

# Contadores assíncronos

Circuitos Digitais II  
Prof. Fernando Passold

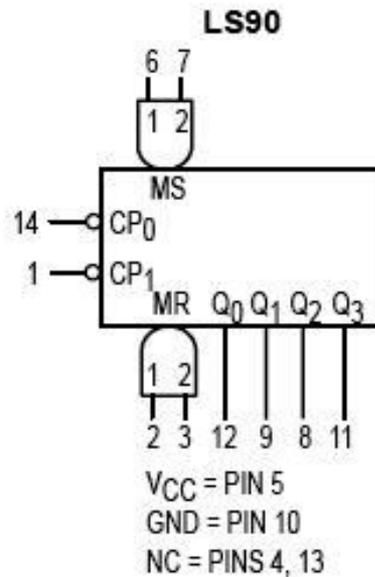


7490,7492, 7493

# CONTADORES INTEGRADOS

# Contadores Assíncronos Integrados

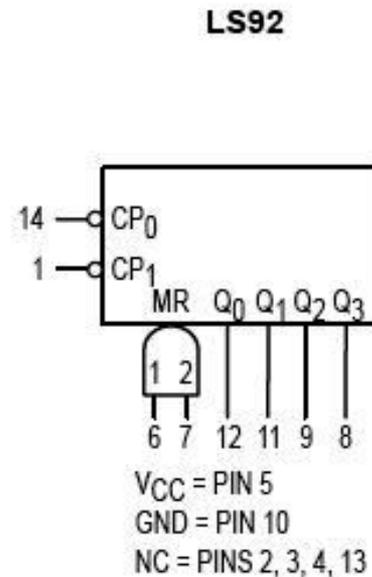
- CI 7490:  $\div 2$  e  $\div 5$ ;
- CI 7492:  $\div 2$  e  $\div 6$ ;
- CI 7493:  $\div 2$  e  $\div 8$ ;



**LS90  
BCD COUNT SEQUENCE**

COUNT	OUTPUT			
	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H

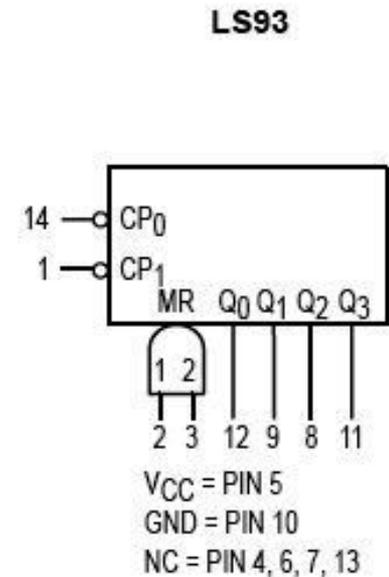
NOTE: Output Q<sub>0</sub> is connected to Input CP<sub>1</sub> for BCD count.



**LS92  
TRUTH TABLE**

COUNT	OUTPUT			
	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	L	L	H
7	H	L	L	H
8	L	H	L	H
9	H	H	L	H
10	L	L	H	H
11	H	L	H	H

NOTE: Output Q<sub>0</sub> is connected to Input CP<sub>1</sub>.



**LS93  
TRUTH TABLE**

COUNT	OUTPUT			
	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H
10	L	H	L	H
11	H	H	L	H
12	L	L	H	H
13	H	L	H	H
14	L	H	H	H
15	H	H	H	H

NOTE: Output Q<sub>0</sub> is connected to Input CP<sub>1</sub>.

# CI 7490 ( $\div 2$ e $\div 5$ )

Pinagem:

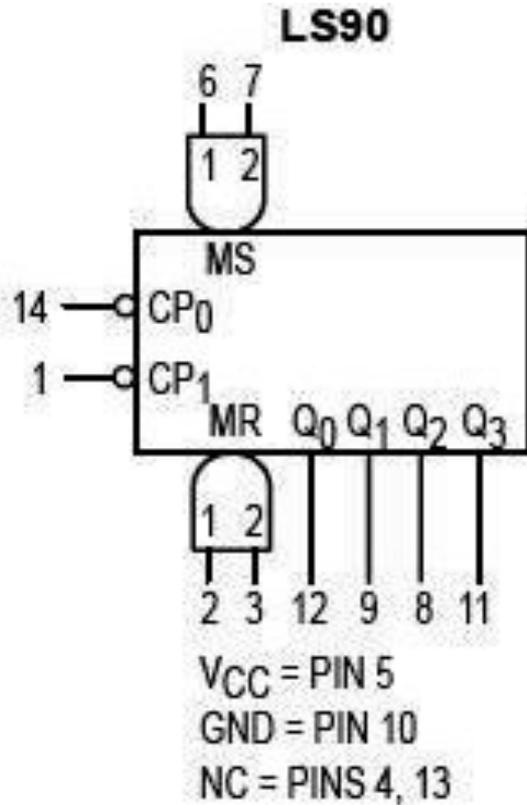
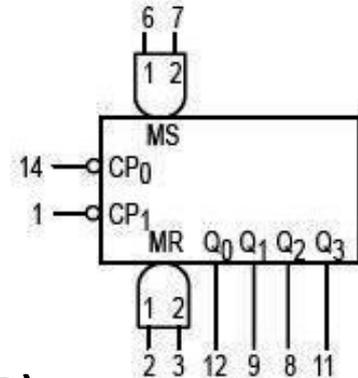


Tabela Verdade:

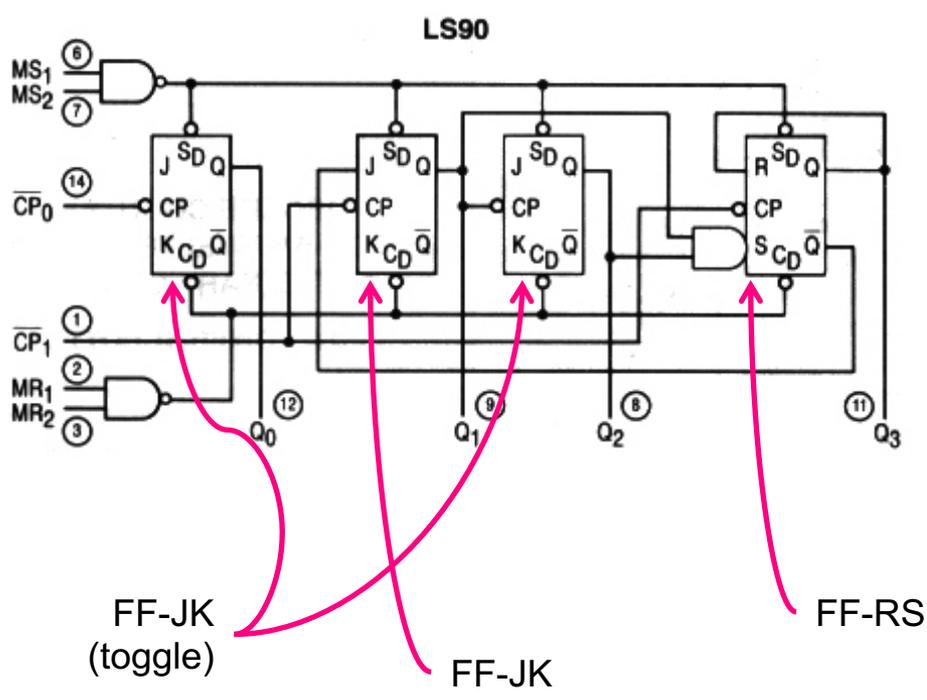
Set/Reset Inputs				Outputs			
MR1	MR2	MS1	MS2	Q3	Q2	Q1	Q0
H	H	L	X	L	L	L	L
H	H	X	L	L	L	L	L
X	X	H	H	H	L	L	H
X	L	X	L	COUNT			
L	X	L	X	COUNT			
L	X	X	L	COUNT			
X	L	L	X	COUNT			

