

Somador e decodificador BCD para display de 7 segmentos

Aula 4

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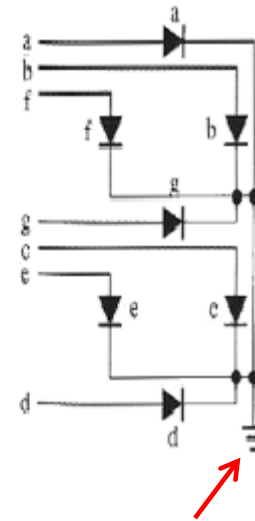
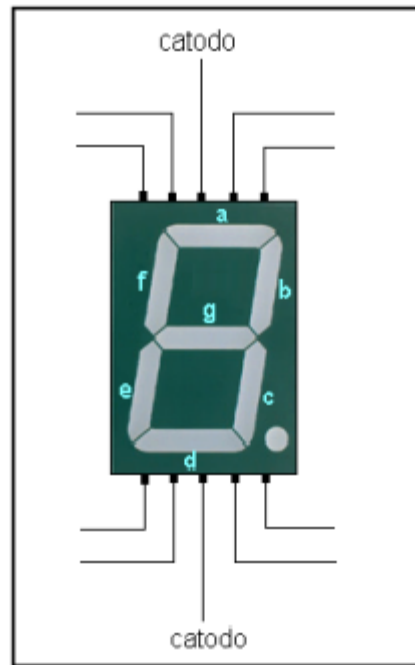
Display de 7 segmentos

Um display de sete segmentos é usado como forma de exibir uma informação numérica, resultado de alguma saída de um circuito digital



Display de 7 segmentos

Configuração catodo comum:

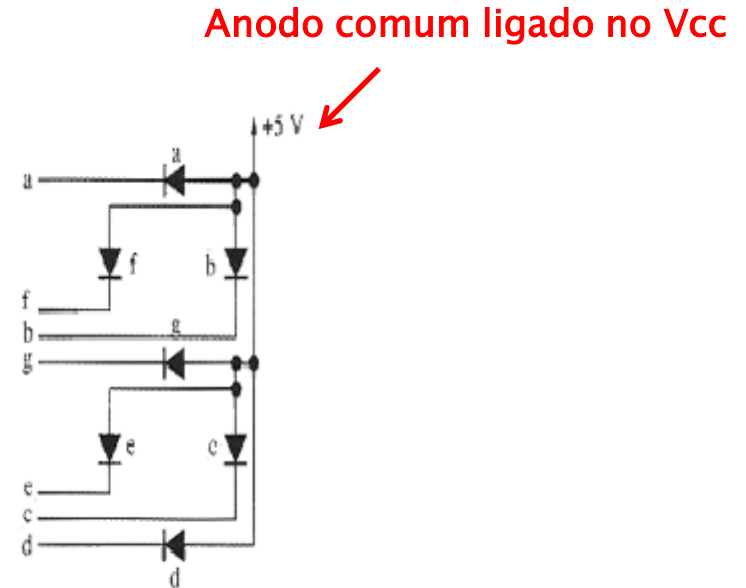
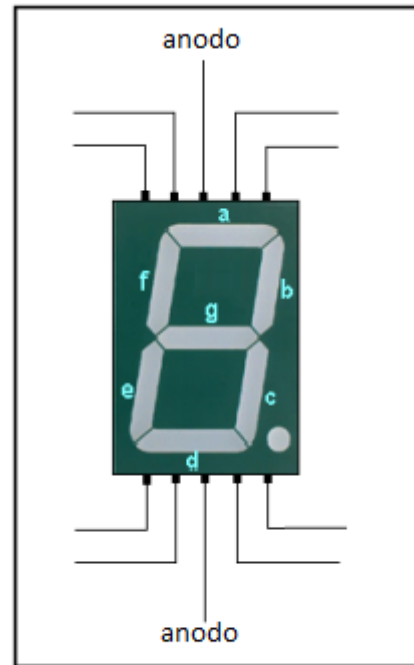


