required to represent the sum of :  $(2^{12} + 2^{12} + 2^{11} + 2^{10})_{10}$  ?

**Q8.** A forensic computer scientist is able to examine a file at the low-level of bytes for analyzing malware. A snippet of the document with the hexadecimal format reads:

41 53 43 49 49 20 20 20

Suppose the text is encoded with the ASCII code (see the encoding table attached to this exam).

(1) what is the content of the document displayed above?

(2) How many bytes are used for the text shown above?

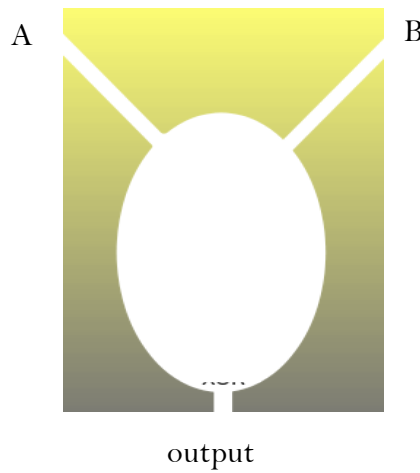
**Q9.** What is the 8-bit result of dividing the following two binary numbers?

1 0 1 0 1 1 0 0 1 ÷ 0 0 0 1 1 0 0 1

**Q10.** Using the two's complement method, adding the following two 8-bit numbers. Convert the result to its decimal equivalent

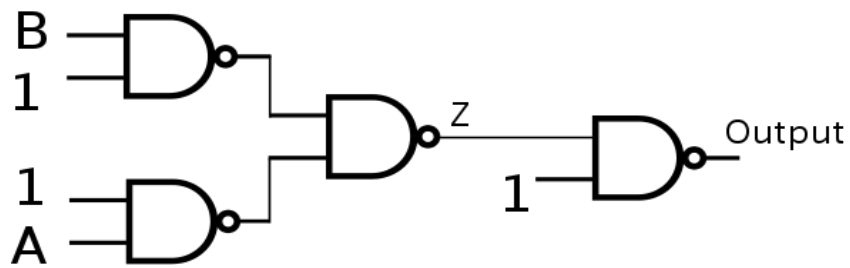
$$\begin{array}{r} 1\ 1\ 0\ 0\ 1\ 0\ 1\ 0 \\ +\ 0\ 1\ 0\ 0\ 1\ 0\ 1\ 1 \\ \hline \end{array}$$

**Q11.** Water flows into one, both, or none of the two white tubes at the top. What logic gate does it produce from the output indicated?



- A) AND
  - B) OR
  - C) NAND
  - D) NOR
  - E) XOR
- Answer:

**Q12.** What one logic gate is equivalent to the logic circuit shown below? Draw the logic gate.



**Q13. (10 points)** Using only NAND gates, draw a circuit equivalent to the given circuit.



Answer:

**Q14. (10 points)** Without running matlab, provide answer to the following matlab build in functions

- (1) ceil(pi)
- (2) floor (-3.02)
- (3) sqrt(round(3.7))
- (4)  $2.0 \setminus 4.0 / 2.0^2$
- (5) mod (1, 4)

**Q15. (10 points)** An anonymous function defined in matlab is a function that is not stored in a program file, but associated with a variable.

$$f(x, y, z) = \sin^2(x^2) + \cos^2(y^2) + z^2$$

Now, define an anonymous function for  $f(x,y)$ , and calculate the values of  $f(2,3,5)$  using the defined anonymous function in Matlab.

Answer:

- (1) How to write the anonymous function in Matlab?
- (2) What is the value of  $f(2,3,5)$  ?

**Q16. (10 points)** Write a script that asks the user to

- (a) write a user-defined function (not an anonymous function) triple(x,y,z) to evaluate the value of  $\sqrt{(\sin^2(x) + \sin^2(y) + \cos^2(z))}$
- (b) use the user-provided values to test the results of triple(3,4,5).

Answer the following questions:

- (1) What is the file name you saved for this user-defined function?
- (2) Write the script in the following blank
- (3) what is your value for triple(3,4,5)?

Encoding Table

Dec	Hex	Name	Char	Ctrl-char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	0	Null	NUL	CTRL-@	32	20	Space	64	40	@	96	60	`
1	1	Start of heading	SOH	CTRL-A	33	21	!	65	41	A	97	61	a
2	2	Start of text	STX	CTRL-B	34	22	"	66	42	B	98	62	b
3	3	End of text	ETX	CTRL-C	35	23	#	67	43	C	99	63	c
4	4	End of xmit	EOT	CTRL-D	36	24	\$	68	44	D	100	64	d
5	5	Enquiry	ENQ	CTRL-E	37	25	%	69	45	E	101	65	e
6	6	Acknowledge	ACK	CTRL-F	38	26	&	70	46	F	102	66	f
7	7	Bell	BEL	CTRL-G	39	27	'	71	47	G	103	67	g
8	8	Backspace	BS	CTRL-H	40	28	(	72	48	H	104	68	h
9	9	Horizontal tab	HT	CTRL-I	41	29	)	73	49	I	105	69	i
10	0A	Line feed	LF	CTRL-J	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	VT	CTRL-K	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	FF	CTRL-L	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage feed	CR	CTRL-M	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	SO	CTRL-N	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	SI	CTRL-O	47	2F	/	79	4F	O	111	6F	o
16	10	Data line escape	DLE	CTRL-P	48	30	0	80	50	P	112	70	p
17	11	Device control 1	DC1	CTRL-Q	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	DC2	CTRL-R	50	32	2	82	52	R	114	72	r
19	13	Device control 3	DC3	CTRL-S	51	33	3	83	53	S	115	73	s
20	14	Device control 4	DC4	CTRL-T	52	34	4	84	54	T	116	74	t
21	15	Neg acknowledge	NAK	CTRL-U	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	SYN	CTRL-V	54	36	6	86	56	V	118	76	v
23	17	End of xmit block	ETB	CTRL-W	55	37	7	87	57	W	119	77	w
24	18	Cancel	CAN	CTRL-X	56	38	8	88	58	X	120	78	x
25	19	End of medium	EM	CTRL-Y	57	39	9	89	59	Y	121	79	y
26	1A	Substitute	SUB	CTRL-Z	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	ESC	CTRL-[	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	FS	CTRL-\	60	3C	<	92	5C	\	124	7C	
29	1D	Group separator	GS	CTRL-]	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	RS	CTRL-^	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	US	CTRL-`	63	3F	?	95	5F	`	127	7F	DEL