

Contadores assíncronos

Circuitos Digitais II
Prof. Fernando Passold

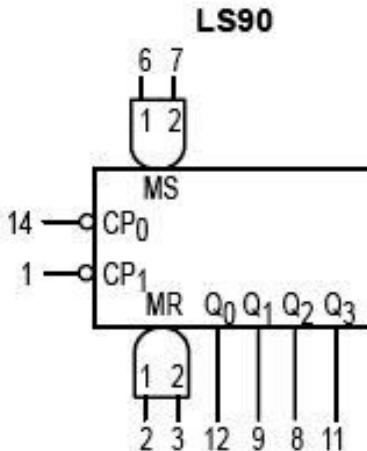


7490, 7492, 7493

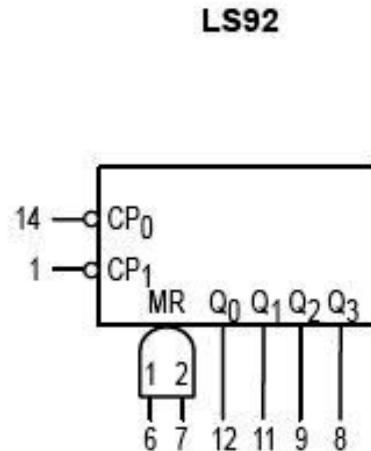
CONTADORES INTEGRADOS

Contadores Assíncronos Integrados

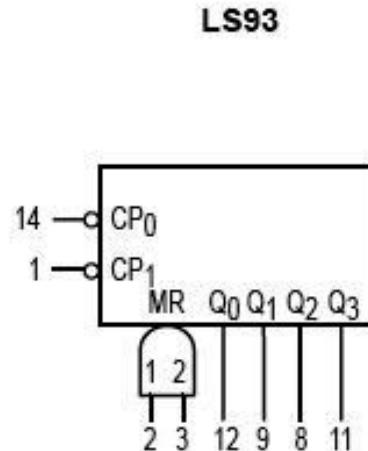
- CI 7490: $\div 2$ e $\div 5$;
- CI 7492: $\div 2$ e $\div 6$;
- CI 7493: $\div 2$ e $\div 8$;



V_{CC} = PIN 5
GND = PIN 10
NC = PINS 4, 13



V_{CC} = PIN 5
GND = PIN 10
NC = PINS 2, 3, 4, 13



V_{CC} = PIN 5
GND = PIN 10
NC = PIN 4, 6, 7, 13

LS90
BCD COUNT SEQUENCE

| COUNT | OUTPUT | | | |
|-------|----------------|----------------|----------------|----------------|
| | Q ₀ | Q ₁ | Q ₂ | Q ₃ |
| 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 Q₀ is connected to Input CP₁ for BCD count.

LS92
TRUTH TABLE

| COUNT | OUTPUT | | | |
|-------|----------------|----------------|----------------|----------------|
| | Q ₀ | Q ₁ | Q ₂ | Q ₃ |
| 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 Q₀ is connected to Input CP₁.

LS93
TRUTH TABLE

| COUNT | OUTPUT | | | |
|-------|----------------|----------------|----------------|----------------|
| | Q ₀ | Q ₁ | Q ₂ | Q ₃ |
| 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 Q₀ is connected to Input CP₁.

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

Pinagem:

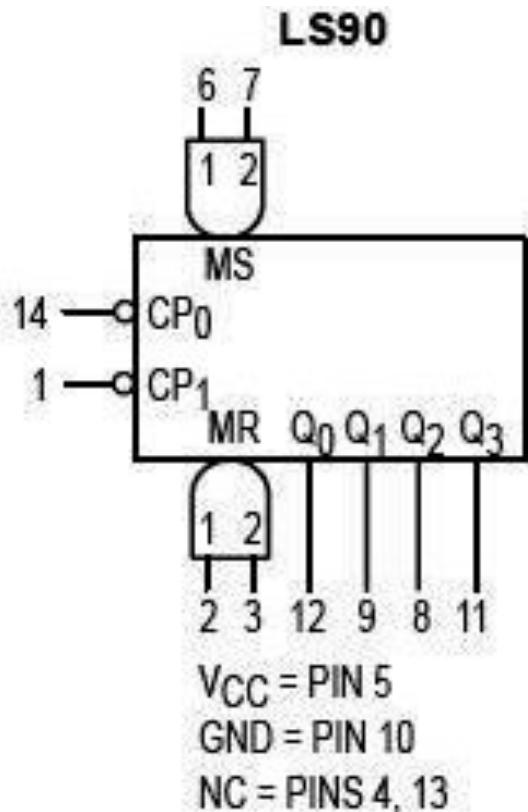


Tabela Verdade:

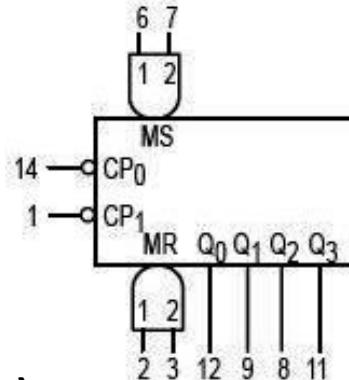
| Set/Reset Inputs | | | | Outputs | | | |
|------------------|-----|-----|-----|---------|-------|----|----|
| MR1 | MR2 | MS1 | MS2 | Q3 | Q2 | Q1 | Q0 |
| H | H | L | X | L | L | L | L |
| H | H | X | L | L | L | L | L |
| X | X | H | H | H | L | L | H |
| X | L | X | L | | COUNT | | |
| L | X | L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

H = HIGH Level

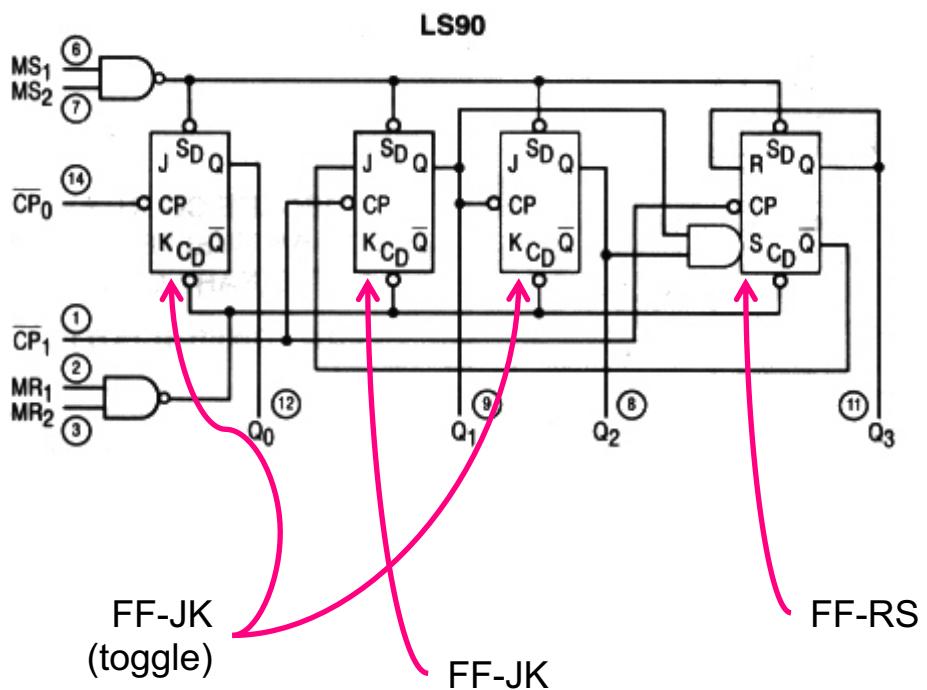
L = LOW Level

X = Don't Care

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



Círcuito Interno:



Seqüência de contagem (BCD):