Catodo comum ligado no GND

Ref fig http://www.ppgel.net.br/rabelo/ensino/sistemas_digita1/aula%20pratica%2002.pdf

Display de 7 segmentos

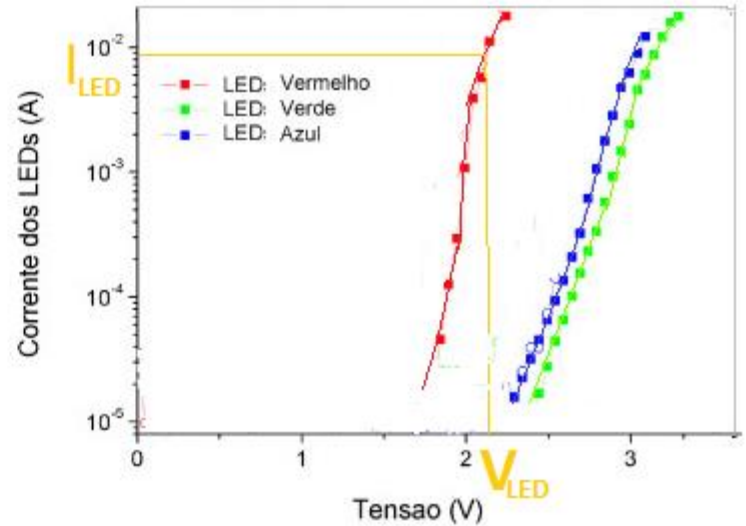
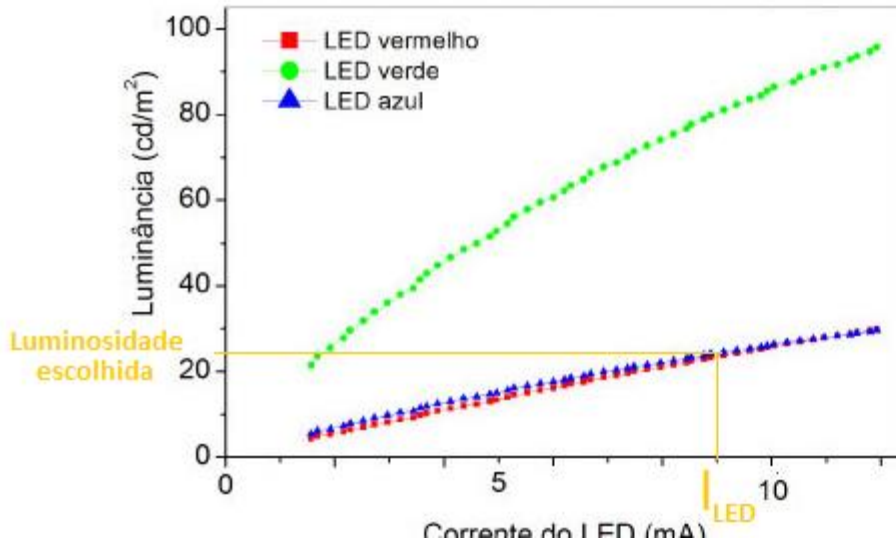
Configuração anodo comum:



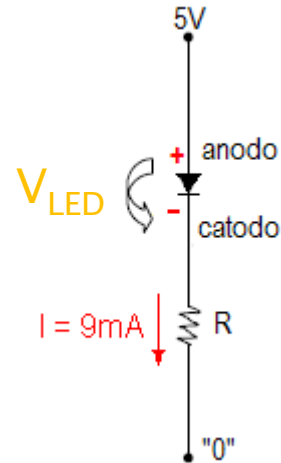
Ref fig http://www.ppgel.net.br/rabelo/ensino/sistemas_digitais1/aula%20pratica%20002.pdf

No experimento vamos utilizar um display anodo comum o qual acende os segmentos quando nos pinos do display for aplicado nível '0'