H = HIGH Level  
L = LOW Level  
X = Don't Care

# CI 7490 ( $\div 2$ e $\div 5$ )



## Circuito Interno:



## Seqüência de contagem (BCD):

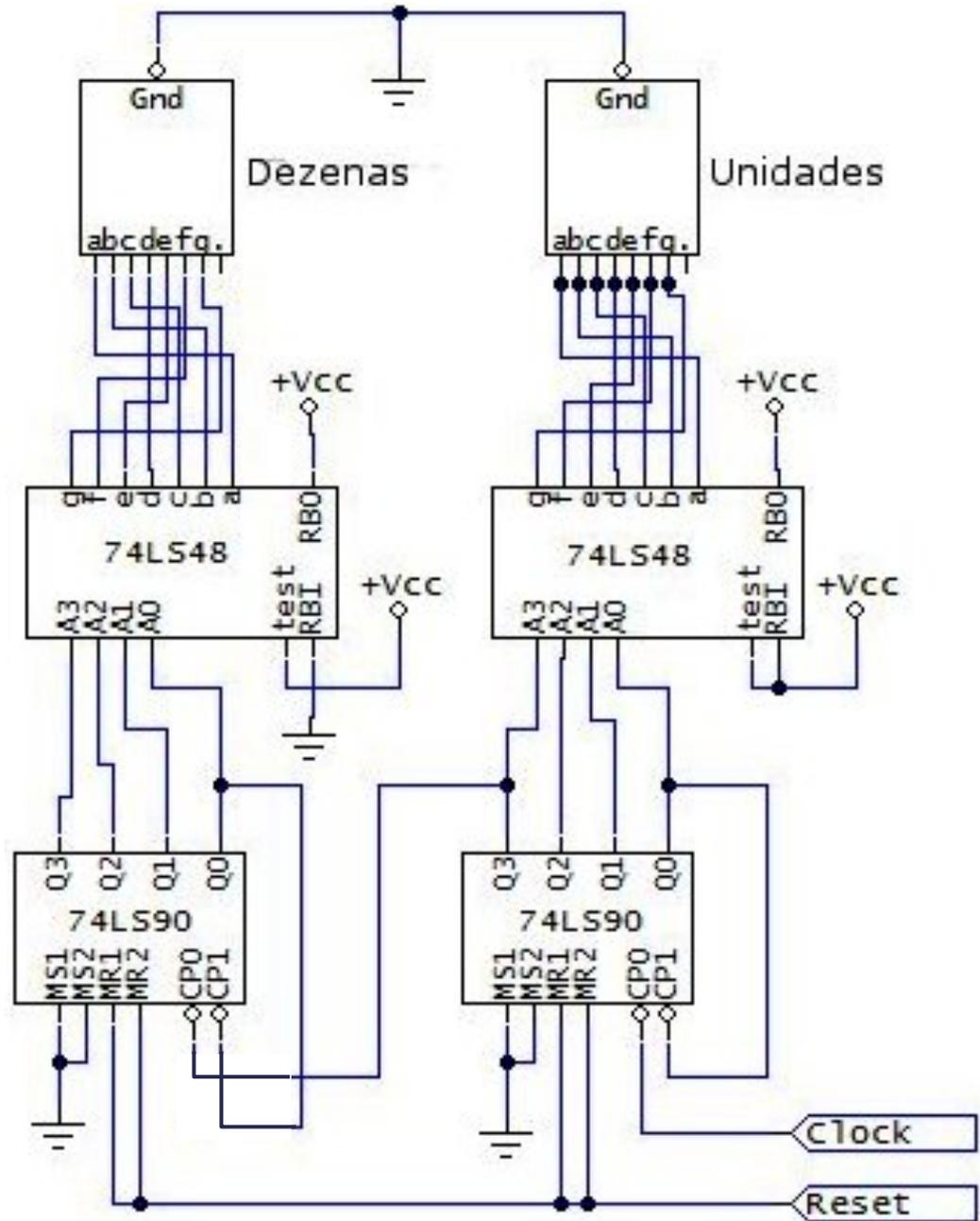
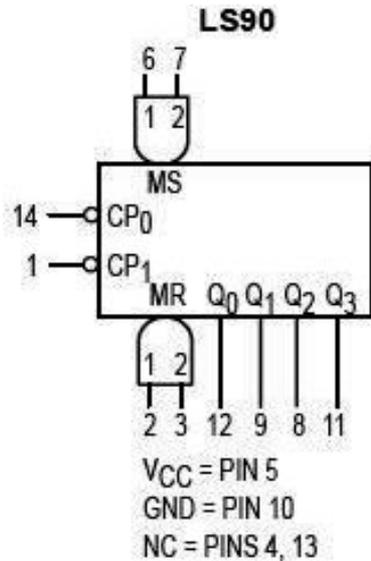
**LS90**  
**BCD COUNT SEQUENCE**

COUNT	OUTPUT			
	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H

**NOTE:** Output Q<sub>0</sub> is connected to Input CP<sub>1</sub> for BCD count.

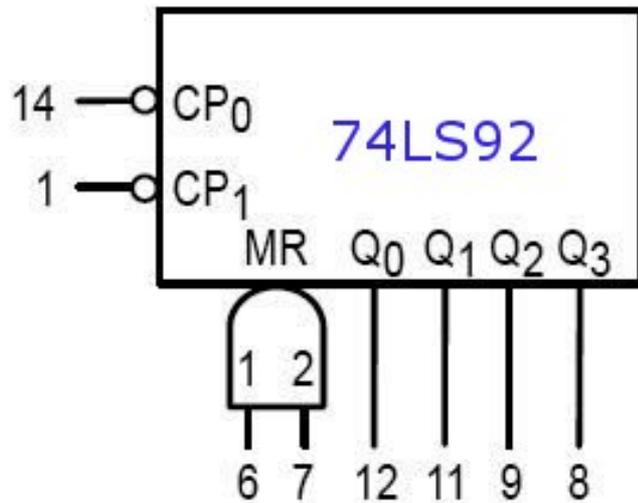
# CI 7490 ( $\div 2$ e $\div 5$ ) Exemplo de uso...

Contador BCD de 0 à 99:



# CI 7492 ( $\div 2$ e $\div 6$ )

## Pinagem:



V<sub>CC</sub> = PIN 5

GND = PIN 10

NC = PINS 2, 3, 4, 13

## Tabela Verdade:

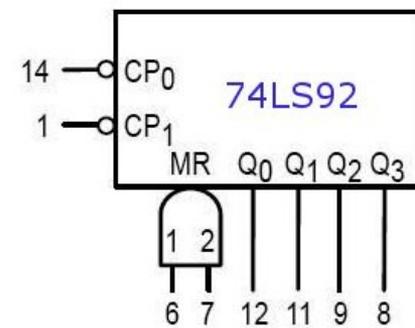
RESET INPUTS		OUTPUTS			
MR <sub>1</sub>	MR <sub>2</sub>	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>
H	H	L	L	L	L
L	H		Count		
H	L		Count		
L	L		Count		

H = HIGH Voltage Level

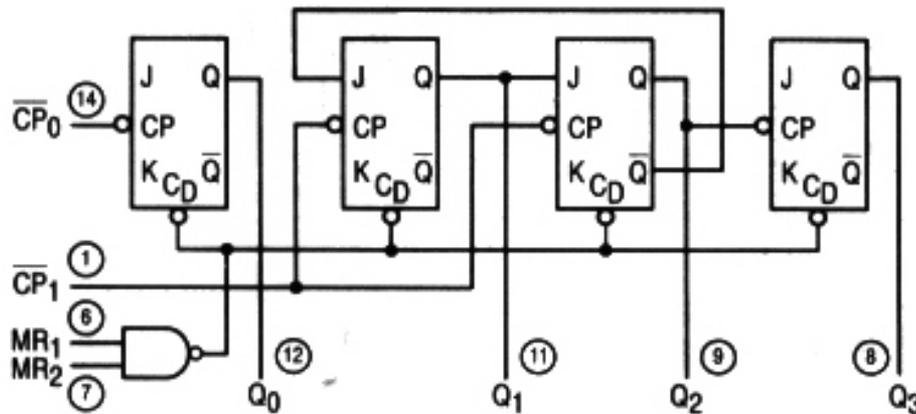
L = LOW Voltage Level

X = Don't Care

# CI 7492 ( $\div 2$ e $\div 6$ )



## Circuito interno:



## Seqüência de contagem:

COUNT	OUTPUT				Saída Decimal da Contagem
	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	
0	L	L	L	L	0
1	H	L	L	L	1
2	L	H	L	L	2
3	H	H	L	L	3
4	L	L	H	L	4
5	H	L	H	L	5
6	L	L	L	H	8
7	H	L	L	H	9
8	L	H	L	H	10
9	H	H	L	H	11
10	L	L	H	H	12
11	H	L	H	H	13

NOTE: Output Q<sub>0</sub> is connected to Input CP<sub>1</sub>.

Os divisores podem ser ligados de forma a se obter um **divisor por 12** na saída Q<sub>3</sub>. Para isto, a saída Q<sub>0</sub> deve ser ligada externamente à entrada /CP<sub>0</sub> e o sinal externo de clock deve ser ligado à /CP<sub>0</sub>.