LS90
BCD COUNT SEQUENCE

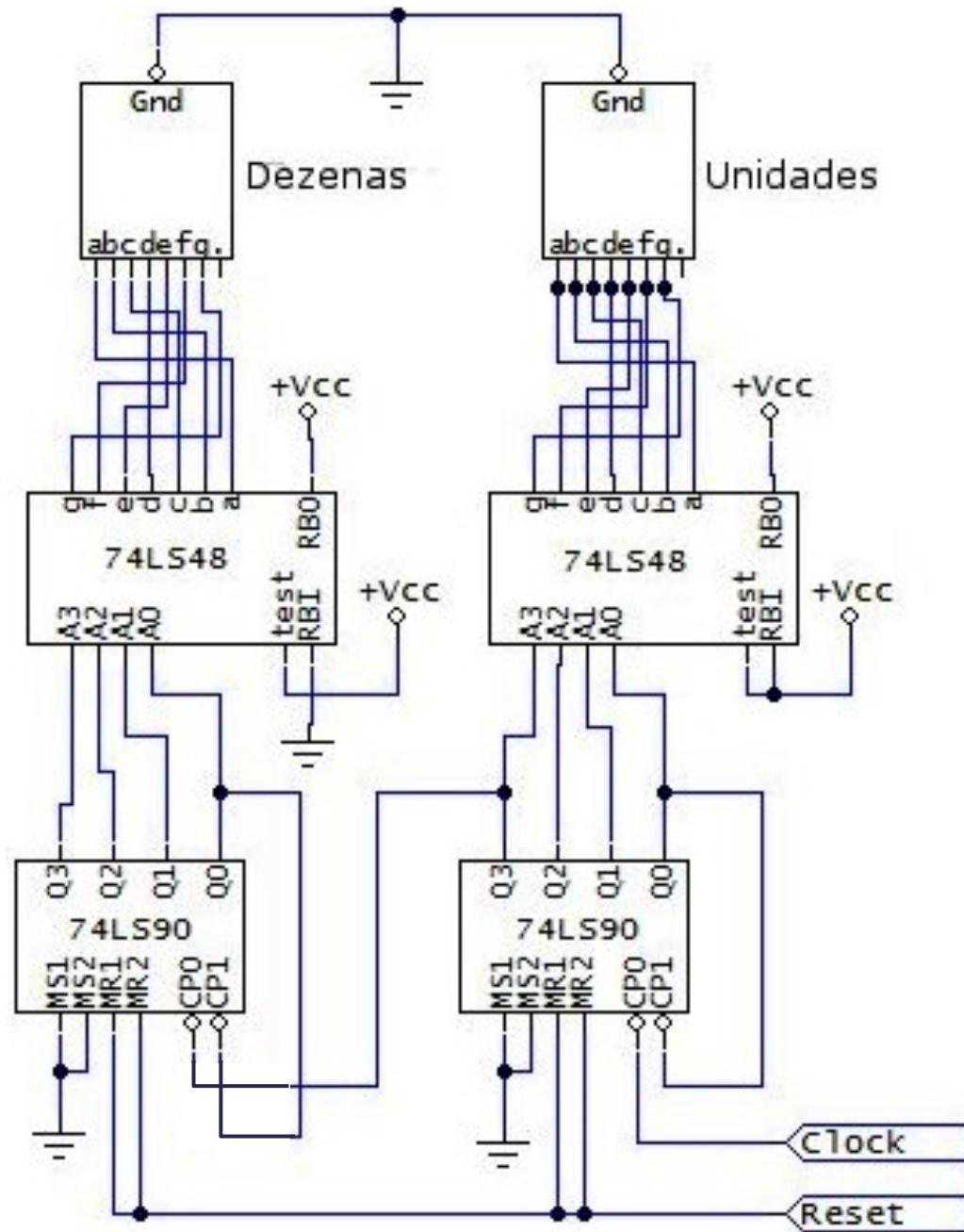
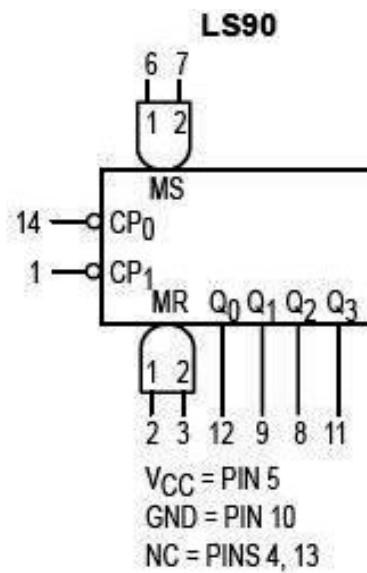
| COUNT | OUTPUT | | | |
|-------|----------------|----------------|----------------|----------------|
| | Q ₀ | Q ₁ | Q ₂ | Q ₃ |
| 0 | L | L | L | L |
| 1 | H | L | L | L |
| 2 | L | H | L | L |
| 3 | H | H | L | L |
| 4 | L | L | H | L |
| 5 | H | L | H | L |
| 6 | L | H | H | L |
| 7 | H | H | H | L |
| 8 | L | L | L | H |
| 9 | H | L | L | H |

NOTE: Output Q₀ is connected to Input CP₁ for BCD count.

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

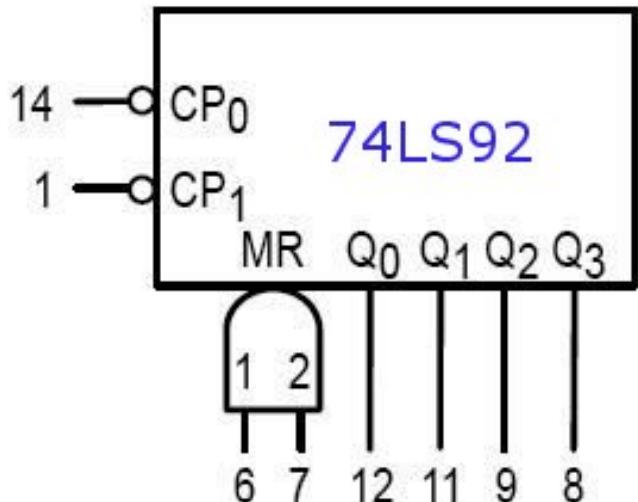
Exemplo de uso...

Contador BCD de 0 à 99:



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

Pinagem:



V_{CC} = PIN 5

GND = PIN 10

NC = PINS 2, 3, 4, 13

Tabela Verdade:

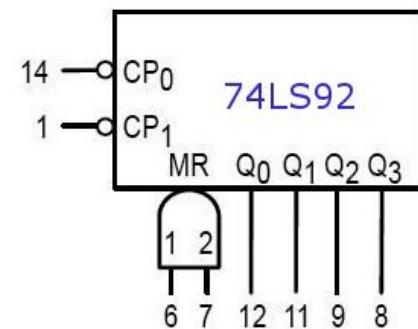
| RESET INPUTS | | OUTPUTS | | | |
|-----------------|-----------------|----------------|----------------|----------------|----------------|
| MR ₁ | MR ₂ | Q ₀ | Q ₁ | Q ₂ | Q ₃ |
| H | H | L | L | L | L |
| L | H | | | Count | |
| H | L | | | Count | |
| L | L | | | Count | |

H = HIGH Voltage Level

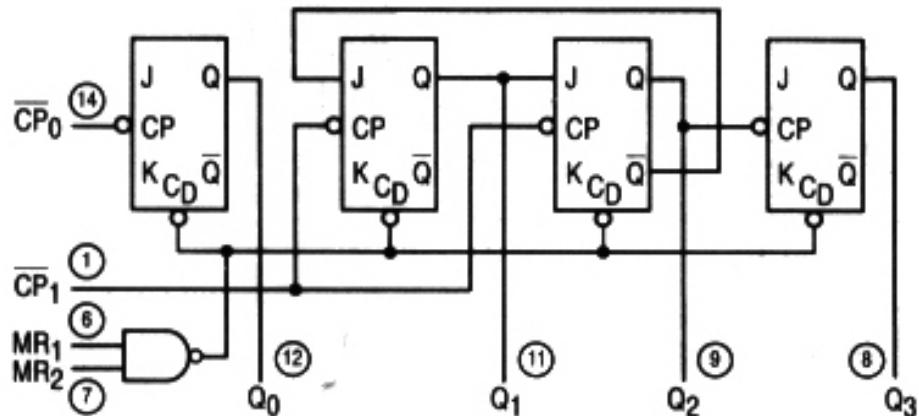
L = LOW Voltage Level

X = Don't Care

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



Círcuito interno:



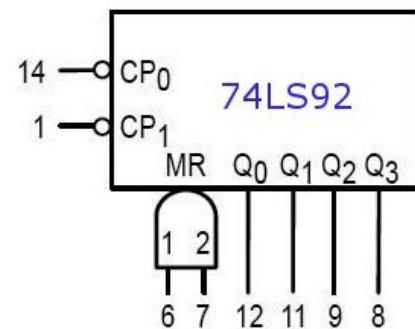
Seqüência de contagem:

| COUNT | OUTPUT | | | | Saída Decimal da Contagem |
|-------|----------------|----------------|----------------|----------------|---------------------------|
| | Q ₀ | Q ₁ | Q ₂ | Q ₃ | |
| 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 Q₀ is connected to Input CP₁.

Os divisores podem ser ligados de forma a se obter um divisor por 12 na saída Q₃. Para isto, a saída Q₀ deve ser ligada externamente à entrada /CP₀ e o sinal externo de clock deve ser ligado à /CP₀.