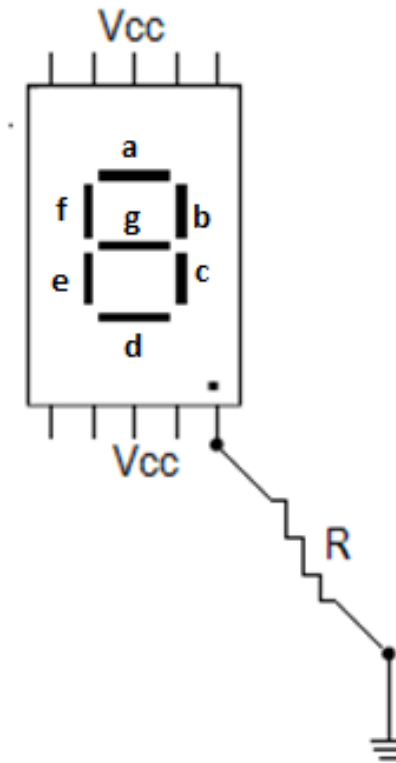
Cálculo do Resistor para ligação do display anodo comum



$$I_{LED} = 9\text{ mA} \quad \text{e}$$
$$V_{LED} = 2,1\text{ V}$$



Mapeamento dos segmentos do Display de 7 segmentos anodo comum

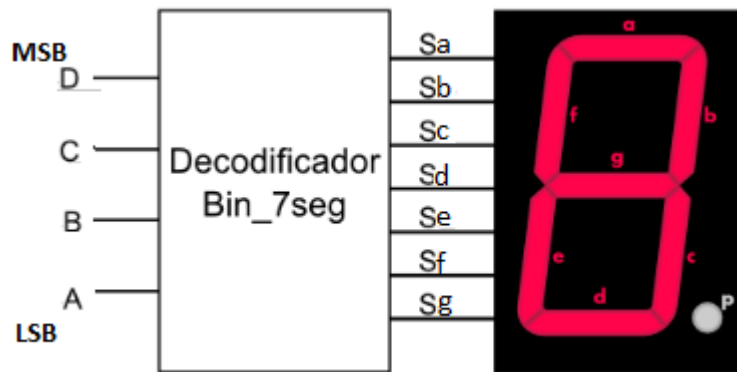


Mapeamento dos segmentos do Display de 7 segmentos

The image shows a screenshot of a circuit simulation software interface, likely Tinkercad, displaying a breadboard circuit. The circuit includes a 7-segment display, a microcontroller (ATTINY), and various passive components. A dropdown menu is open over the display, showing options for 'Fio' (Wire) and 'Cor' (Color) set to 'verde' (green). The interface includes a search bar, a component list, and a toolbar. A video call inset in the bottom right corner shows a woman with glasses, identified as Luiza Maria Romeiro Codá. The Windows taskbar at the bottom shows the date as 31/08/2020 and the time as 17:17.

Decodificador com Display de 7 segmentos

As entradas do segmentos do display recebem o sinal de um decodificador binário para 7 segmentos, a qual deve fornecer corrente suficiente para polarizar os LEDs e acender os segmentos corretos para representar os números referentes às entradas binárias.

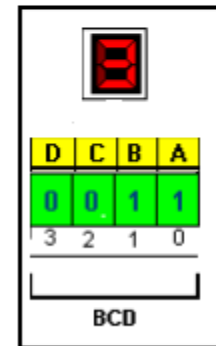
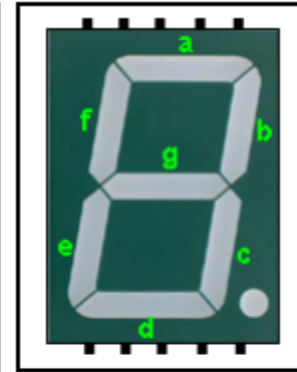


