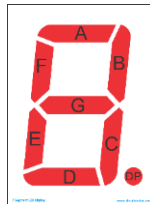


Lab Experiment: Project 1

Circuit Design: Display a name

Using Multisim, design a decoder (like the 7447) that will display each letter of either your first or last name (use 5 letters). A template and worksheet are provided to you as a starting point. There is an example solution on page 3. Your report should describe the design process and must include the Multisim file for your design along with the completed Truth Table and Karnaugh maps.



7 Segment Font

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
0 1 2 3 4 5 6 7 8 9 0

Segment Truth Table Worksheet (the X stands for a Don't Care)

Minterm	Letter	C	B	A		a	b	c	d	e	f	g
0		0	0	0								
1		0	0	1								
2		0	1	0								
3		0	1	1								
4		1	0	0								
5		1	0	1		X	X	X	X	X	X	X
6		1	1	0		X	X	X	X	X	X	X
7		1	1	1		X	X	X	X	X	X	X

Karnaugh Map Worksheets

	\bar{A}	A		\bar{A}
\bar{C}	$\bar{C}\bar{B}\bar{A} = 0$	$\bar{C}\bar{B}A = 1$	$\bar{C}B\bar{A} = 3$	$\bar{C}B\bar{A} = 2$
C	$C\bar{B}\bar{A} = 4$	$C\bar{B}A = 5$	$CBA = 7$	$CB\bar{A} = 6$
	\bar{B}		B	
			X	X
			X	X

	\bar{A}	A		\bar{A}
\bar{C}	$\bar{C}\bar{B}\bar{A} = 0$	$\bar{C}\bar{B}A = 1$	$\bar{C}B\bar{A} = 3$	$\bar{C}B\bar{A} = 2$
C	$C\bar{B}\bar{A} = 4$	$C\bar{B}A = 5$	$CBA = 7$	$CB\bar{A} = 6$
	\bar{B}		B	
			X	X
			X	X

	\bar{A}	A		\bar{A}
\bar{C}	$\bar{C}\bar{B}\bar{A} = 0$	$\bar{C}\bar{B}A = 1$	$\bar{C}B\bar{A} = 3$	$\bar{C}B\bar{A} = 2$
C	$C\bar{B}\bar{A} = 4$	$C\bar{B}A = 5$	$CBA = 7$	$CB\bar{A} = 6$
	\bar{B}		B	
			X	X
			X	X

	\bar{A}	A		\bar{A}
\bar{C}	$\bar{C}\bar{B}\bar{A} = 0$	$\bar{C}\bar{B}A = 1$	$\bar{C}B\bar{A} = 3$	$\bar{C}B\bar{A} = 2$
C	$C\bar{B}\bar{A} = 4$	$C\bar{B}A = 5$	$CBA = 7$	$CB\bar{A} = 6$
	\bar{B}		B	
			X	X
			X	X

	\bar{A}	A		\bar{A}
\bar{C}	$\bar{C}\bar{B}\bar{A} = 0$	$\bar{C}\bar{B}A = 1$	$\bar{C}B\bar{A} = 3$	$\bar{C}B\bar{A} = 2$
C	$C\bar{B}\bar{A} = 4$	$C\bar{B}A = 5$	$CBA = 7$	$CB\bar{A} = 6$
	\bar{B}		B	
			X	X
			X	X

	\bar{A}	A		\bar{A}
\bar{C}	$\bar{C}\bar{B}\bar{A} = 0$	$\bar{C}\bar{B}A = 1$	$\bar{C}B\bar{A} = 3$	$\bar{C}B\bar{A} = 2$
C	$C\bar{B}\bar{A} = 4$	$C\bar{B}A = 5$	$CBA = 7$	$CB\bar{A} = 6$
	\bar{B}		B	
			X	X
			X	X

	\bar{A}	A		\bar{A}
\bar{C}	$\bar{C}\bar{B}\bar{A} = 0$	$\bar{C}\bar{B}A = 1$	$\bar{C}B\bar{A} = 3$	$\bar{C}B\bar{A} = 2$
C	$C\bar{B}\bar{A} = 4$	$C\bar{B}A = 5$	$CBA = 7$	$CB\bar{A} = 6$
	\bar{B}		B	
			X	X
			X	X

Enter your name. If your name is less than 5 letters add any letters or numbers you want to create 5 characters for the display. Using the seven-segment display font determine the display segments for each character. Determine the segment minterms and create the Karnaugh Map for each segment. Determine the segment equations and design and simulate the circuit using Multisym.

