Name:_____

Data Representation, Logic, Huffman Coding, Binary Numbers

DUE: Friday March 17, 2017 @ the beginning of class | Please staple all sheets together BEFORE class.

Goal: The purpose of this assignment is to get a little practice with binary numbers, think about representing data digitally, and review basic logic as the foundation of how computers compute.

Exercises:

Binary Numbers

1   Convert 10 base 10 to base 2. _____

2   Convert 16 base 10 to base 2. _____

3   Convert 32 base 10 to base 2. _____

4   Convert 217 base 10 to base 2. _____

5   Convert RGB color (128, 0, 255) to base 2. (_____, _____, _____)

6   Add 1101011 base 2 to 1011100 base 2, SHOW YOUR WORK.

7   Add 1011 base 2 to 110 base 2. SHOW YOUR WORK.

$$\begin{array}{r} 1101011 \\ +1011100 \\ \hline \end{array} \qquad \begin{array}{r} 1011 \\ +\ 110 \\ \hline \end{array}$$

8   What letters does this binary (base 2) data correspond to assuming it is in ASCII?

01001010, 01100001, 11110111, 00110000 = _____, _____, _____, _____

ASCII	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	N_U	S_H	S_X	E_X	E_T	E_Q	A_K	B_L	B_S	H_T	L_F	V_T	F_F	C_R	S_O	S_I
0001	D_L	D_1	D_2	D_3	D_4	N_K	S_Y	E_Σ	C_N	E_M	S_B	E_C	F_S	G_S	R_S	U_S
0010		!	"	#	$	%	&	'	(	)	*	+	,	–	.	/
0011	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
0100	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0101	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
0110	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
0111	p	q	r	s	t	u	v	w	x	y	z	{			}	~	D_T
1000	8_0	8_1	8_2	8_3	I_N	N_L	S_S	E_S	H_S	H_J	Y_S	P_D	P_V	R_I	S_2	S_3
1001	D_C	P_1	P_Z	S_E	C_C	M_M	S_P	E_P	O_8	O_Q	O_A	C_S	S_T	O_S	P_M	A_P
1010	A_O	¡	¢	£	♀	¥	¦	§	¨	©	♂	«	¬	–	®	‾
1011	°	±	²	³	´	µ	¶	·	ꓹ	¹	º	»	¼	½	¾	¿
1100	À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï
1101	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	×	Ø	Ù	Ú	Û	Ü	Ý	Þ	ß
1110	à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï
1111	ð	ñ	ò	ó	ô	õ	ö	÷	ø	ù	ú	û	ü	ý	þ	ÿ

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Logic

9 Complete the following truth tables.

(a) **NOT (p OR q)**

p	q	p OR q	NOT (p OR q)
1	1		
1	0		
0	1		
0	0		

(b) **p AND (NOT q)**

p	q	NOT q	p AND (NOT q)
1	1		
1	0		
0	1		
0	0		

(c) **p AND q AND r**

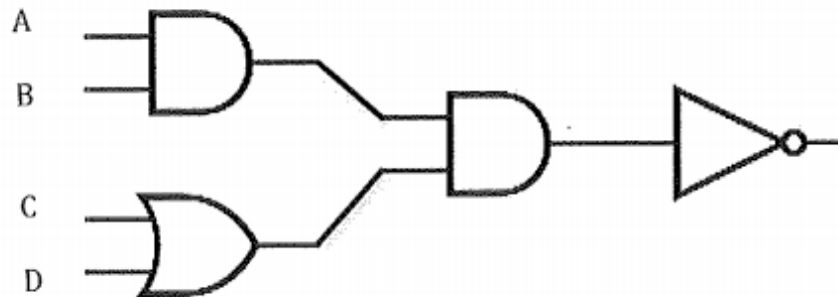| p	q	r	p AND q	(p AND q) AND r
1	1	1		
1	0	1		
0	1	1		
0	0	1		
1	1	0		
1	0	0		
0	1	0		
0	0	0		

10 Using the 3 basic logic gates shown here, draw logic diagrams for the following logical statements.

| AND | OR | NOT |
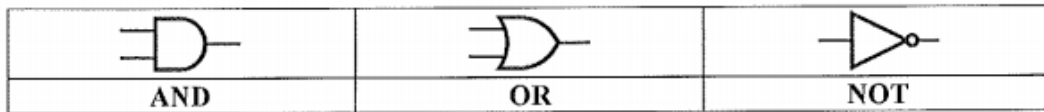
a NOT (P OR Q)

b (A OR B) AND (NOT C)

11 Write the logical statement that corresponds to the following logic diagram.

_____

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Huffman Coding *(Please attach a separate sheet of paper for the Huffman trees.)*

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    a   Generate a binary Huffman tree from the following letter frequencies for the word *bananarama*.

letter	b	a	n	r	m
frequency	1	5	2	1	1

    b   Using the binary Huffman tree you created for (a), give the binary Huffman encoding for the letter sequence *barn*. _____

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    a   Generate a binary Huffman tree from the letter frequencies in the tongue twister: *She sells sea shells by the seashore*. Do not include the space character in your tree.

    b   Using the binary Huffman tree you created for (a), give the binary Huffman encoding for the letter sequence *share*. _____

14 Create the Huffman tree that goes with the following frequency table.

letter	c	s	r	t	e
frequency	1	2	3	4	7