Ref fig <http://www.fpgaparatodos.com.br/>

Decodificação de display de 7 segmentos anodo comum

- ▶ *Entradas binárias e números decimais apresentados no display*

entradas BCD				segmentos de saída							DISPLAY
D	C	B	A	a	b	c	d	e	f	g	
0	0	0	0	0	0	0	0	0	0	1	0
0	0	0	1	1	0	0	1	1	1	1	1
0	0	1	0	0	0	1	0	0	1	0	0
0	0	1	1	0	0	0	0	1	1	0	0
0	1	0	0	1	0	0	1	1	0	0	0
0	1	0	1	0	1	0	0	1	0	0	0
0	1	1	0	0	1	0	0	0	0	0	0
0	1	1	1	0	0	0	1	1	1	1	1
1	0	0	0	0	0	0	0	0	0	0	0
1	0	0	1	0	0	0	0	1	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1

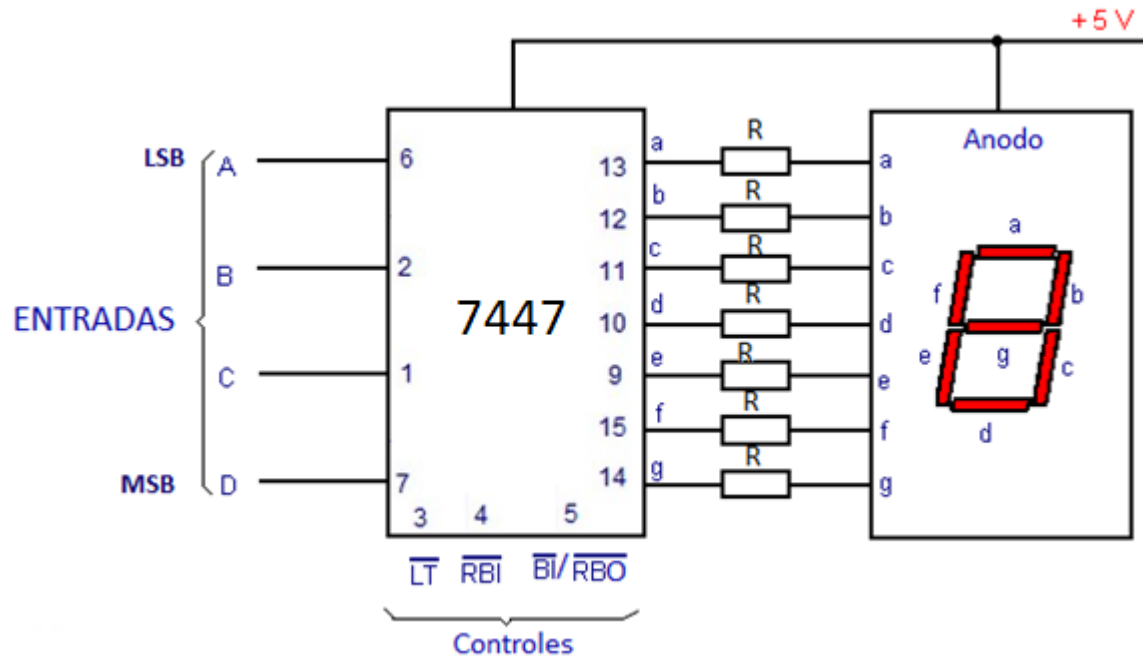


Para este decodificador as demais combinações de entrada mostram os segmentos apagados (11111111)

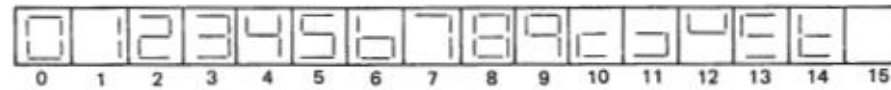
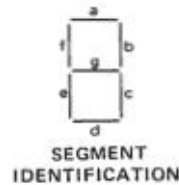
Ref fig http://www.ppgel.net.br/rabelo/ensino/sistemas_digitais1/aula%20pratica%2002.pdf

Decodificador BCD para 7 segmentos:

- 7447 é um CI coletor aberto com 4 entradas BCD e saídas para serem interligadas com um display de 7 segmentos anodo comum;
- O 7447 apresenta três entradas de controle que devem ser ligadas adequadamente para o perfeito funcionamento
- O resistor R é ligado entre a saída do decodificador e as entradas do display, com valor adequado para que a corrente seja suficiente para acender os segmentos.