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

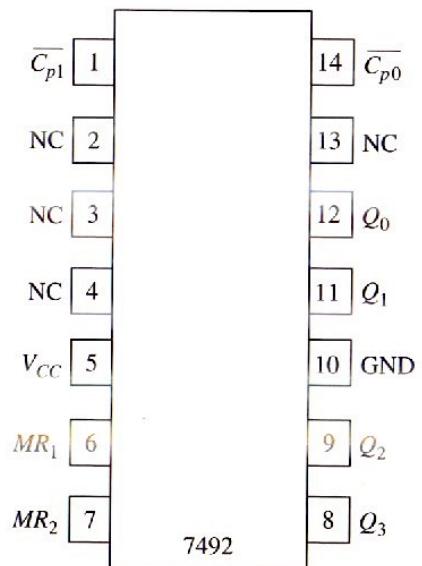
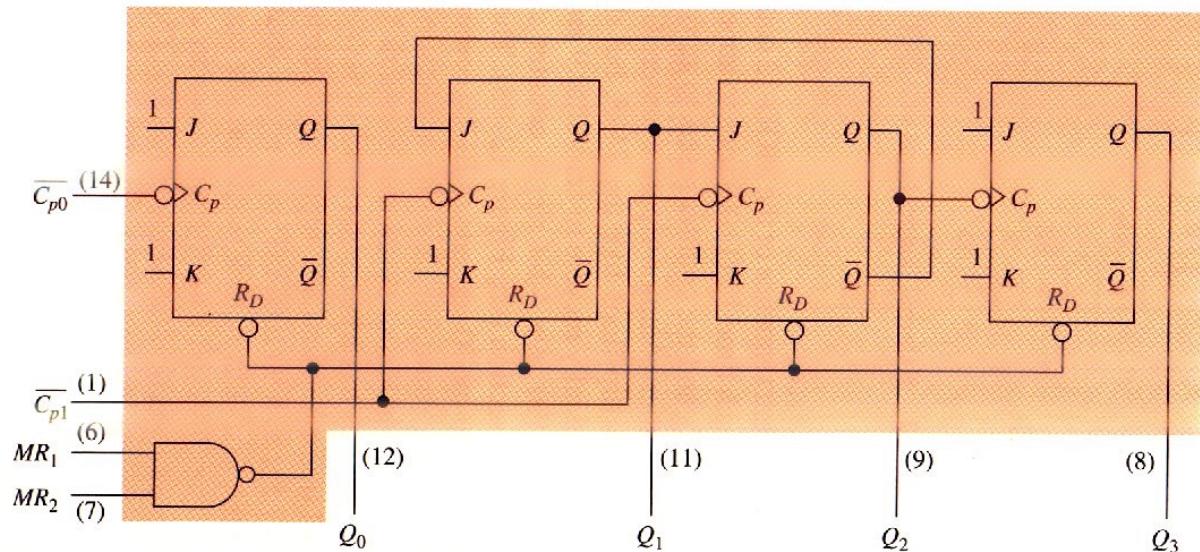


Blocos internos:

() = pin numbers

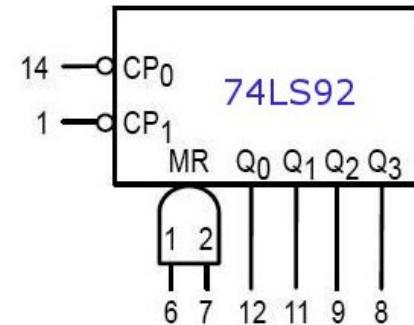
V_{CC} = pin 5

GND = pin 10

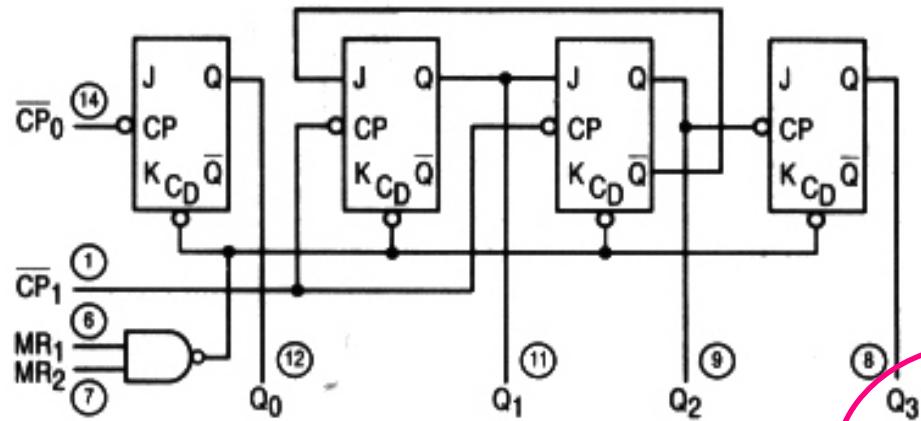


Os divisores podem ser ligados de forma a se obter um divisor por 12 na saída Q_D . Para isto, a saída Q_A deve ser ligada externamente à entrada B e o sinal externo de clock deve ser ligado à A.

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



Círcuito interno:



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

Seqüência de contagem:

| COUNT | OUTPUT | | | | Saída Decimal da Contagem |
|-------|----------------|----------------|----------------|----------------|---------------------------|
| | Q ₀ | Q ₁ | Q ₂ | Q ₃ | |
| 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 Q₀ is connected to Input CP₁.

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:

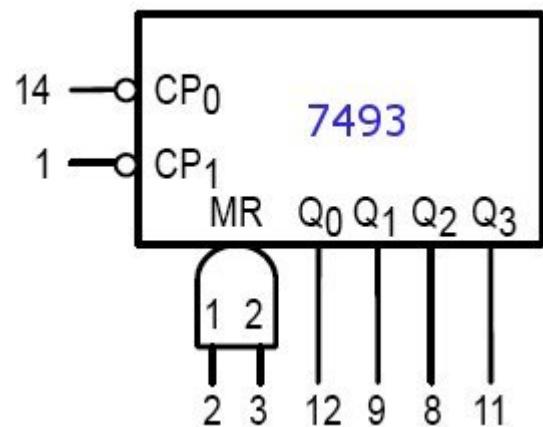
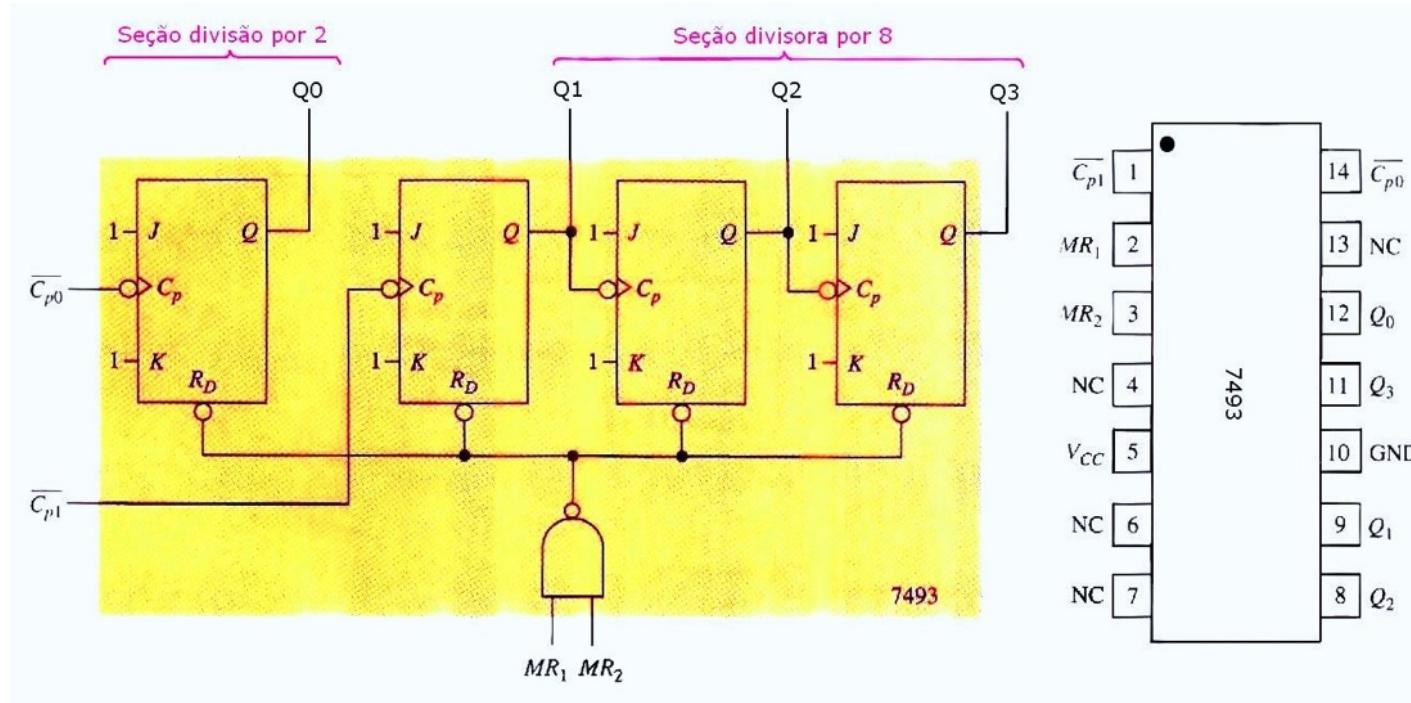