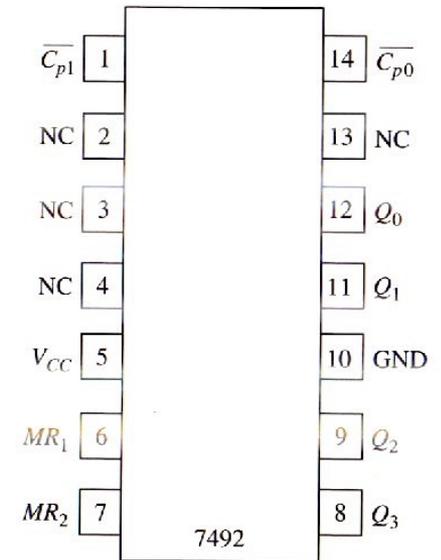
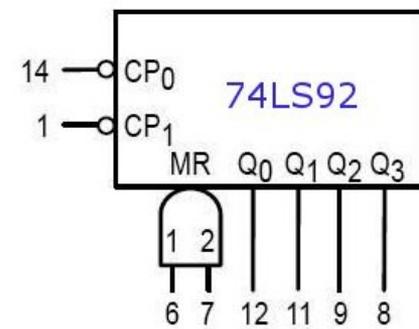
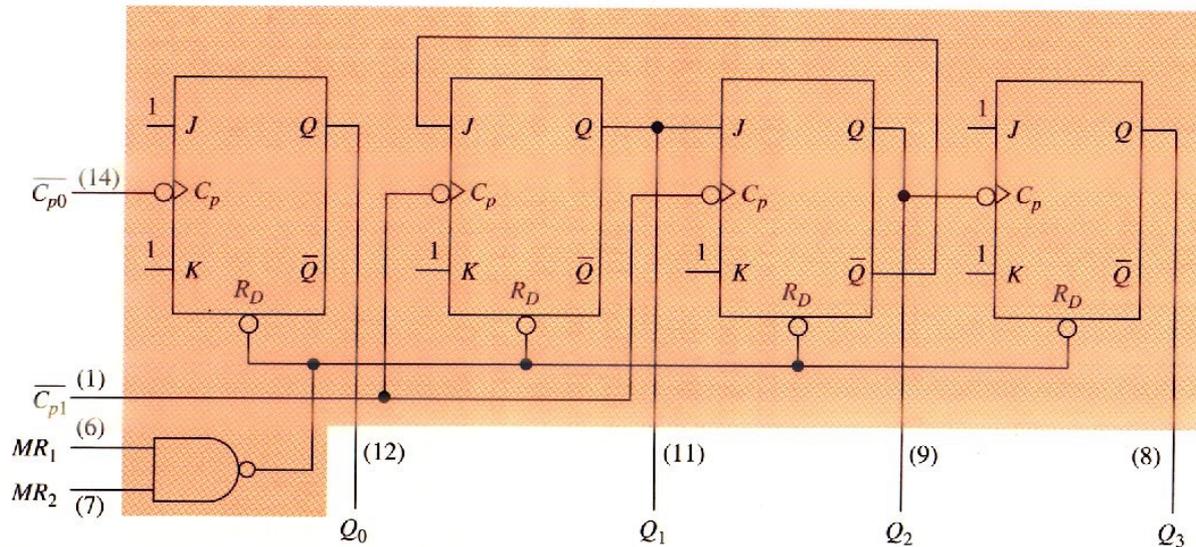
# CI 7492 ( $\div 2$ e $\div 6$ )

## Blocos internos:

( ) = pin numbers

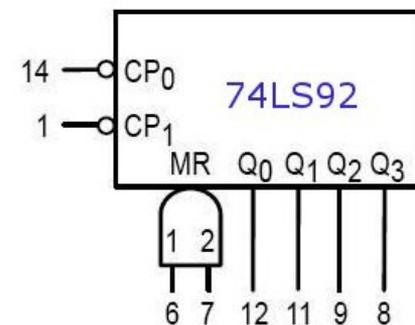
$V_{CC}$  = pin 5

GND = pin 10

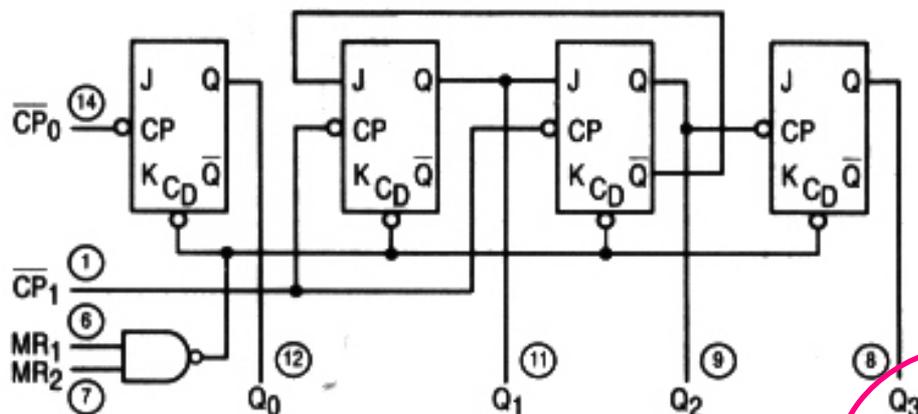


Os divisores podem ser ligados de forma a se obter um divisor por 12 na saída  $Q_D$ . Para isto, a saída  $Q_A$  deve ser ligada externamente à entrada B e o sinal externo de clock deve ser ligado à A.

# CI 7492 ( $\div 2$ e $\div 6$ )



## Circuito interno:



## Seqüência de contagem:

COUNT	OUTPUT				Saída Decimal da Contagem
	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	
0	L	L	L	L	0
1	H	L	L	L	1
2	L	H	L	L	2
3	H	H	L	L	3
4	L	L	H	L	4
5	H	L	H	L	5
6	L	L	L	H	8
7	H	L	L	H	9
8	L	H	L	H	10
9	H	H	L	H	11
10	L	L	H	H	12
11	H	L	H	H	13

Atenção: "Salto" (fora da seq. Binária)

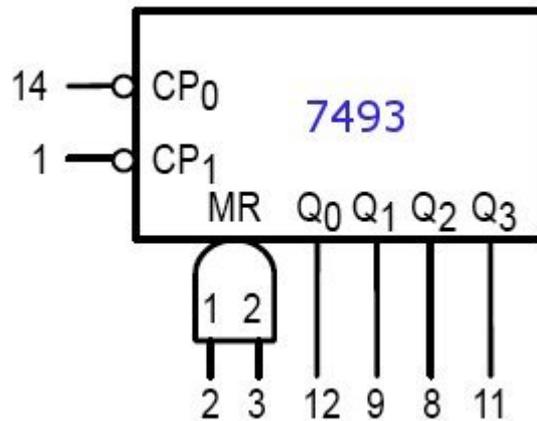
NOTE: Output Q<sub>0</sub> is connected to Input CP<sub>1</sub>.

**Atenção:** para a seqüência de contagem do 7492, quando em modo divisor por 12, a cada 12 pulsos de *clock* na entrada externa *clock* (entrada A), o contador executa a seqüência:

**0, 1, 2, 4, 4, 5, 8, 9, 10, 11, 12 e 13** (note a ausência dos estados 6 e 7) e depois disto, retorna ao estado inicial.

# CI 7493 ( $\div 2$ e $\div 8$ )

**Pinagem:**

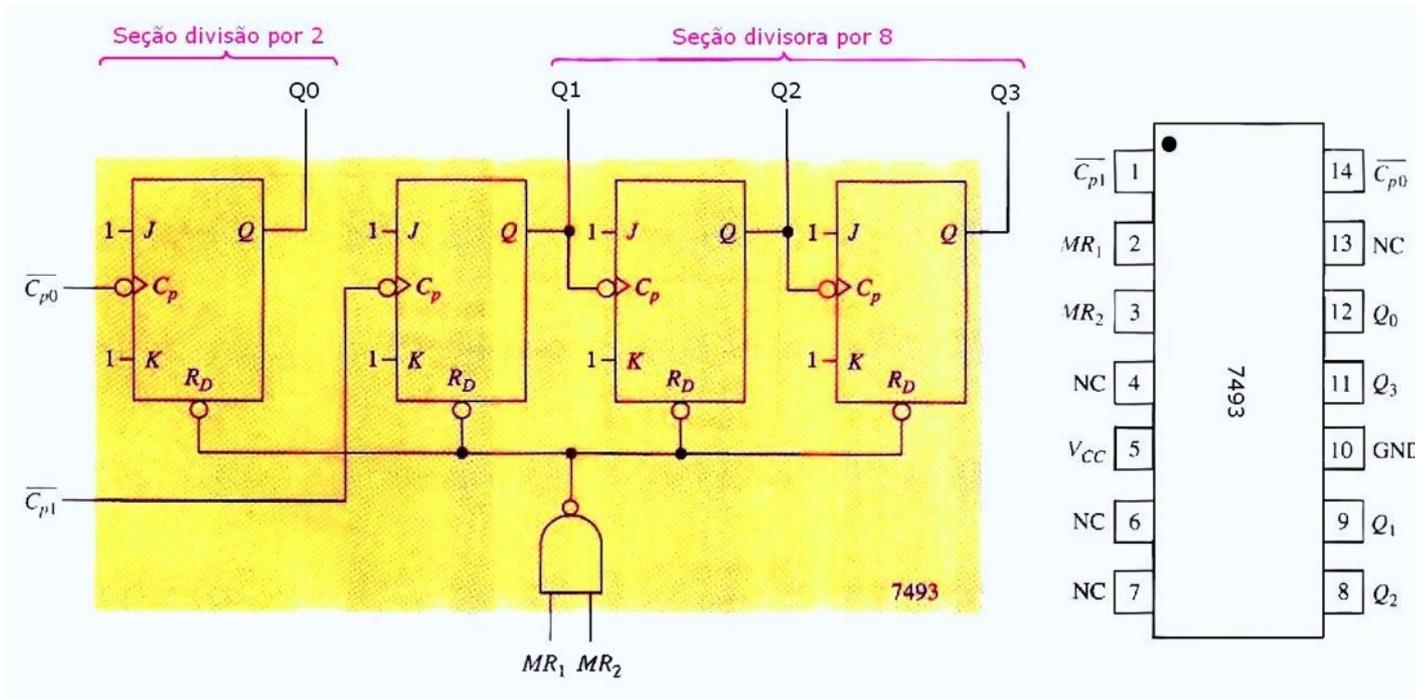


**Tabela Verdade:**

Os divisores podem ser ligados de forma a se obter um **divisor por 16** na saída Q<sub>D</sub>. Para isto, a saída Q<sub>A</sub> deve ser ligada externamente à entrada B e o sinal externo de *clock* deve ser ligado à A.