Decodificador 7447: BCD para display de 7 seg. anodo comum



NUMERICAL DESIGNATIONS AND RESULTANT DISPLAYS

'46A, '47A, 'LS47 FUNCTION TABLE (T1)

DECIMAL OR FUNCTION	INPUTS						$\overline{\text{BI}}/\overline{\text{RBO}}^\dagger$	OUTPUTS							NOTE
	$\overline{\text{LT}}$	$\overline{\text{RBI}}$	D	C	B	A		a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	ON	ON	ON	ON	ON	ON	OFF	1
1	H	X	L	L	L	H	H	OFF	ON	ON	OFF	OFF	OFF	OFF	
2	H	X	L	L	H	L	H	ON	ON	OFF	ON	ON	OFF	ON	
3	H	X	L	L	H	H	H	ON	ON	ON	ON	OFF	OFF	ON	
4	H	X	L	H	L	L	H	OFF	ON	ON	OFF	OFF	ON	ON	
5	H	X	L	H	L	H	H	ON	OFF	ON	ON	OFF	ON	ON	
6	H	X	L	H	H	L	H	OFF	OFF	ON	ON	ON	ON	ON	
7	H	X	L	H	H	H	H	ON	ON	ON	OFF	OFF	OFF	OFF	
8	H	X	H	L	L	L	H	ON	ON	ON	ON	ON	ON	ON	
9	H	X	H	L	L	H	H	ON	ON	ON	OFF	OFF	ON	ON	
10	H	X	H	L	H	L	H	OFF	OFF	OFF	ON	ON	OFF	ON	
11	H	X	H	L	H	H	H	OFF	OFF	ON	ON	OFF	OFF	ON	
12	H	X	H	H	L	L	H	OFF	ON	OFF	OFF	OFF	ON	ON	
13	H	X	H	H	L	H	H	ON	OFF	OFF	ON	OFF	ON	ON	
14	H	X	H	H	H	L	H	OFF	OFF	OFF	ON	ON	ON	ON	
15	H	X	H	H	H	H	H	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
BI	X	X	X	X	X	X	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	2
RBI	H	L	L	L	L	L	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	3
LT	L	X	X	X	X	X	H	ON	ON	ON	ON	ON	ON	ON	4

H = high level, L = low level, X = irrelevant

- NOTES:
1. The blanking input ($\overline{\text{BI}}$) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input ($\overline{\text{RBI}}$) must be open or high if blanking of a decimal zero is not desired.
 2. When a low logic level is applied directly to the blanking input ($\overline{\text{BI}}$), all segment outputs are off regardless of the level of any other input.
 3. When ripple-blanking input ($\overline{\text{RBI}}$) and inputs A, B, C, and D are at a low level with the lamp test input high, all segment outputs go off and the ripple-blanking output ($\overline{\text{RBO}}$) goes to a low level (response condition).
 4. When the blanking input/ripple blanking output ($\overline{\text{BI}}/\overline{\text{RBO}}$) is open or held high and a low is applied to the lamp-test input, all segment outputs are on.

$^\dagger \overline{\text{BI}}/\overline{\text{RBO}}$ is wire AND logic serving as blanking input ($\overline{\text{BI}}$) and/or ripple-blanking output ($\overline{\text{RBO}}$).