Tabela Verdade:

Os divisores podem ser ligados de forma a se obter um **divisor por 16** na saída Q_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 7493 ($\div 2$ e $\div 8$)

Blocos internos:

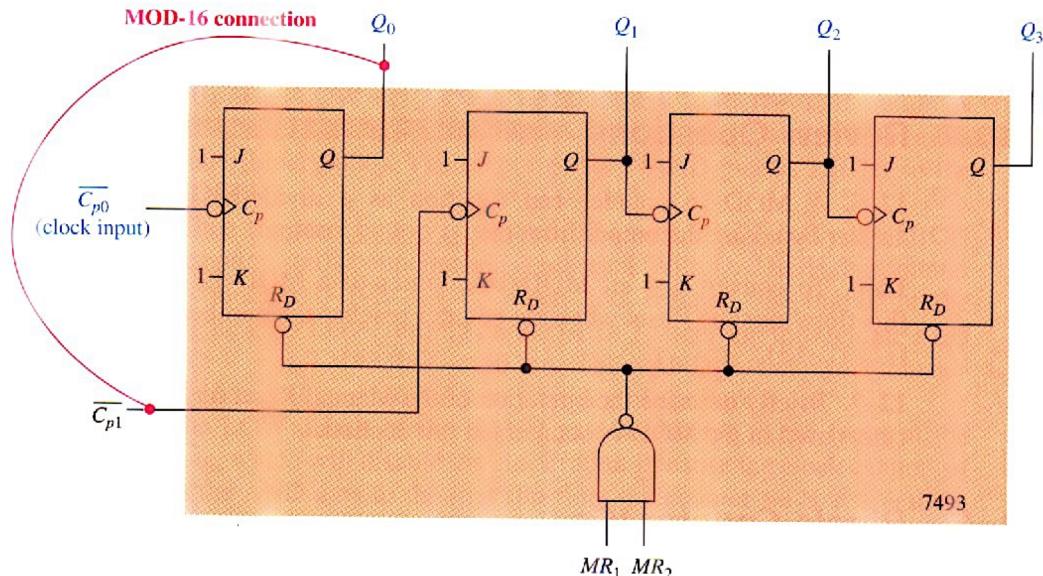
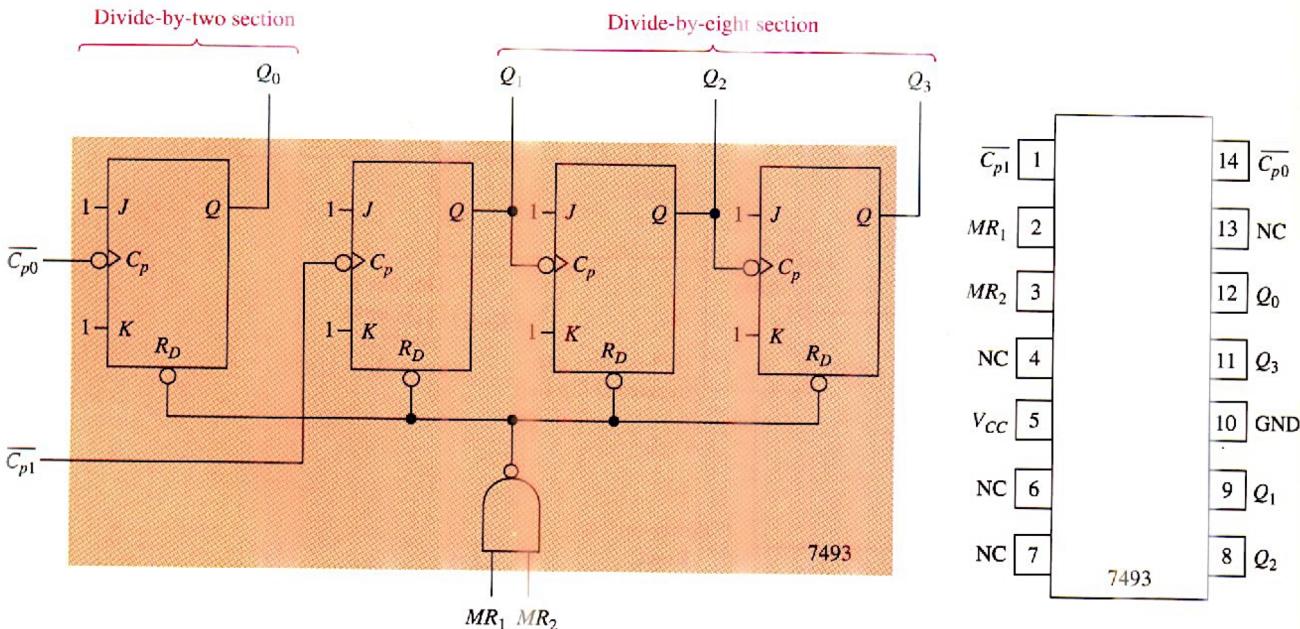


Os divisores podem ser ligados de forma a se obter um **divisor por 16** na saída Q_D . Para isto, a saída Q_A deve ser ligada externamente à entrada B e o sinal externo de *clock* deve ser ligado à A.

CI 7493 $(\div 2 \text{ e } \div 8)$

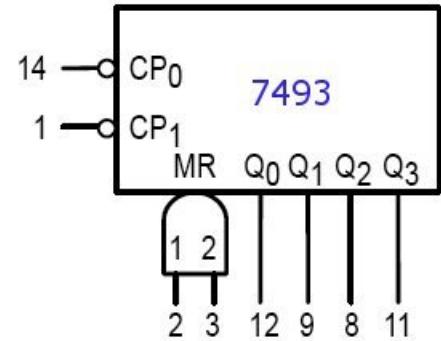
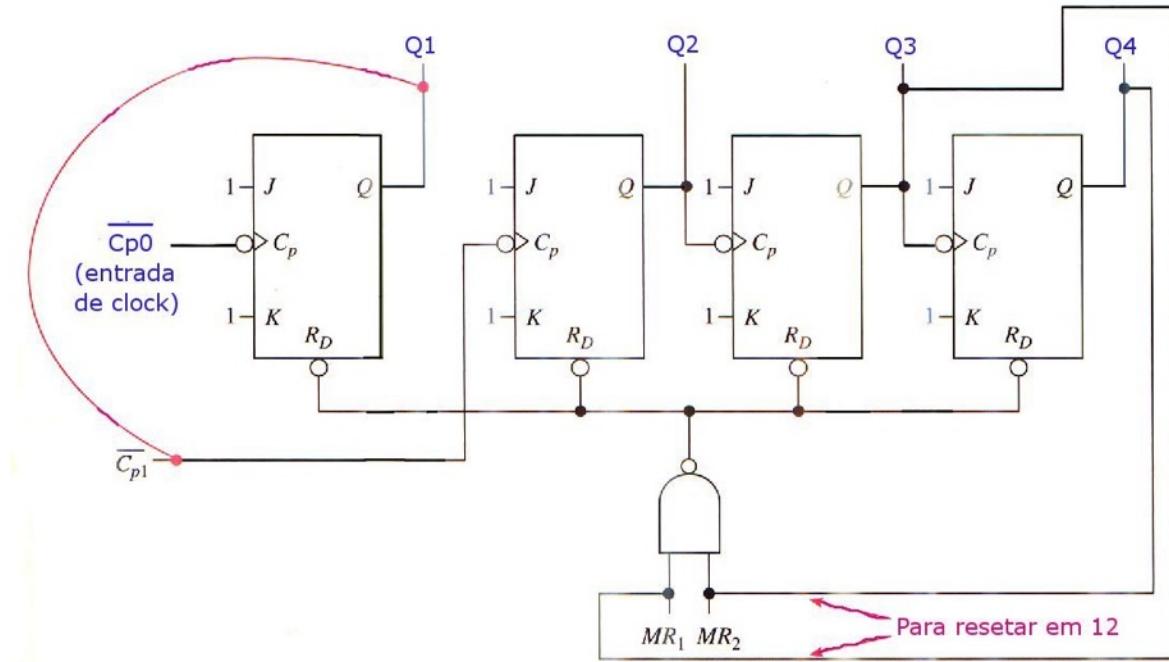
Uso:

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.