Example/Solution:

Minterm	Letter	C	B	A		a	b	c	d	e	f	g
0	A	0	0	0		1	1	1	0	1	1	1
1	S	0	0	1		1	0	1	1	0	1	1
2	S	0	1	0		1	0	1	1	0	1	1
3	E	0	1	1		1	0	0	1	1	1	1
4	R	1	0	0		0	0	0	0	1	0	1
5	Not used	1	0	1		X	X	X	X	X	X	X
6	Not used	1	1	0		X	X	X	X	X	X	X
7	Not used	1	1	1		X	X	X	X	X	X	X

The Karnaugh Maps:

Segment 'a'									\bar{A}	A		\bar{A}
MT	a	b	c	d	e	f	g	\bar{C}	$\bar{C}\bar{B}\bar{A}=0$	$\bar{C}\bar{B}A=1$	$\bar{C}BA=3$	$\bar{C}B\bar{A}=2$
0	1	1	1	0	1	1	1		1	1	1	1
1	1	0	1	1	0	1	1					
2	1	0	1	1	0	1	1					
3	1	0	0	1	1	1	1	C	$C\bar{B}\bar{A}=4$	$C\bar{B}A=5$	$CBA=7$	$CB\bar{A}=6$
4	0	0	0	0	1	0	1		0	X	X	X
5	X	X	X	X	X	X	X					
6	X	X	X	X	X	X	X					
7	X	X	X	X	X	X	X		\bar{B}		B	

$$\text{Segment } a = \bar{C}$$

Segment 'b'									\bar{A}	A		\bar{A}
MT	a	b	c	d	e	f	g	\bar{c}	$\bar{c}\bar{b}\bar{a}=0$	$\bar{c}\bar{b}a=1$	$\bar{c}ba=3$	$\bar{c}b\bar{a}=2$
0	1	1	1	0	1	1	1		1	0	0	0
1	1	0	1	1	0	1	1					
2	1	0	1	1	0	1	1	c	$c\bar{b}\bar{a}=4$	$c\bar{b}a=5$	$cba=7$	$cb\bar{a}=6$
3	1	0	0	1	1	1	1		0	X	X	X
4	0	0	0	0	1	0	1					
5	X	X	X	X	X	X	X					
6	X	X	X	X	X	X	X					
7	X	X	X	X	X	X	X					
									\bar{B}		B	

$$\text{Segment } b = \bar{A} \bar{B} \bar{C}$$

Segment 'c'									\bar{A}	A		\bar{A}
MT	a	b	c	d	e	f	g	\bar{c}	$\bar{c}\bar{b}\bar{a}=0$	$\bar{c}\bar{b}a=1$	$\bar{c}ba=3$	$\bar{c}b\bar{a}=2$
0	1	1	1	0	1	1	1		1	1	0	1
1	1	0	1	1	0	1	1					
2	1	0	1	1	0	1	1	c	$c\bar{b}\bar{a}=4$	$c\bar{b}a=5$	$cba=7$	$cb\bar{a}=6$
3	1	0	0	1	1	1	1		0	X	X	X
4	0	0	0	0	1	0	1					
5	X	X	X	X	X	X	X					
6	X	X	X	X	X	X	X					
7	X	X	X	X	X	X	X					
									\bar{B}		B	

$$\text{Segment } c = \bar{A} B + \bar{B} \bar{C}$$

Segment 'd'									\bar{A}	A		\bar{A}
MT	a	b	c	d	e	f	g	\bar{c}	$\bar{c}\bar{b}\bar{a}=0$	$\bar{c}\bar{b}a=1$	$\bar{c}ba=3$	$\bar{c}b\bar{a}=2$
0	1	1	1	0	1	1	1		0	1	1	1
1	1	0	1	1	0	1	1					
2	1	0	1	1	0	1	1	c	$c\bar{b}\bar{a}=4$	$c\bar{b}a=5$	$cba=7$	$cb\bar{a}=6$
3	1	0	0	1	1	1	1		0	X	X	X
4	0	0	0	0	1	0	1					
5	X	X	X	X	X	X	X					
6	X	X	X	X	X	X	X					
7	X	X	X	X	X	X	X					
									\bar{B}		B	

$$\text{Segment } d = A + B$$

Segment 'e'									\bar{A}	A	\bar{A}
MT	a	b	c	d	e	f	g				
0	1	1	1	0	1	1	1	$\bar{C}\bar{B}\bar{A}=0$	$\bar{C}\bar{B}A=1$	$\bar{C}BA=3$	$\bar{C}B\bar{A}=2$
1	1	0	1	1	0	1	1	1	0	1	0
2	1	0	1	1	0	1	1				
3	1	0	0	1	1	1	1				
4	0	0	0	0	1	0	1	$C\bar{B}\bar{A}=4$	$C\bar{B}A=5$	$CBA=7$	$CB\bar{A}=6$
5	X	X	X	X	X	X	X	1	X	X	X
6	X	X	X	X	X	X	X				
7	X	X	X	X	X	X	X				
								\bar{B}			
								B			