Decodificador 7447: BCD para display de 7 seg. anodo comum

LT(Lamp Test): quando em nível baixo testa todos os segmentos

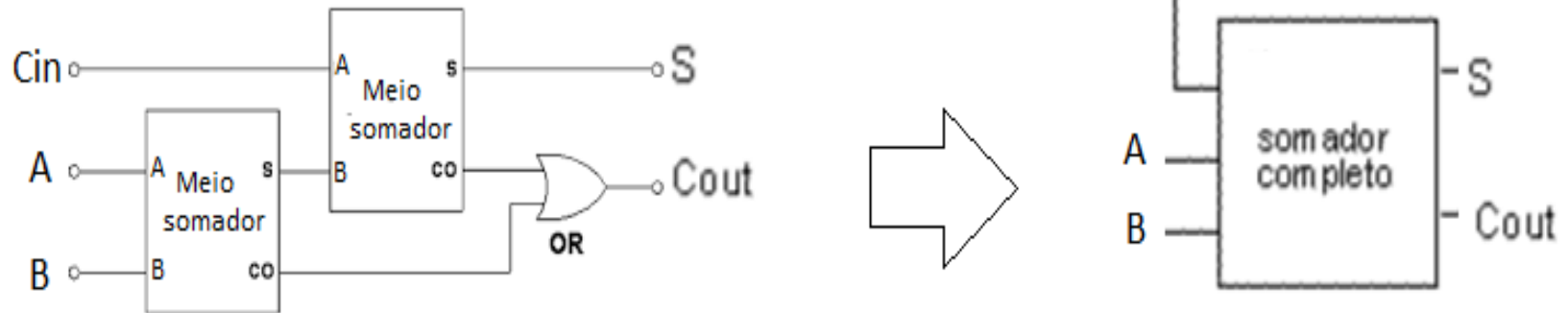
RBI (Ripple Blanking Input): quando em nível baixo apaga o display quando as entradas forem zero

BI/RBO (Blanking Input/ Ripple Blanking Output) : quando em nível baixo apaga o display, independente do valor das entradas e serve como saída para transmitir esse sinal para outros displays.

Somador Completo de 1 bit:

Um somador completo de 1 bit soma 2 bits de cada palavra (palavra A e palavra B) com um carry inicial (Cin), e o resultado é obtido na saída S e o carry final em Cout

A



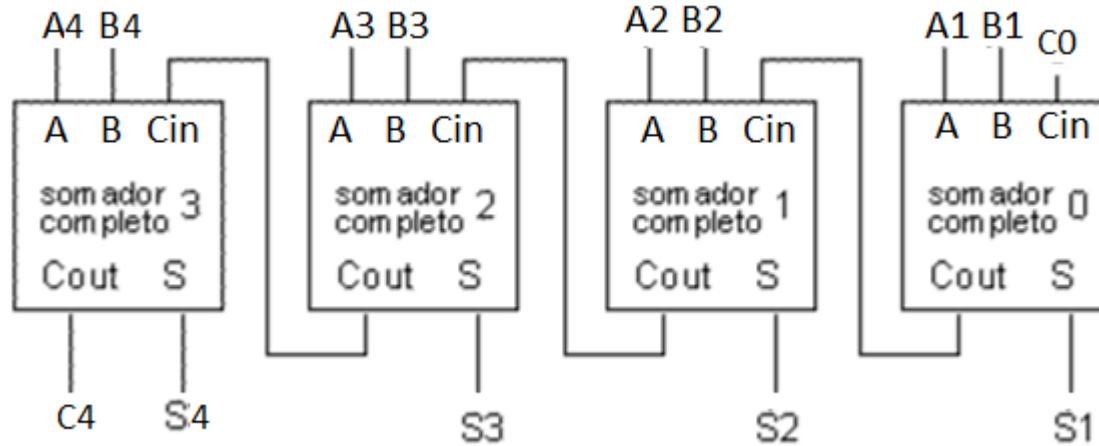
Carry inicial ("0" ou "1") \Rightarrow **Cin** +

Palavra A de 1 bit \Rightarrow **A** +

Palavra B de 1 bit \Rightarrow **B**

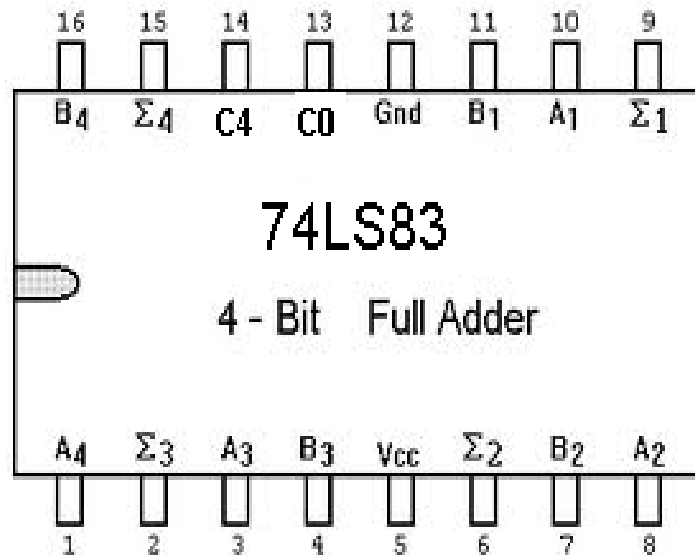
Cout **S** \leftarrow Resultado (2 bits)