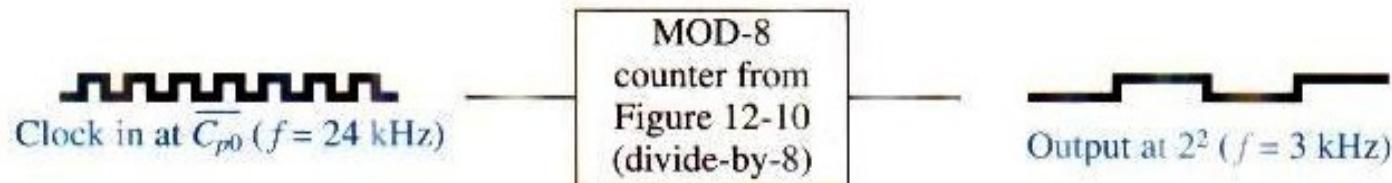
Exemplo

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



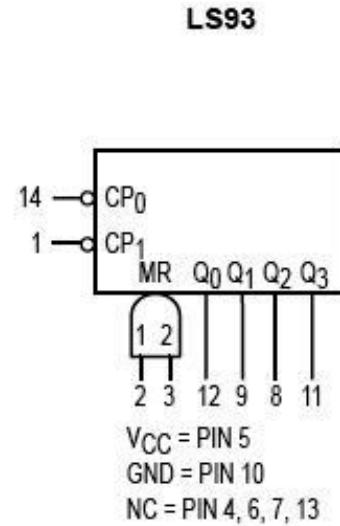
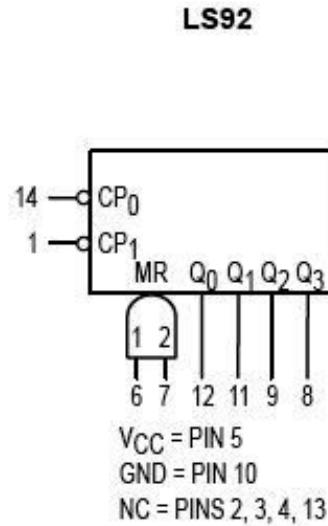
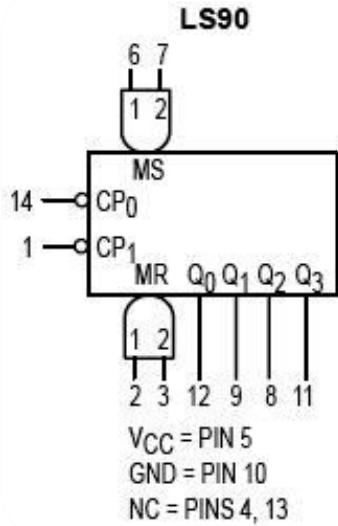
$$12_{(10)} = 1100_{(2)}$$

Projeto de contadores de módulo- n



Exercícios:

- Ex₁: Circuito divisor de freqüência por 100 usando 2 CIs 7490.
- Ex₂: Circuito divisor de freqüência por 42:



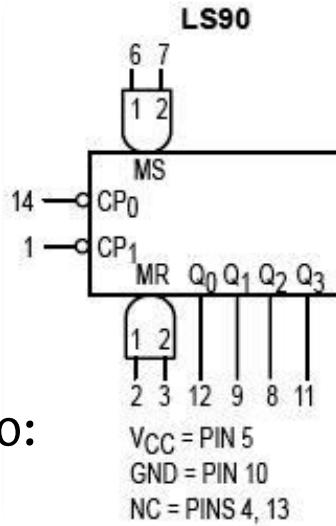
Solução a) Usando CI 7490:

Solução b) Usando CI 7493:

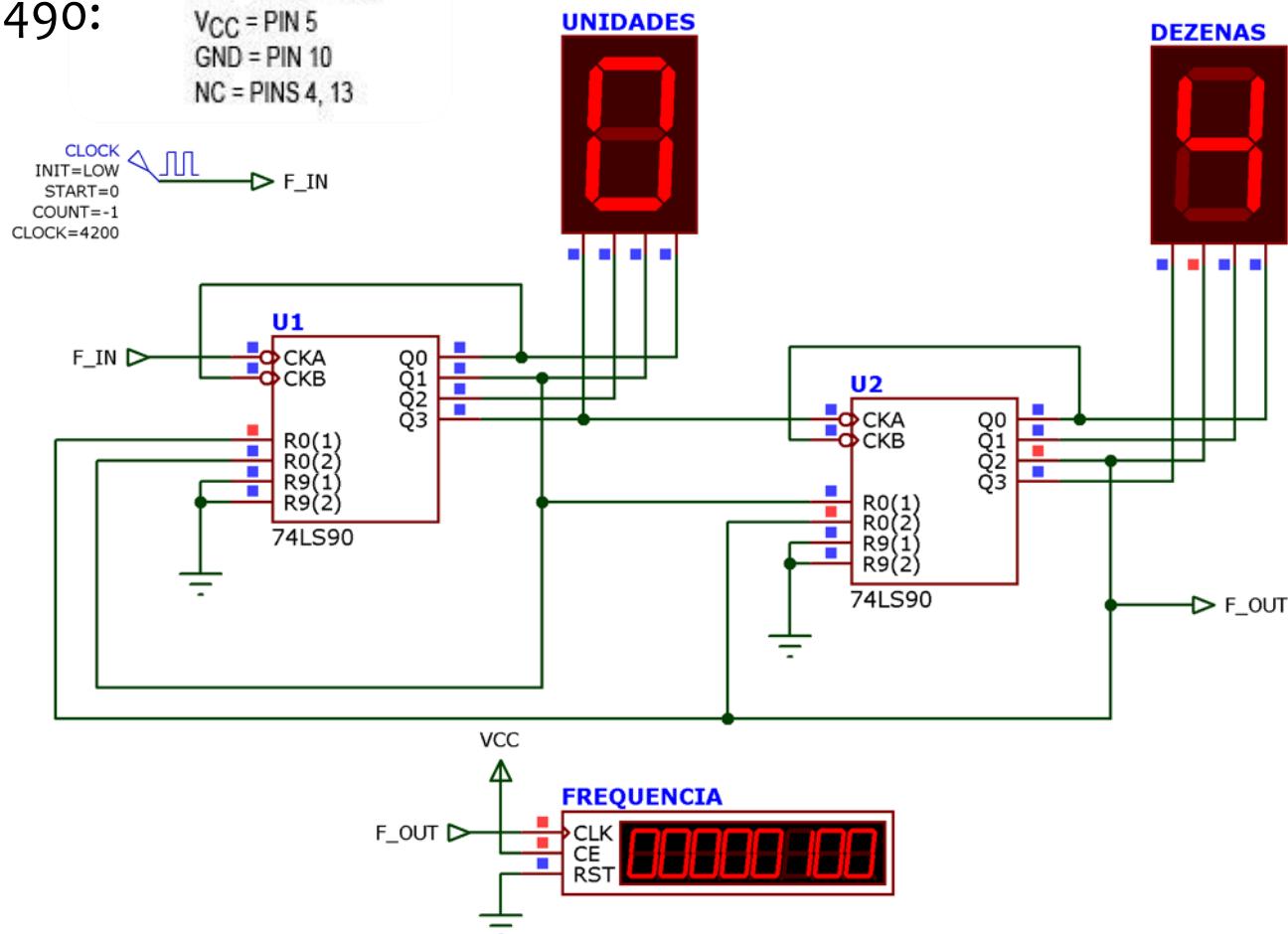
Exercícios:

- Ex₂: Circuito divisor de freqüência por 42:

Solução a) Usando CI 7490:



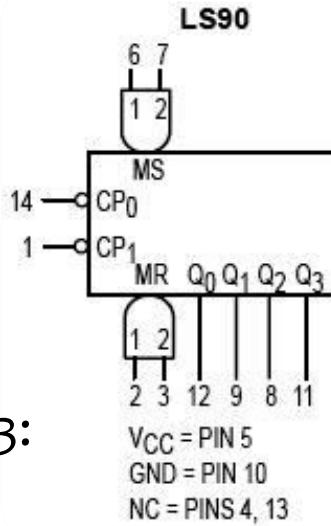
Note:
 DEZ(U2) UNID(U1)
 $42_{(10)} = 0100 \mid 0010_{(2,BCD)}$



Exercícios:

- Ex₂: Circuito divisor de freqüência por 42:

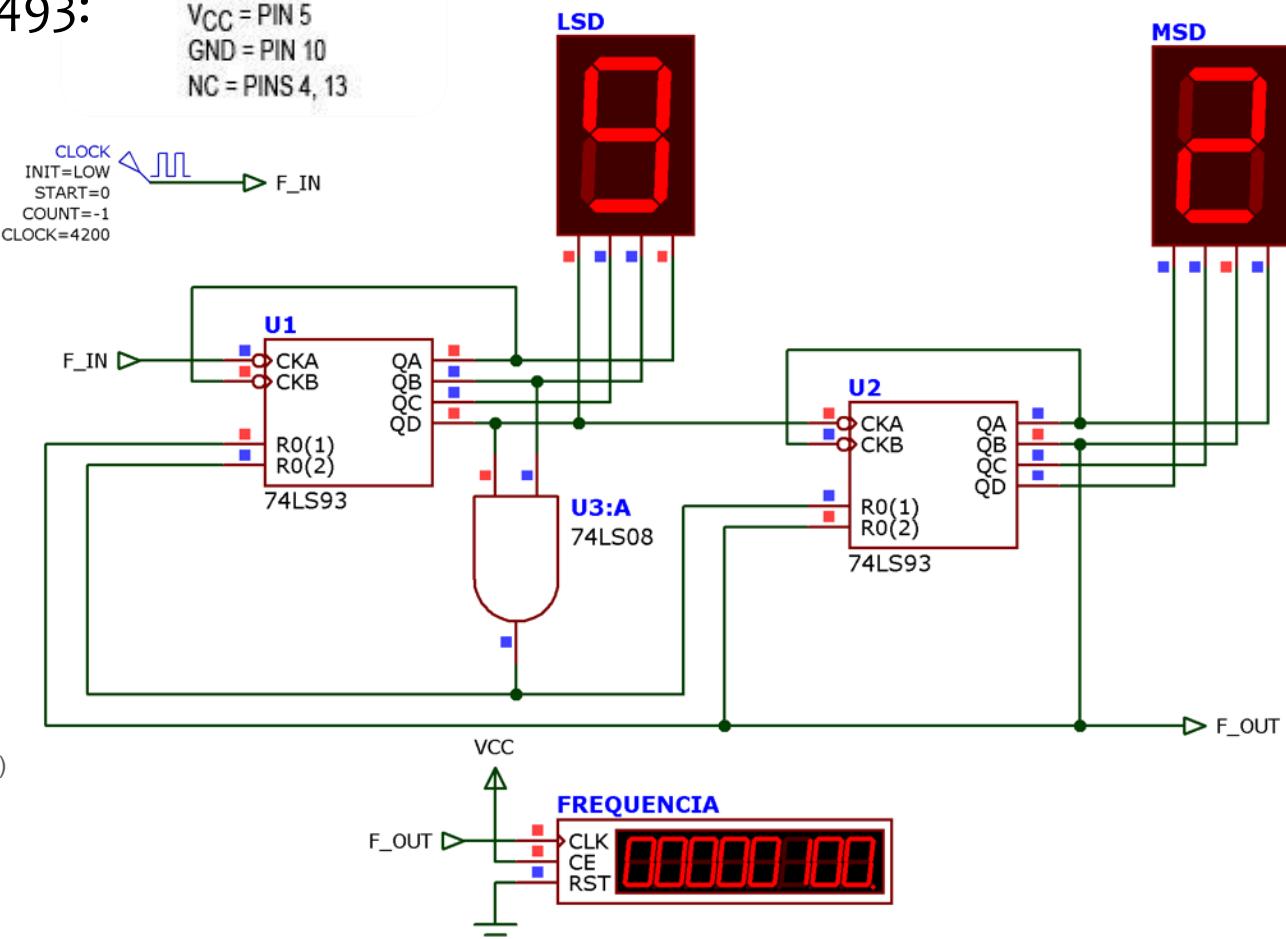
Solução a) Usando CI 7493:



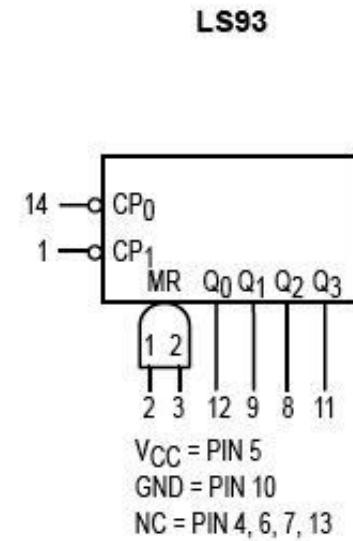
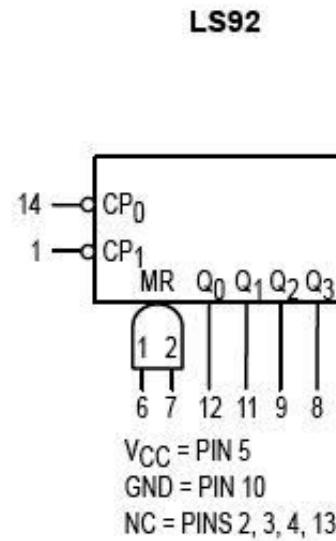
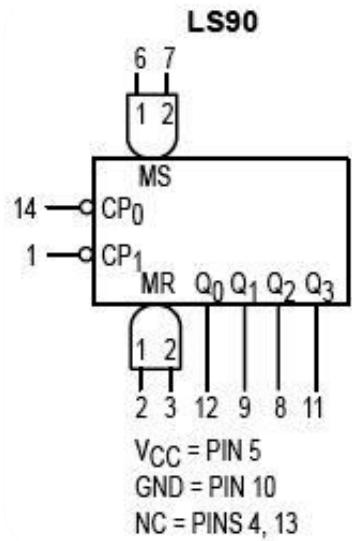
Note:

| | | |
|---------------------------|--------|---------------------|
| Nible Superior | Nibble | Nible Inferior |
| 42 ₍₁₀₎ = 0100 | : | 0010 ₍₂₎ |

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



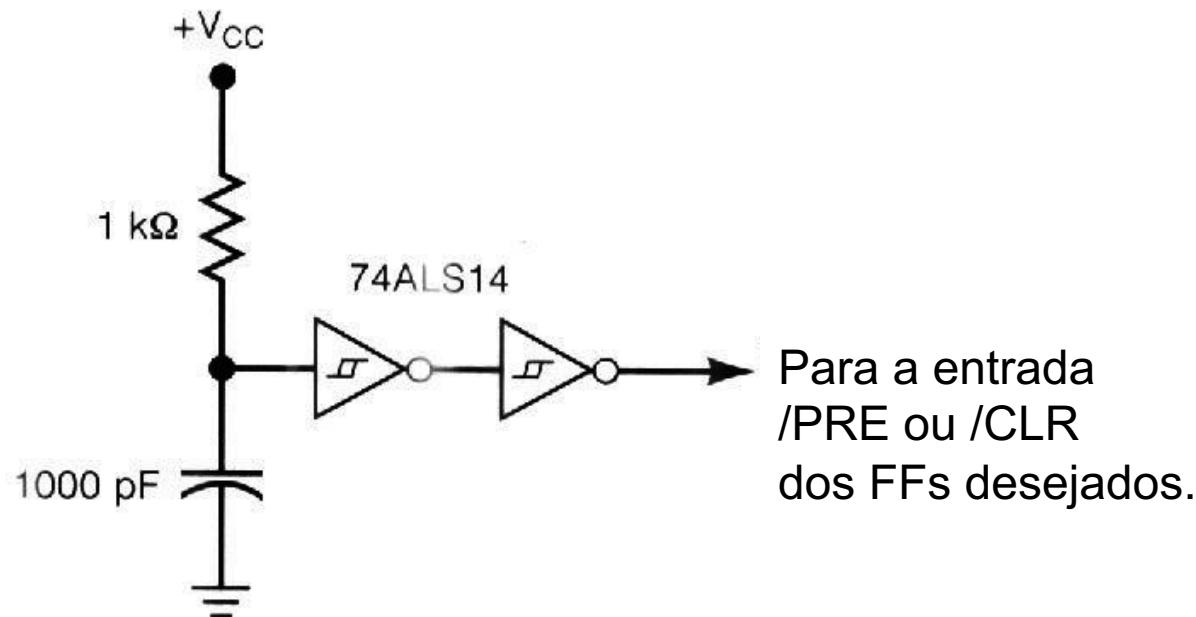
Exercícios:



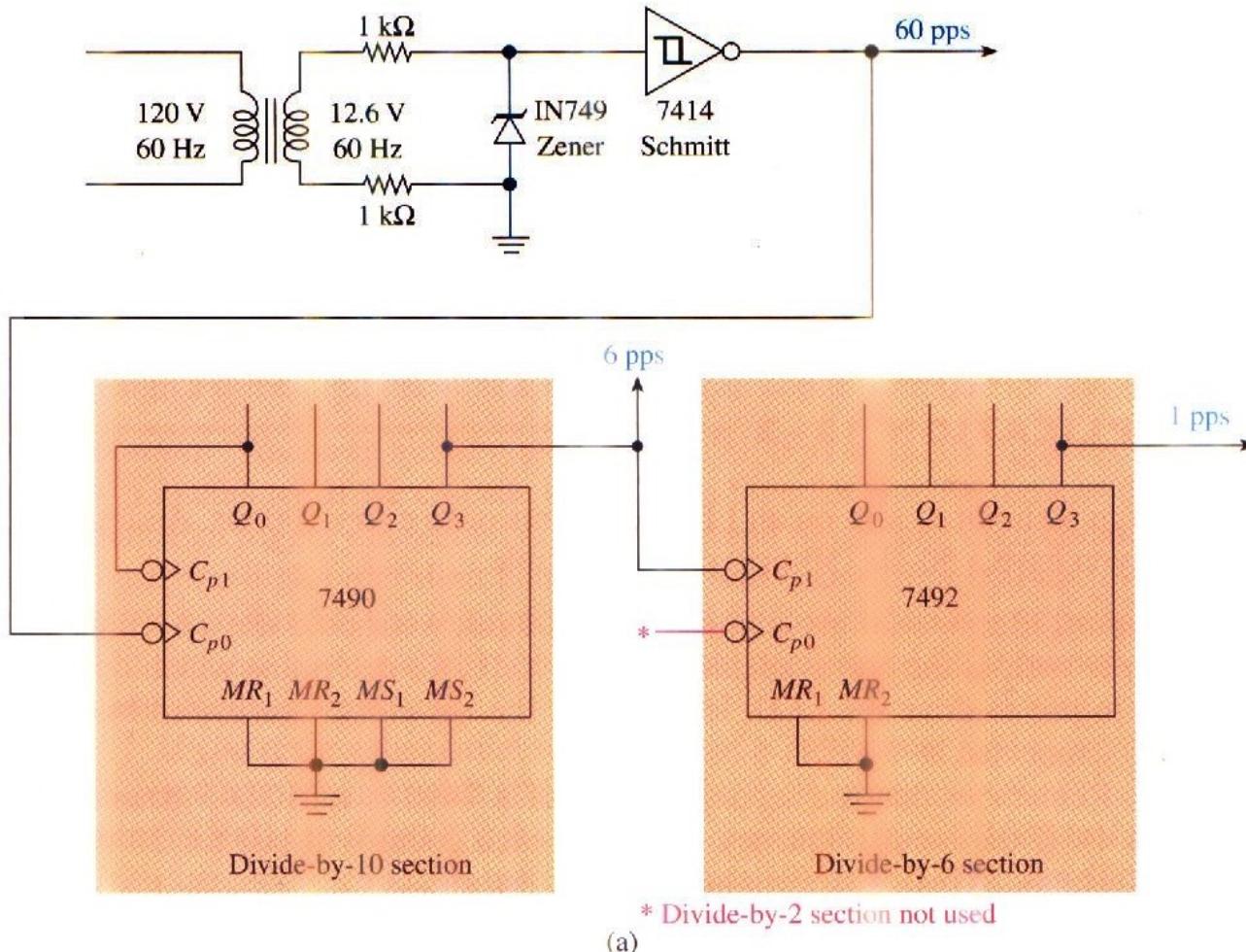
- Ex₃: Circuito divisor por 7 usando CI 7492 ($\div 2$ e $\div 6$).
- Ex₄: Circuito divisor por 11 usando CI 7492 ($\div 2$ e $\div 6$).
- Ex₅: Circuito divisor por 12 usando CI 7492 ($\div 2$ e $\div 6$).
- Ex₆: Circuito divisor por 88 usando CI 7490 ($\div 2$ e $\div 5$).

Utilidades:

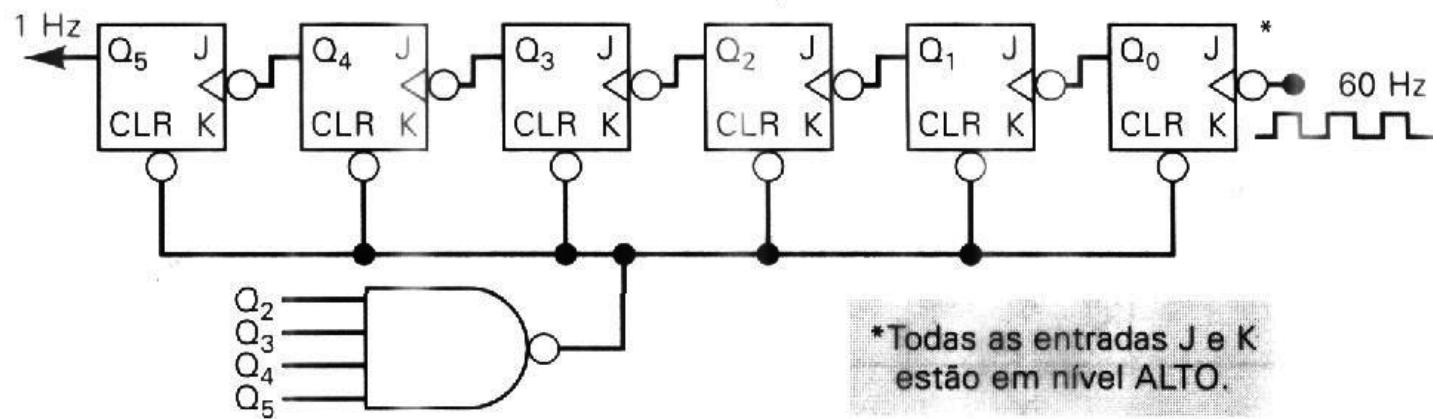
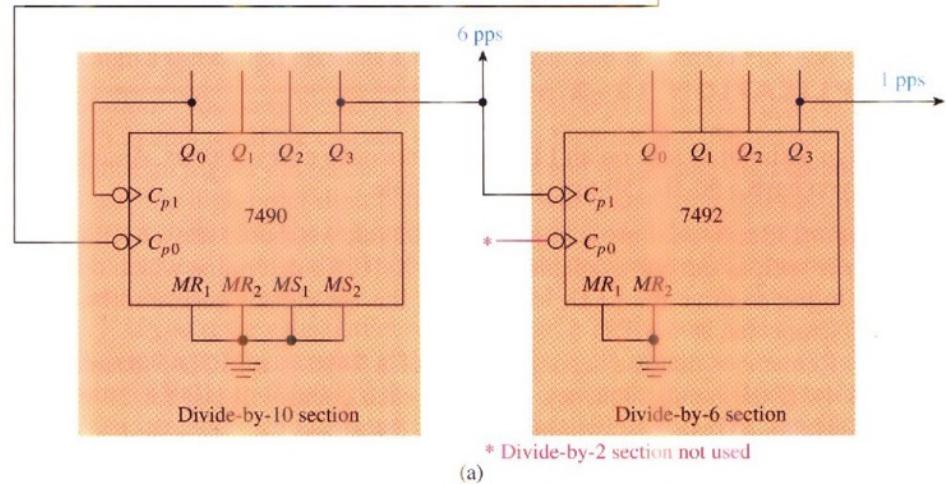
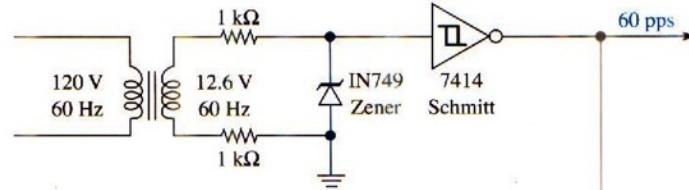
Círcuito de Reset/Preset automático...