# CI 7493 ( $\div 2$ e $\div 8$ )

## Blocos internos:



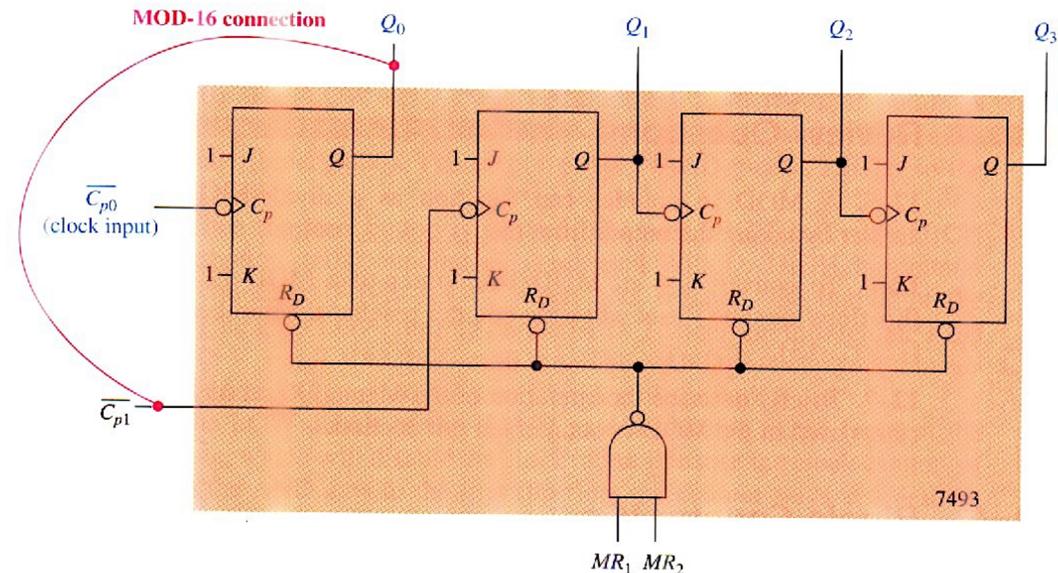
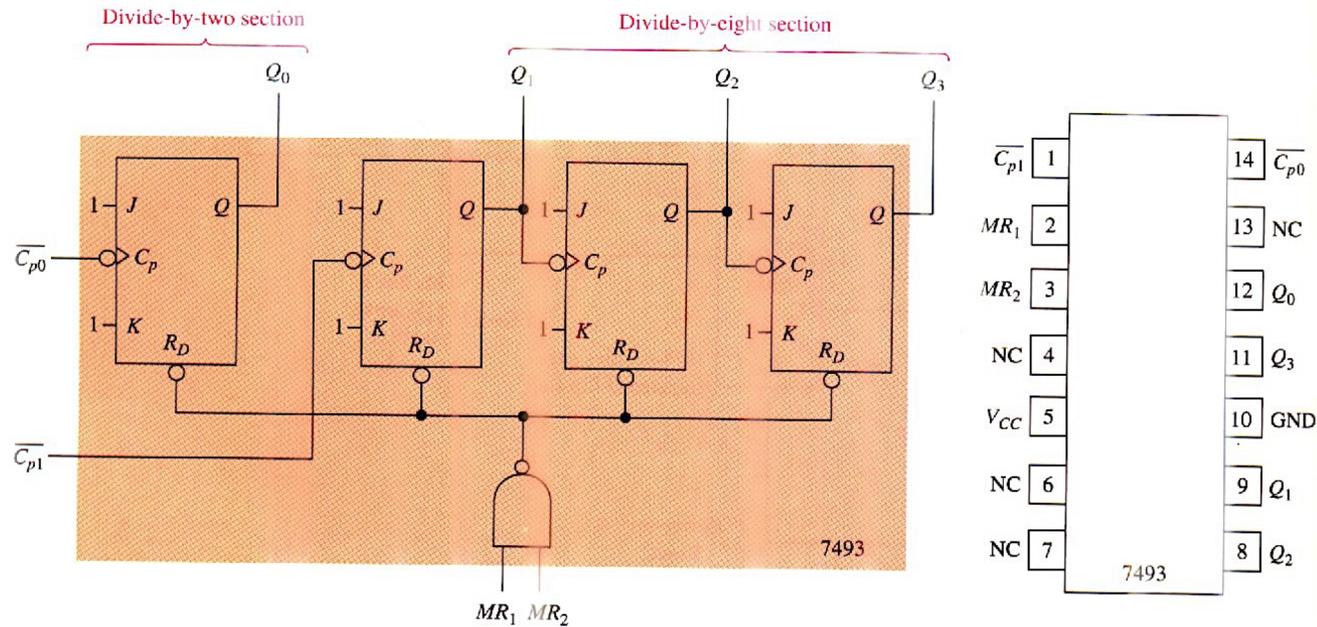
Os divisores podem ser ligados de forma a se obter um **divisor por 16** na saída Q<sub>D</sub>. Para isto, a saída Q<sub>A</sub> deve ser ligada externamente à entrada B e o sinal externo de *clock* deve ser ligado à A.

# CI 7493

## ( $\div 2$ e $\div 8$ )

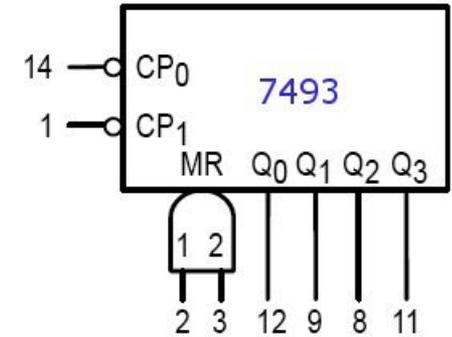
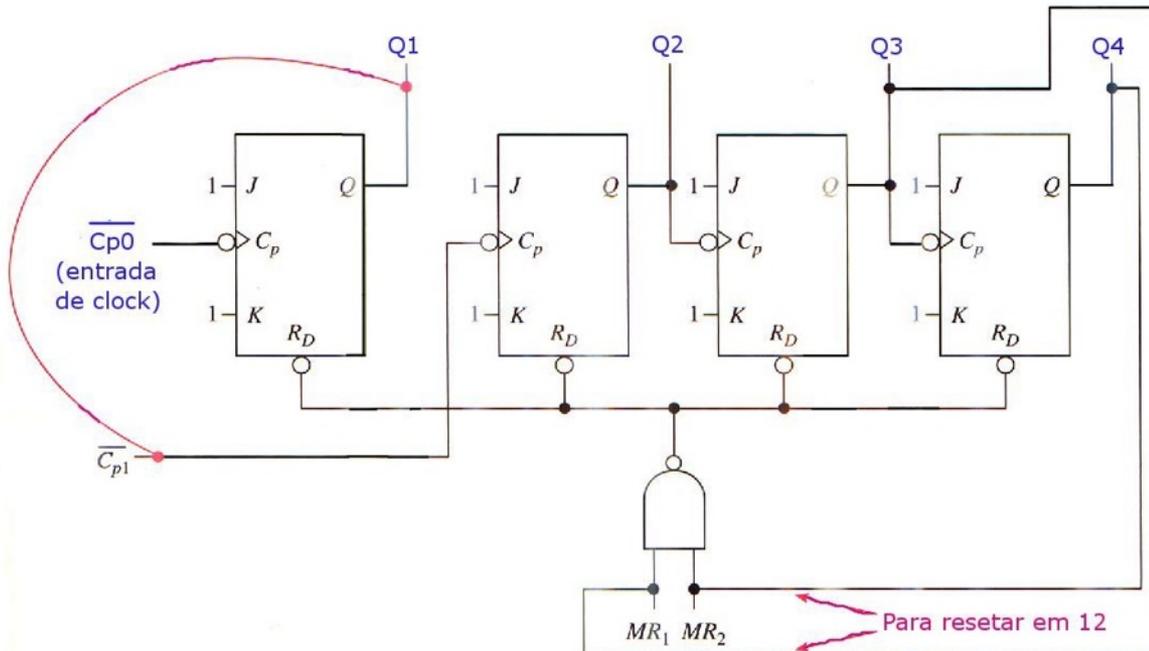
### Uso:

Os divisores podem ser ligados de forma a se obter um **divisor por 16** na saída  $Q_D$ . Para isto, a saída  $Q_A$  deve ser ligada externamente à entrada B e o sinal externo de *clock* deve ser ligado à A.