Somador Completo de 4 bits:



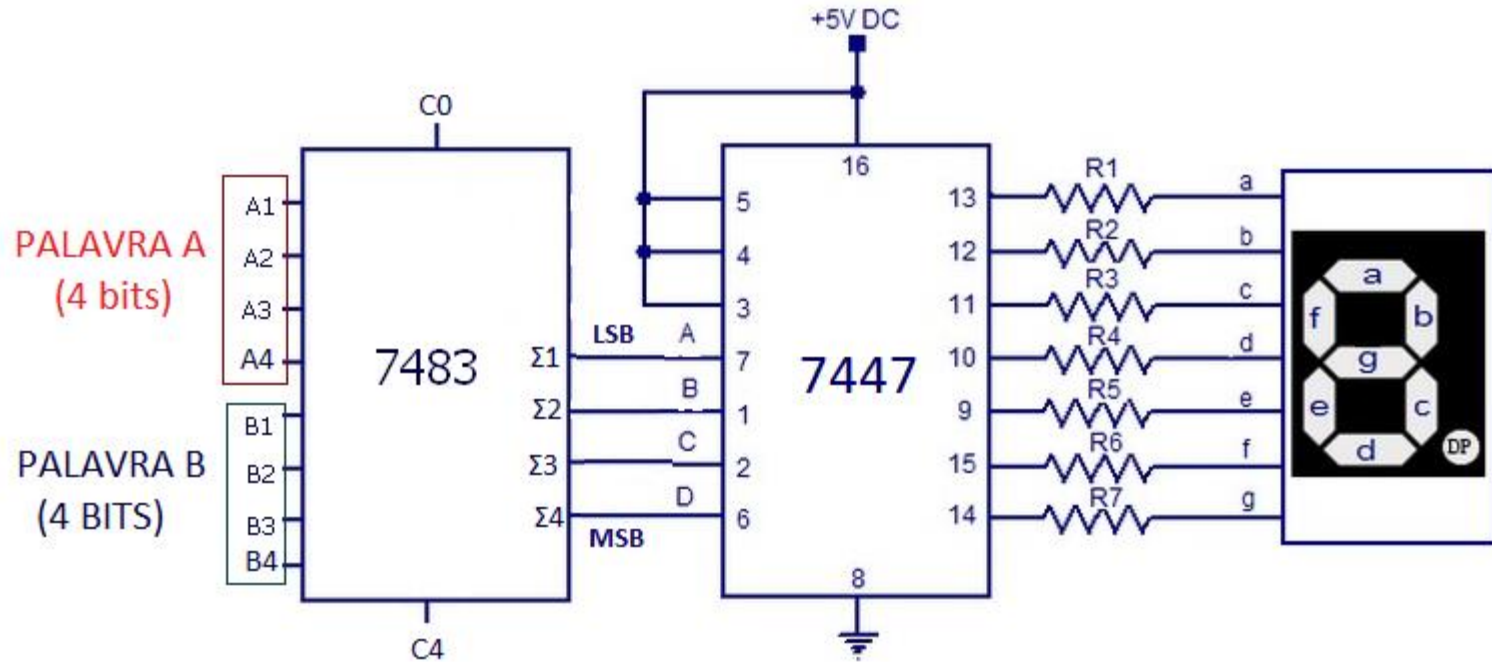
$$\begin{array}{r}
 \text{Palavra A} \\
 \text{Palavra B} \\
 \hline
 \begin{array}{r}
 C_0 + \\
 A_4 \ A_3 \ A_2 \ A_1 \\
 B_4 \ B_3 \ B_2 \ B_1 \\
 \hline
 C_4 \ S_4 \ S_3 \ S_2 \ S_1
 \end{array}
 \end{array}$$