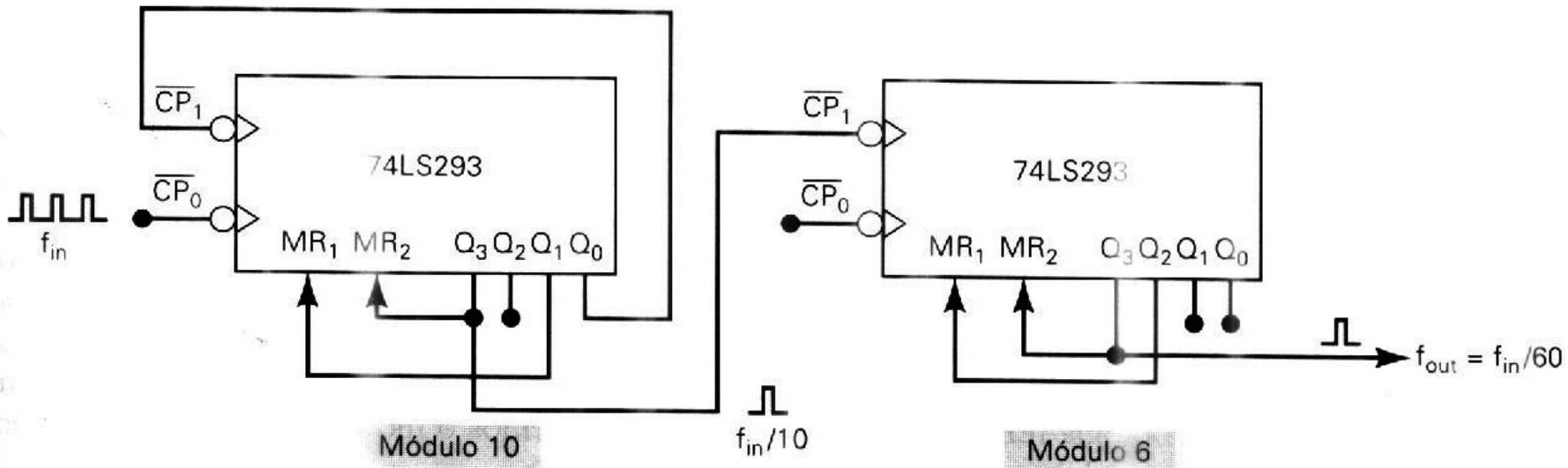
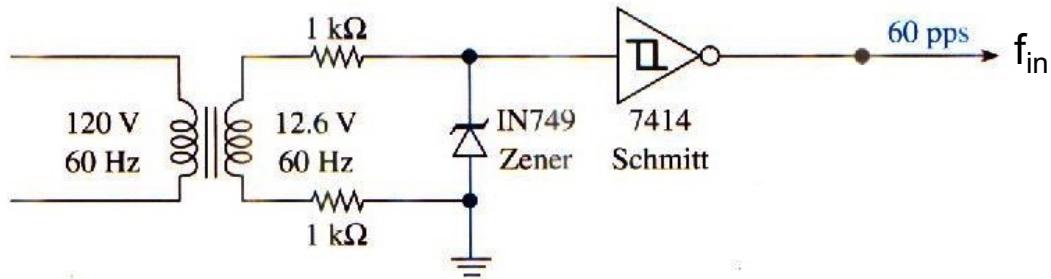
Aplicações práticas: Gerador de 1 Hz à partir da rede..



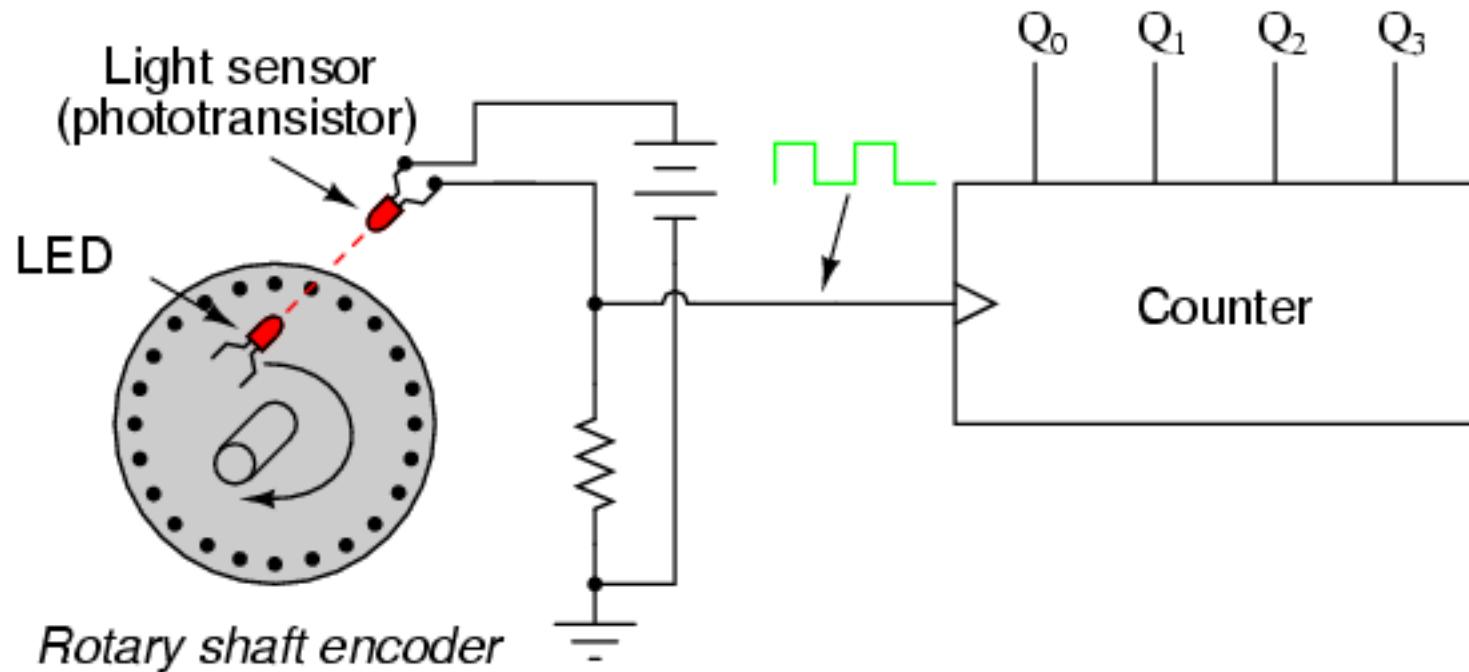
Aplicações práticas: Contador Módulo-60..



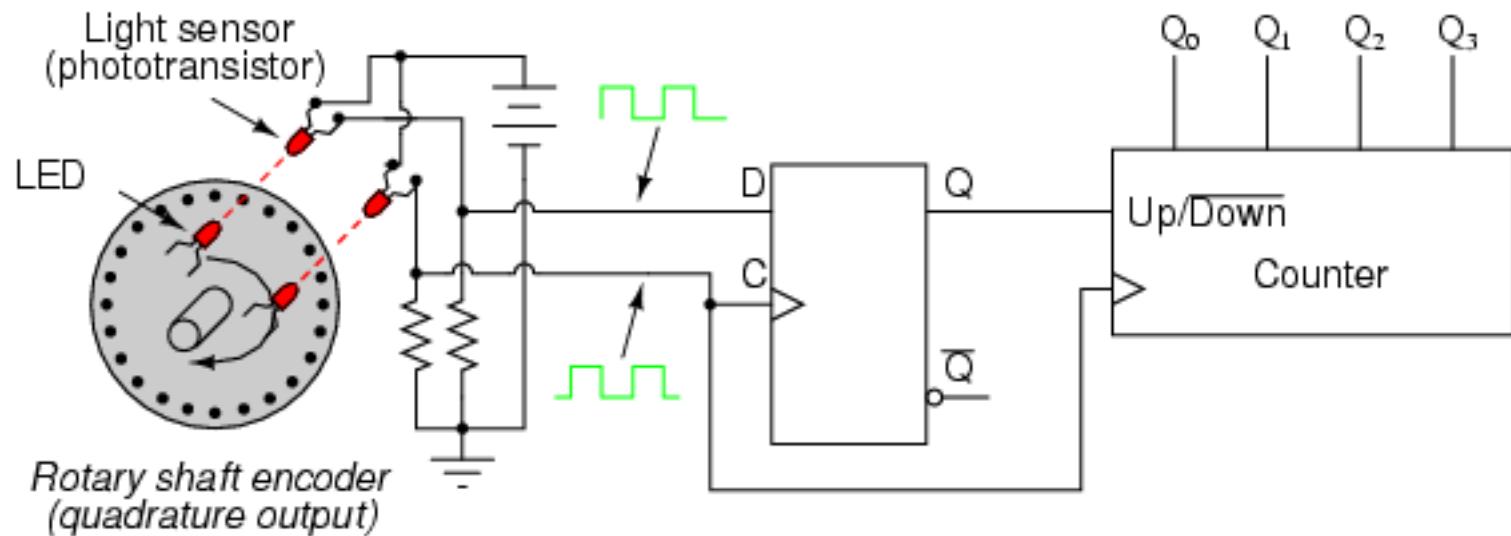
Aplicações práticas: Contador Módulo-60..



Aplicações práticas: Contador para Encoder Relativo



Aplicações práticas: Contador para Encoder Relativo (2)



Aplicações: Efeito Visual..