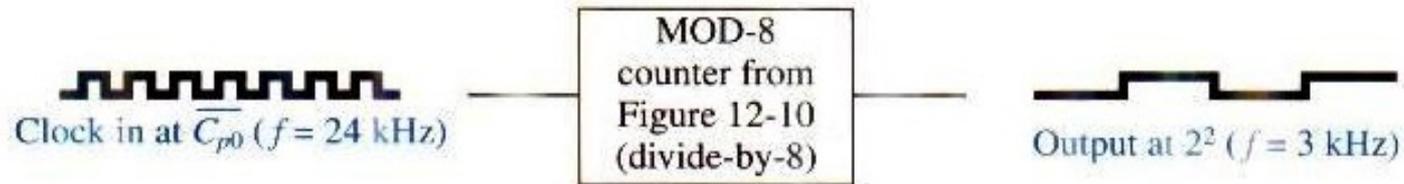
# Exemplo

Contador de **módulo-12** usando CI 7493 ( $\div 2$  e  $\div 8$ )



$$12_{(10)} = 1100_{(2)}$$

# Projeto de contadores de módulo- $n$

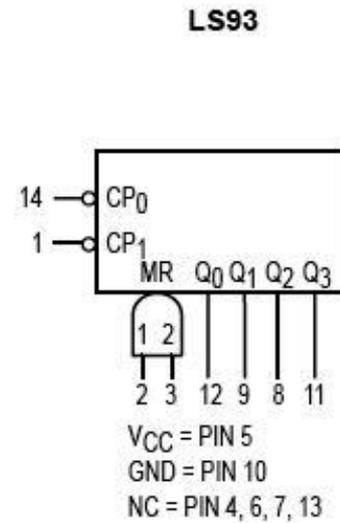
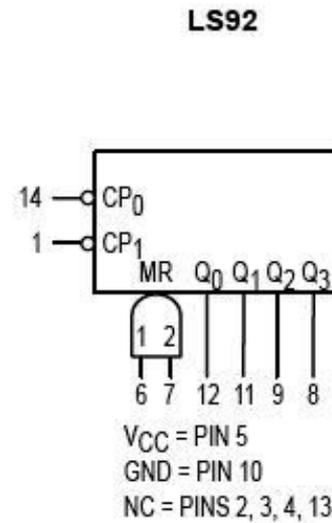
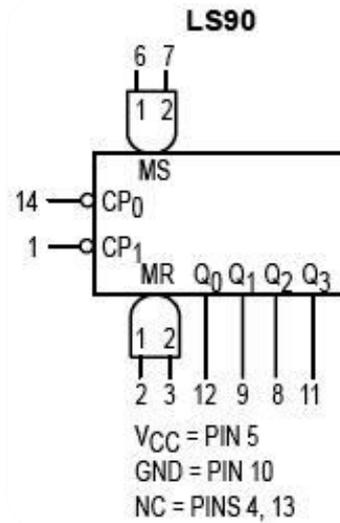


# Exercícios:

- Ex<sub>1</sub>: Circuito divisor de frequência por 100 usando 2 CIs 7490.
- Ex<sub>2</sub>: Circuito divisor de frequência por 42:

Solução a) Usando CI 7490:

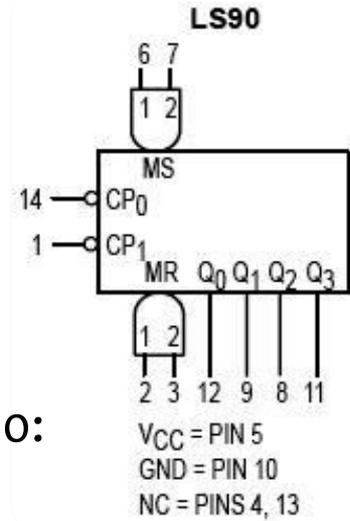
Solução b) Usando CI 7493:



# Exercícios:

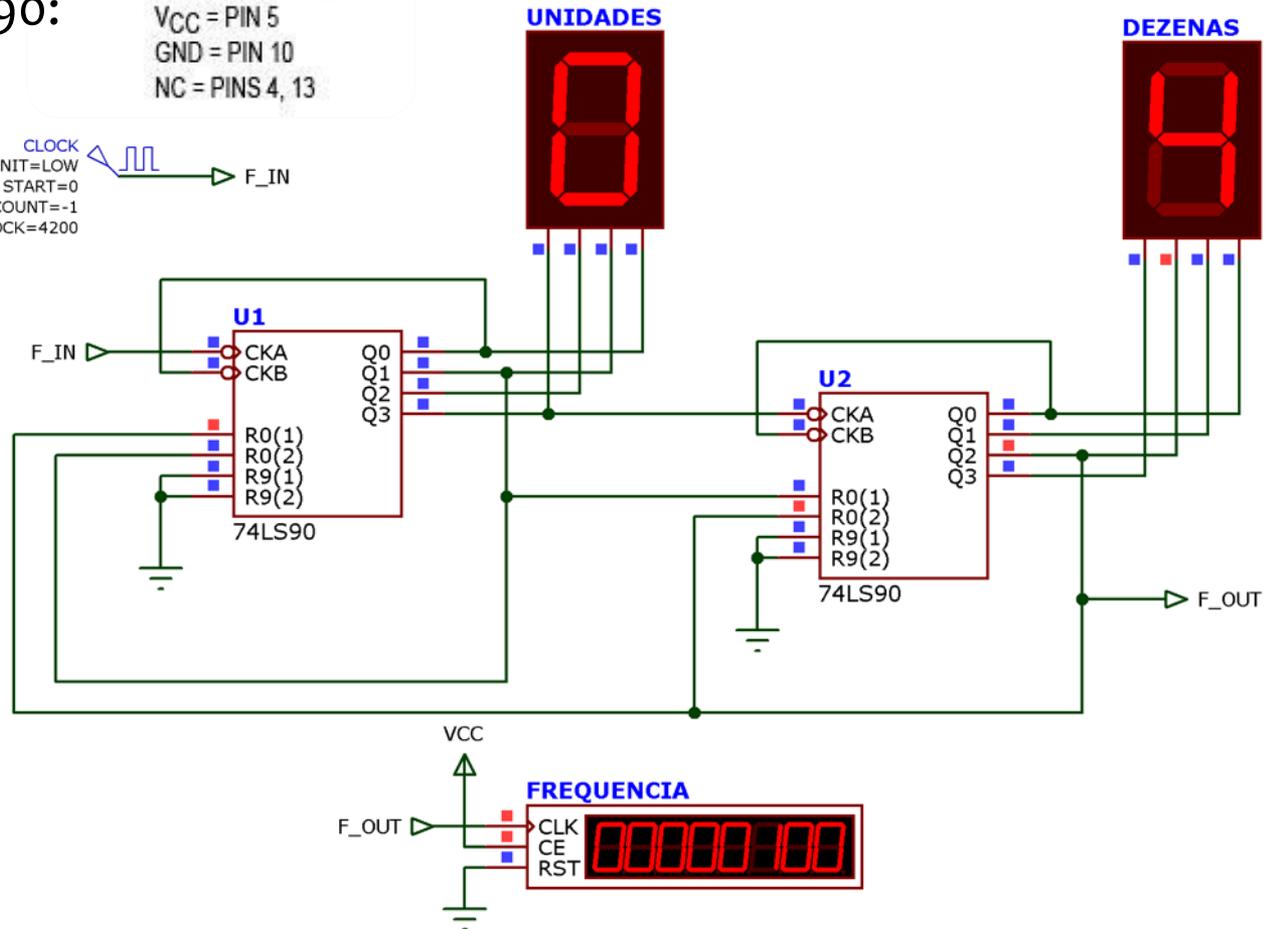
- Ex<sub>2</sub>: Circuito divisor de frequência por 42:

Solução a) Usando CI 7490:



CLOCK  
INIT=LOW  
START=0  
COUNT=-1  
CLOCK=4200

F\_IN



Note:

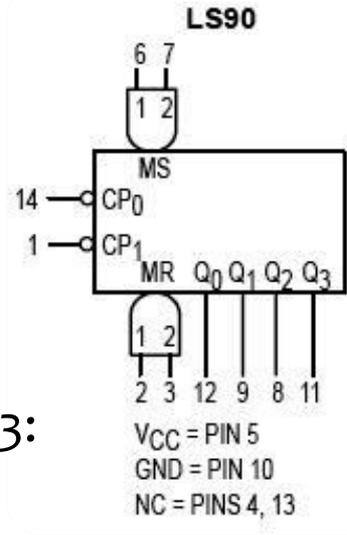
DEZ(U2) UNID(U1)

$$42_{(10)} = 0100 \mid 0010_{(2,BCD)}$$

# Exercícios:

- Ex<sub>2</sub>: Circuito divisor de frequência por 42:

Solução a) Usando CI 7493:



CLOCK  
INIT=LOW  
START=0  
COUNT=-1  
CLOCK=4200

F\_IN

LSD

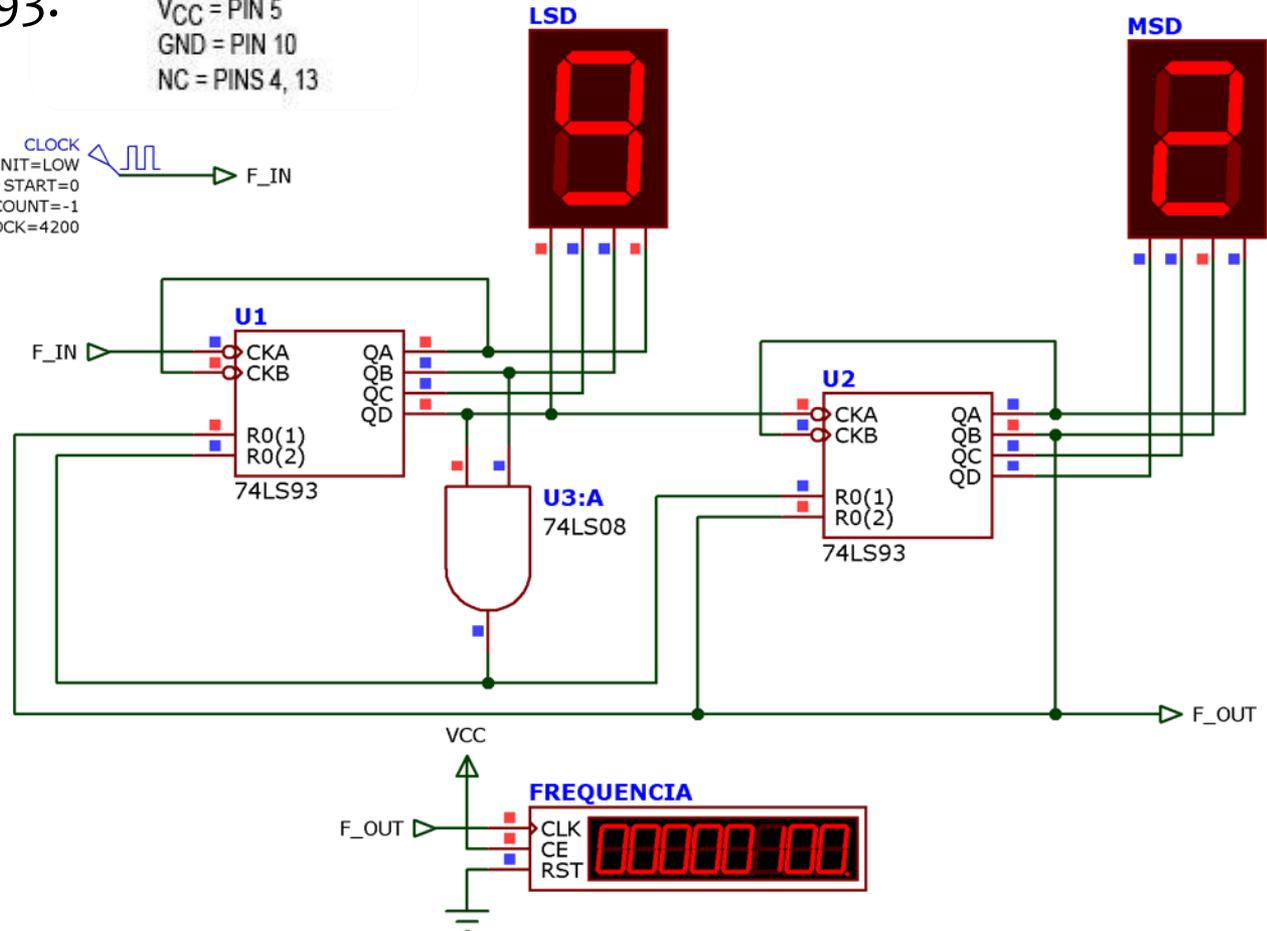
MSD

Note:

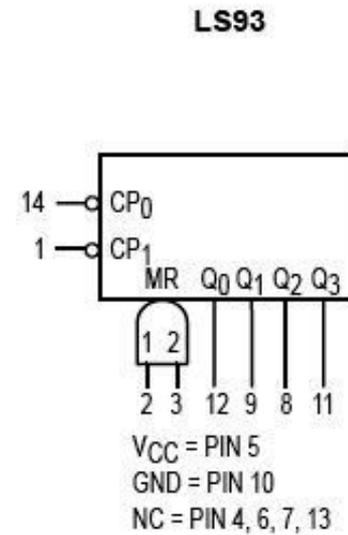
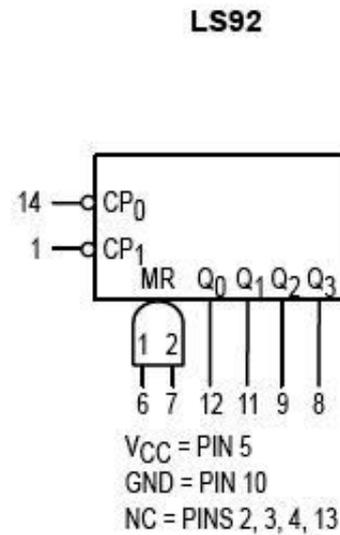
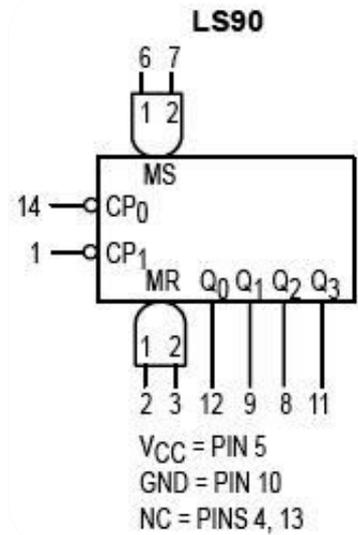
Nible Superior	Nible Inferior
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$42_{(10)} = 0100 : 0010_{(2)}$

$$\begin{array}{r} 42 \overline{) 16} \rightarrow 42_{(10)} = 2A_{(16)} \\ -32 \phantom{00} \\ \hline 10 \\ A \end{array} \quad = 0100:1010_{(2)}$$



# Exercícios:



- Ex<sub>3</sub>: Circuito divisor por 7 usando CI 7492 ( $\div 2$  e  $\div 6$ ).

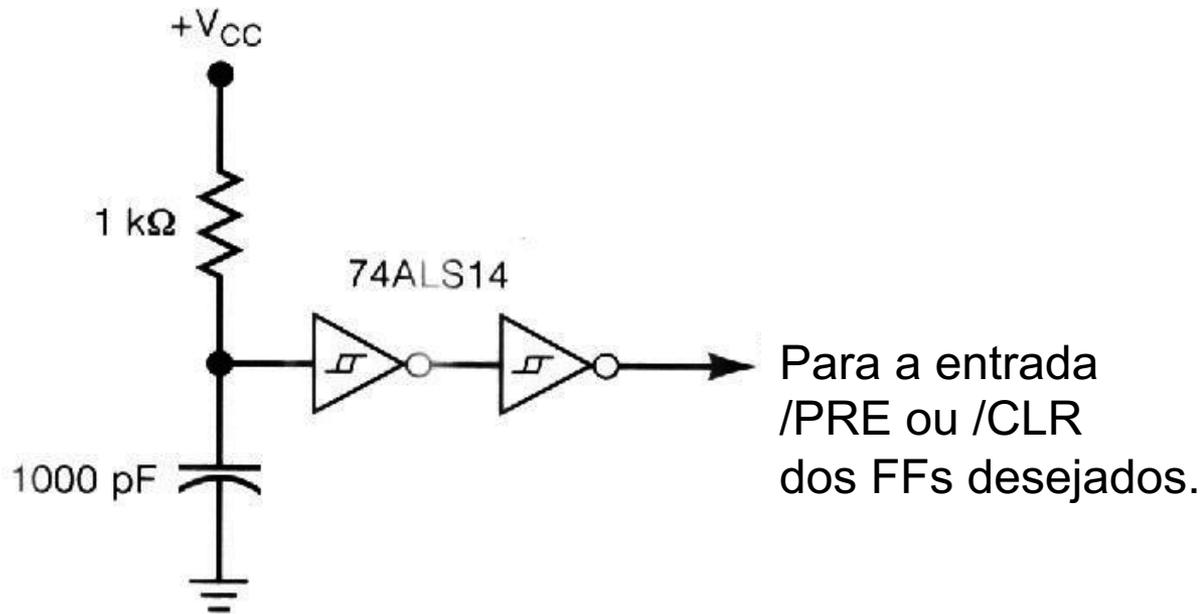
- Ex<sub>4</sub>: Circuito divisor por 11 usando CI 7492 ( $\div 2$  e  $\div 6$ ).