7483: Somador Completo de 4 bits:

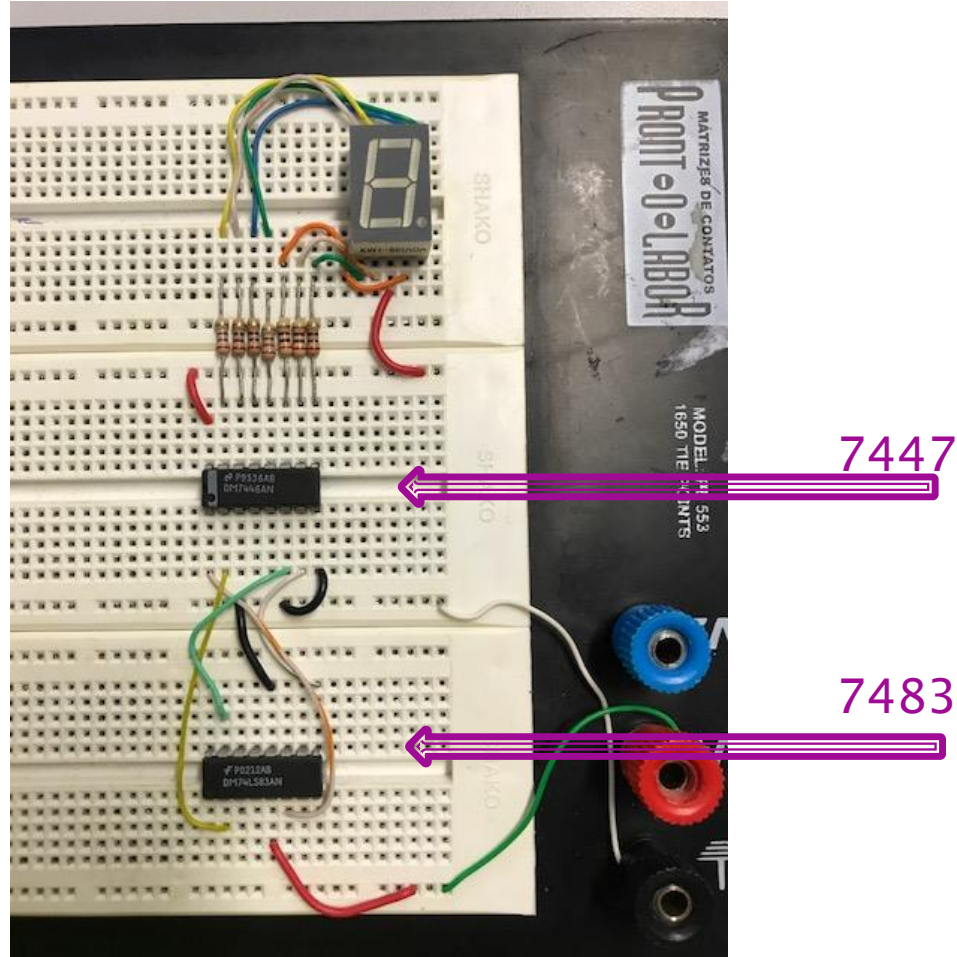


$$\begin{array}{r} + C_0 \\ + \left(\begin{array}{cccc} A_4 & A_3 & A_2 & A_1 \\ B_4 & B_3 & B_2 & B_1 \end{array} \right) \\ \hline C_4 \quad \Sigma_4 \quad \Sigma_3 \quad \Sigma_2 \quad \Sigma_1 \end{array}$$

Somador , decodificador e display



Circuito Somador , decodificador e display no protoboard



Circuito Somador , decodificador e display no módulo de Montagem

autores alunas: Daniela Miura Tamiya e Karina Yumi da Cruz