$$\text{Segment } e = AB + \bar{A}\bar{B}$$

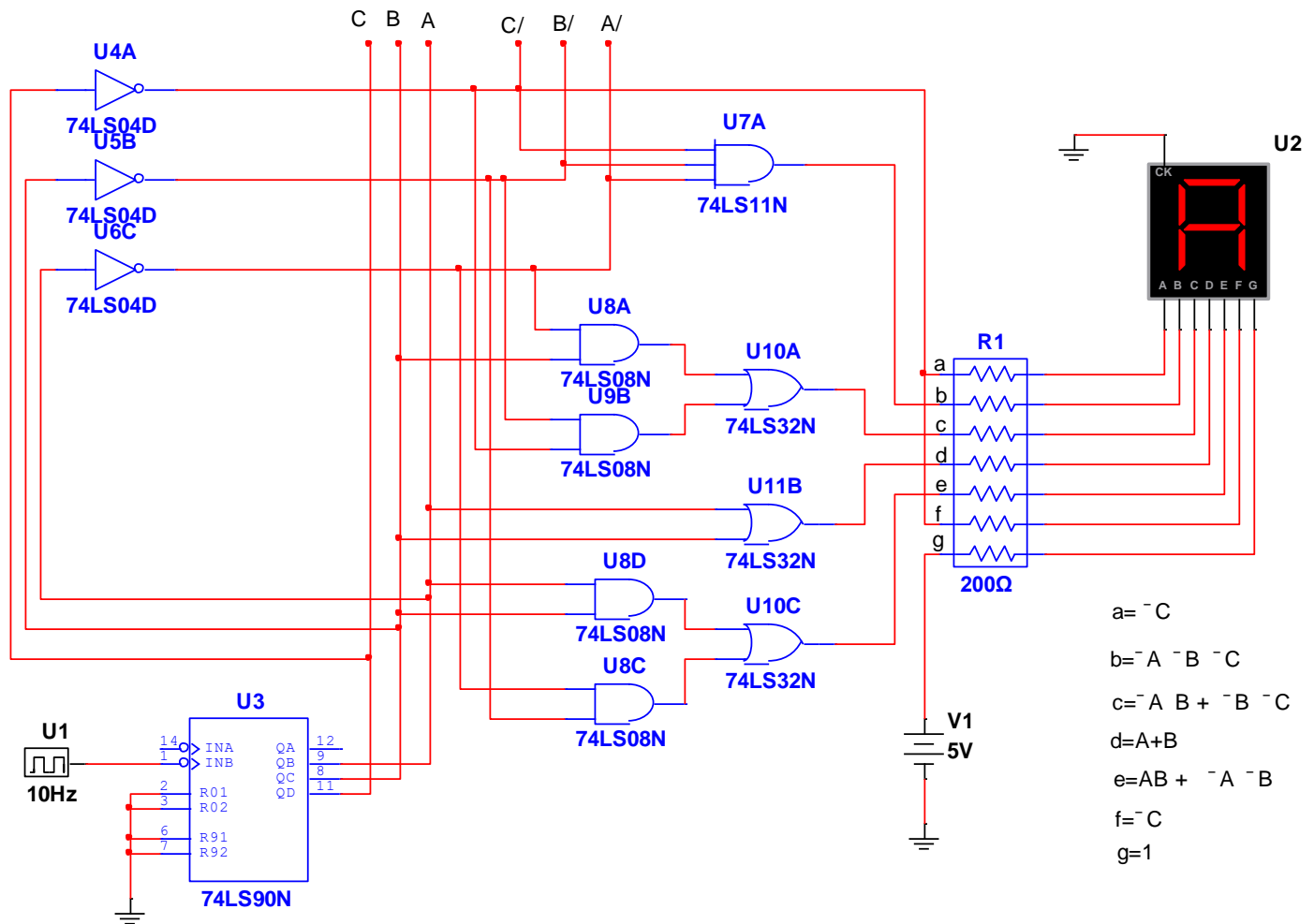
Segment 'f'									\bar{A}	A	\bar{A}
MT	a	b	c	d	e	f	g				
0	1	1	1	0	1	1	1	$\bar{C}\bar{B}\bar{A}=0$	$\bar{C}\bar{B}A=1$	$\bar{C}BA=3$	$\bar{C}B\bar{A}=2$
1	1	0	1	1	0	1	1	1	1	1	1
2	1	0	1	1	0	1	1				
3	1	0	0	1	1	1	1				
4	0	0	0	0	1	0	1				
5	X	X	X	X	X	X	X	$C\bar{B}\bar{A}=4$	$C\bar{B}A=5$	$CBA=7$	$CB\bar{A}=6$
6	X	X	X	X	X	X	X	0	X	X	X
7	X	X	X	X	X	X	X				
								\bar{B}			
								B			

$$\text{Segment } f = \bar{C}$$

Segment 'g'									\bar{A}	A	\bar{A}
MT	a	b	c	d	e	f	g				
0	1	1	1	0	1	1	1	$\bar{C}\bar{B}\bar{A}=0$	$\bar{C}\bar{B}A=1$	$\bar{C}BA=3$	$\bar{C}B\bar{A}=2$
1	1	0	1	1	0	1	1	1	1	1	1
2	1	0	1	1	0	1	1				
3	1	0	0	1	1	1	1				
4	0	0	0	0	1	0	1				
5	X	X	X	X	X	X	X	$C\bar{B}\bar{A}=4$	$C\bar{B}A=5$	$CBA=7$	$CB\bar{A}=6$
6	X	X	X	X	X	X	X	1	X	X	X
7	X	X	X	X	X	X	X				
								\bar{B}			
								B			

$$\text{Segment } g = 1$$

Multisim Circuit:



----- END PROJECT 1 -----