- Ex<sub>5</sub>: Circuito divisor por 12 usando CI 7492 ( $\div 2$  e  $\div 6$ ).

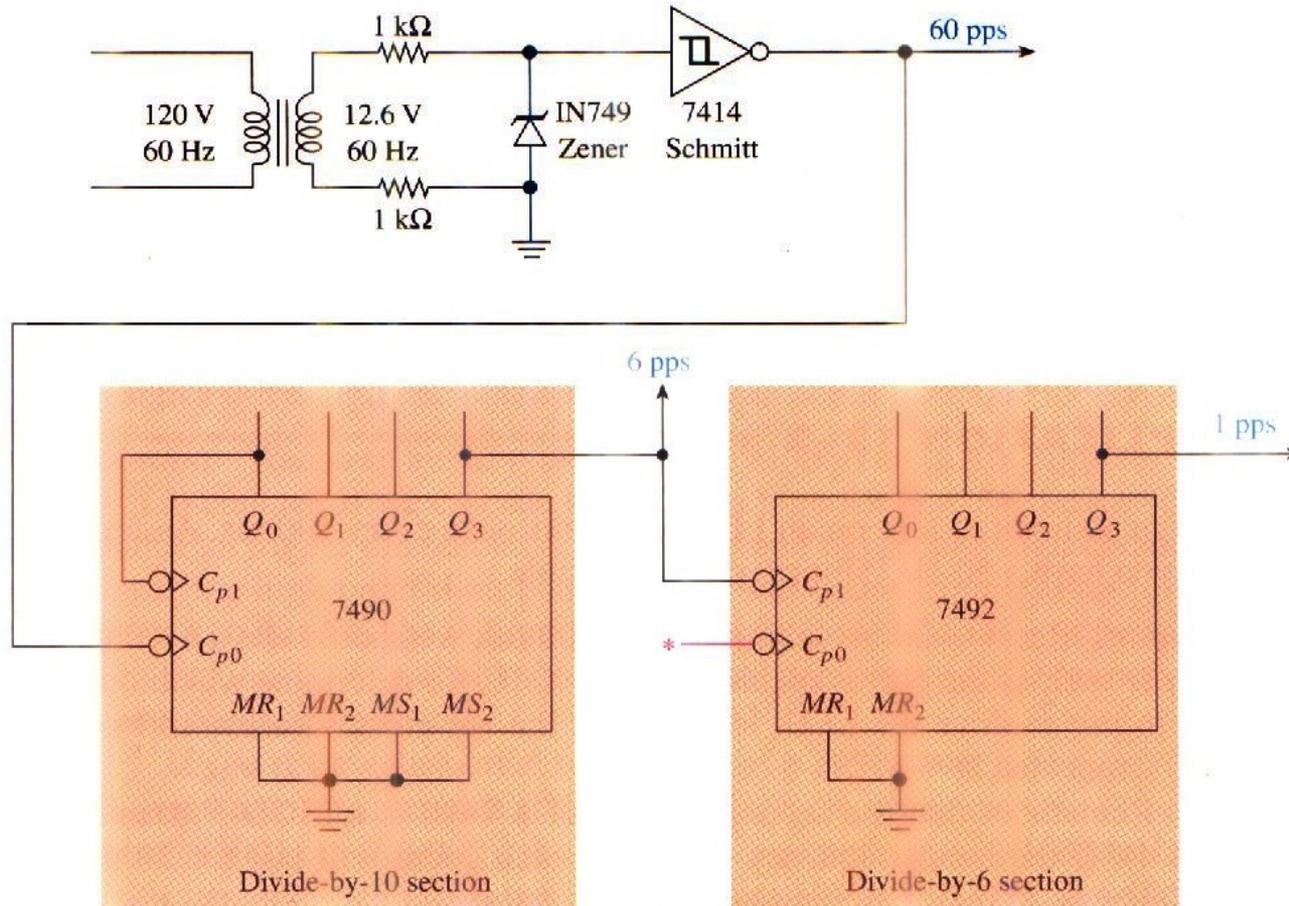
- Ex<sub>6</sub>: Circuito divisor por 88 usando CI 7490 ( $\div 2$  e  $\div 5$ ).

Utilidades:

Circuito de Reset/Preset automático...

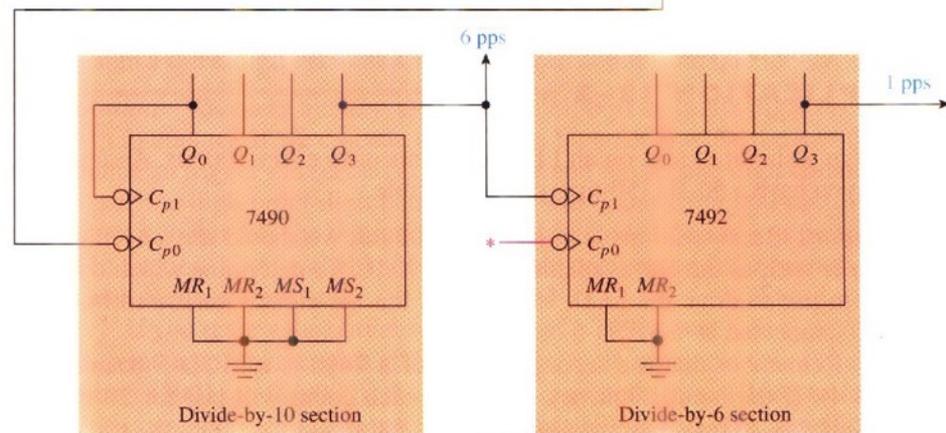
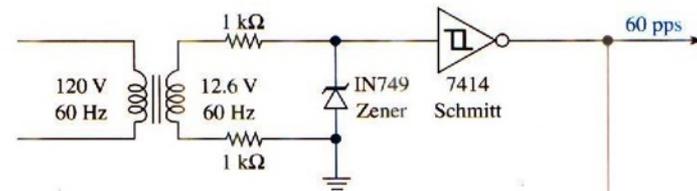


# Aplicações práticas: Gerador de 1 Hz à partir da rede..

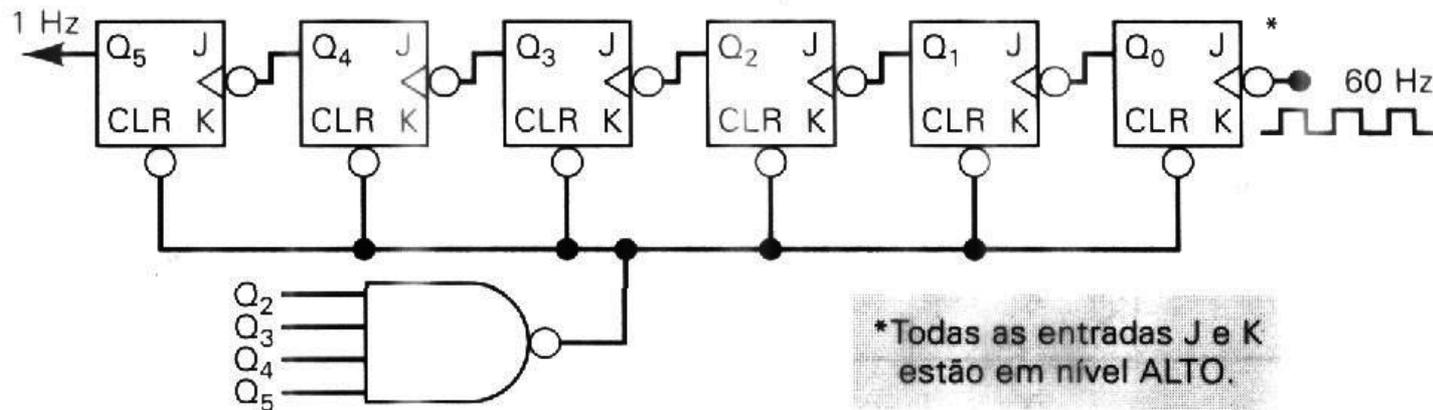


\* Divide-by-2 section not used  
(a)

# Aplicações práticas: Contador Módulo-60..

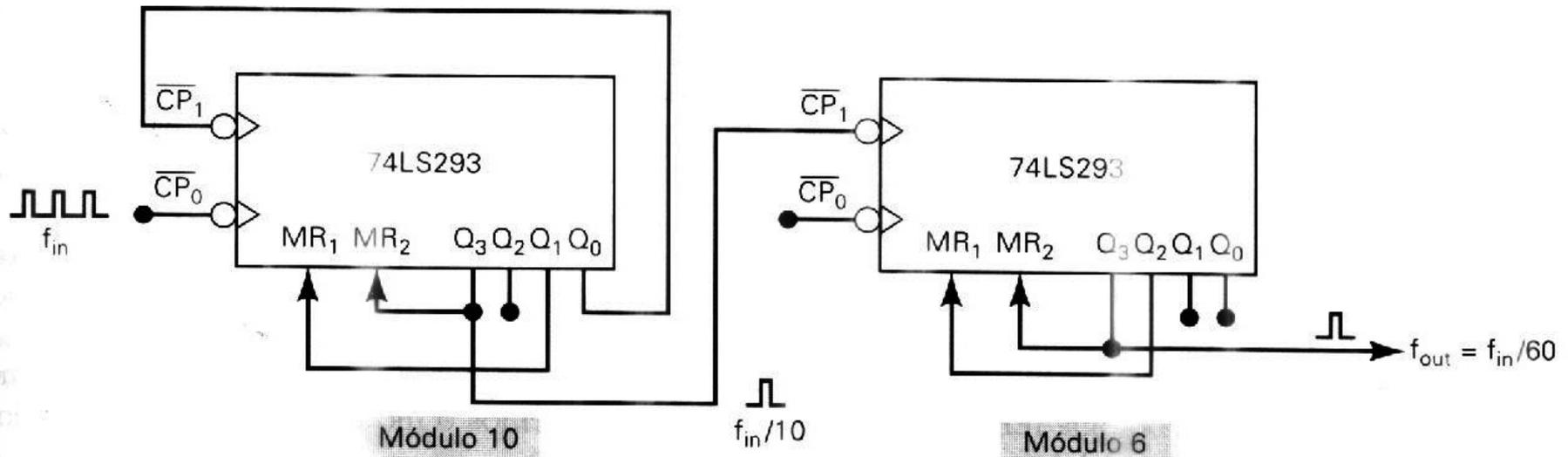
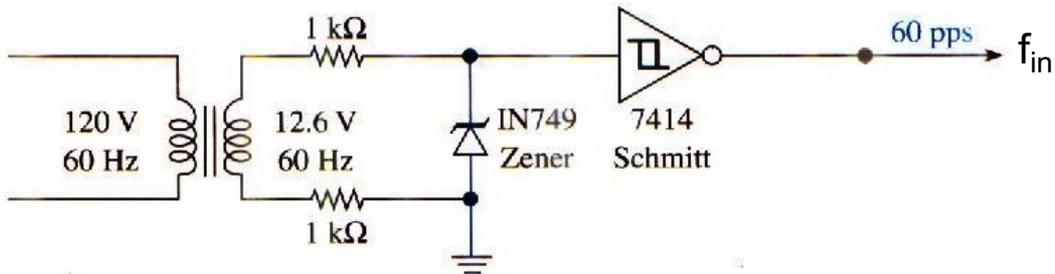


\* Divide-by-2 section not used  
(a)

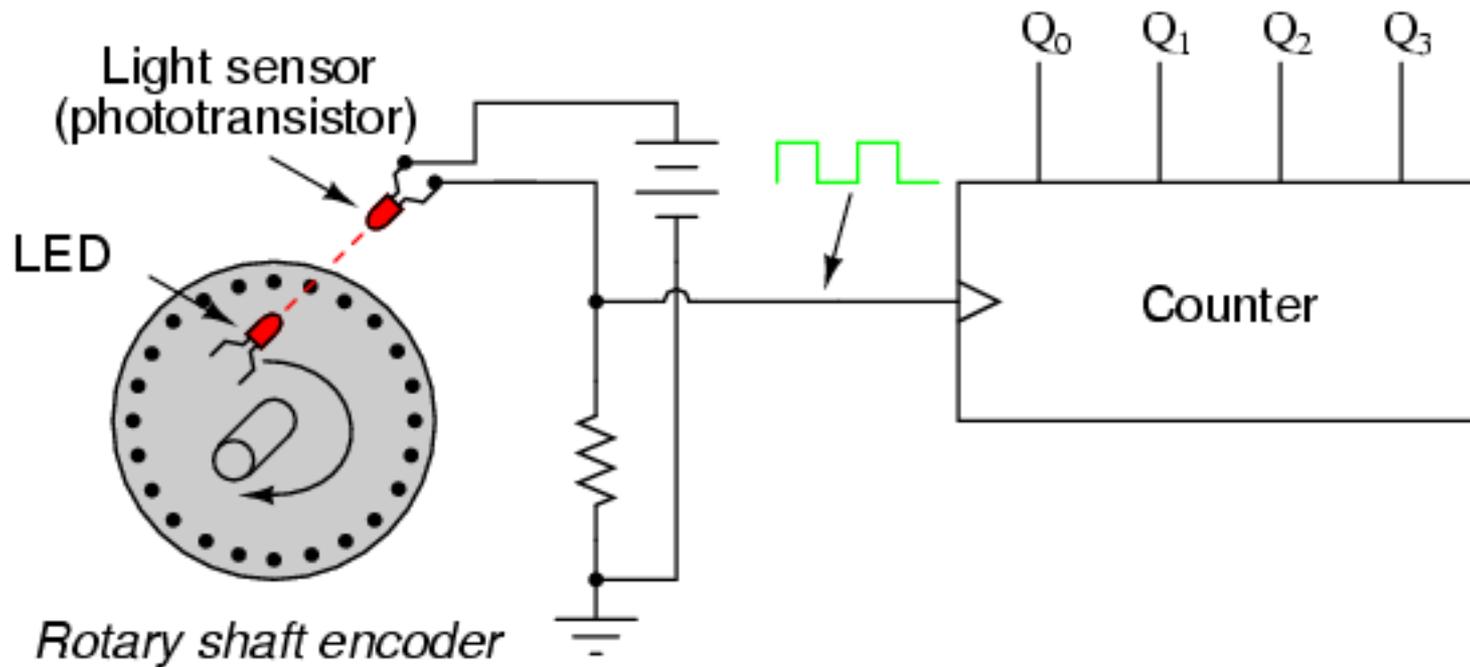


\*Todas as entradas J e K  
estão em nível ALTO.

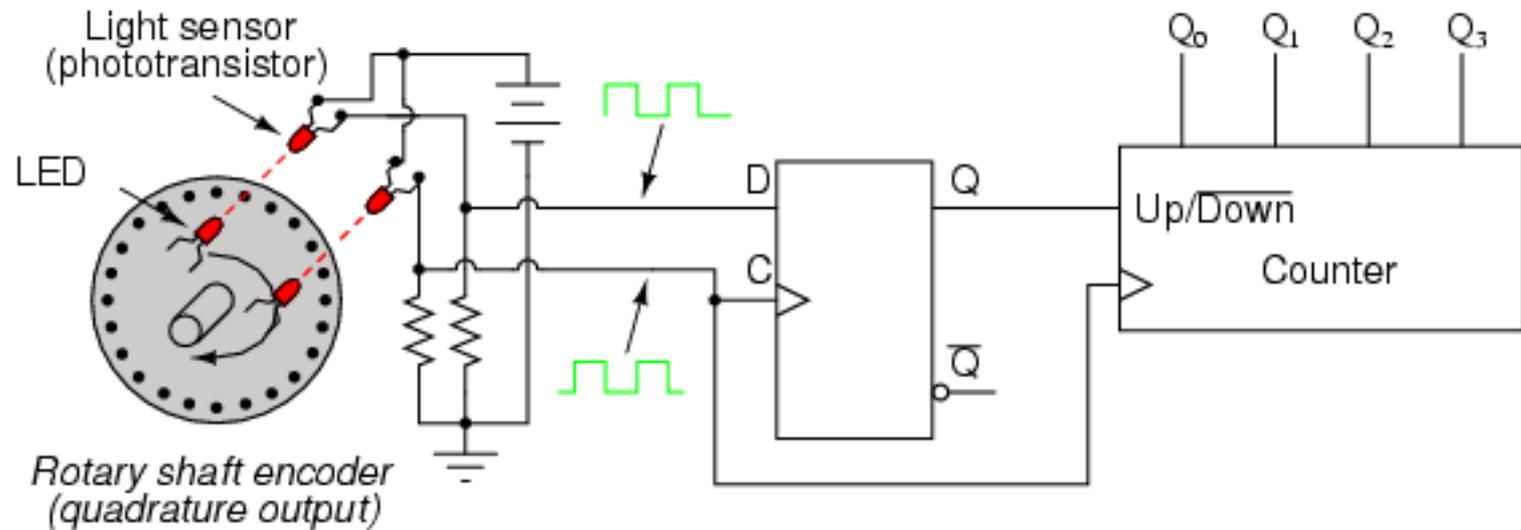
# Aplicações práticas: Contador Módulo-60..



# Aplicações práticas: Contador para Encoder Relativo



# Aplicações práticas: Contador para Encoder Relativo (2)



# Aplicações: Efeito Visual..

