

PCS3515 – Sistemas Digitais

Blocos Básicos

Circuitos Comparadores

Seções 6.8 e 6.9 – livro texto

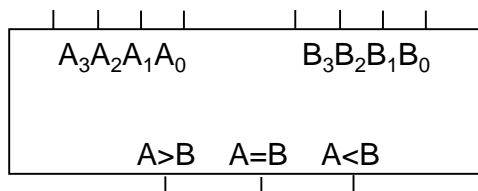
Com apoio do material dos demais professores

2018/1

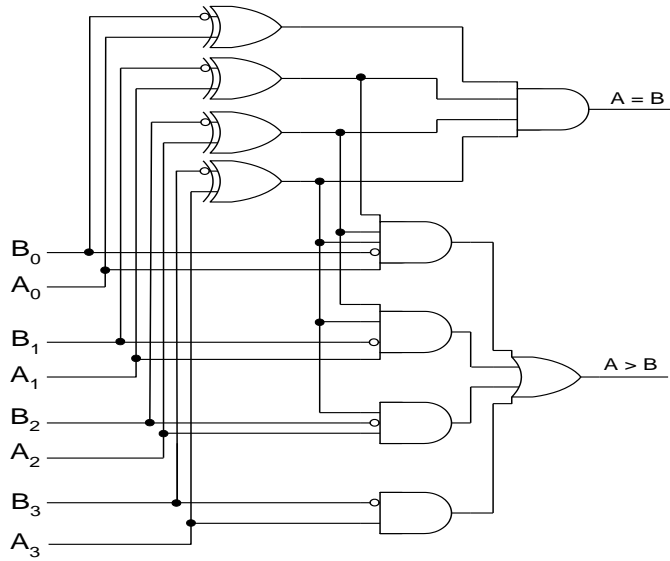
From *Digital Design: Principles and Practices*, Fourth Edition, John F. Wakerly, ISBN 0-13-186389-4.
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Comparadores

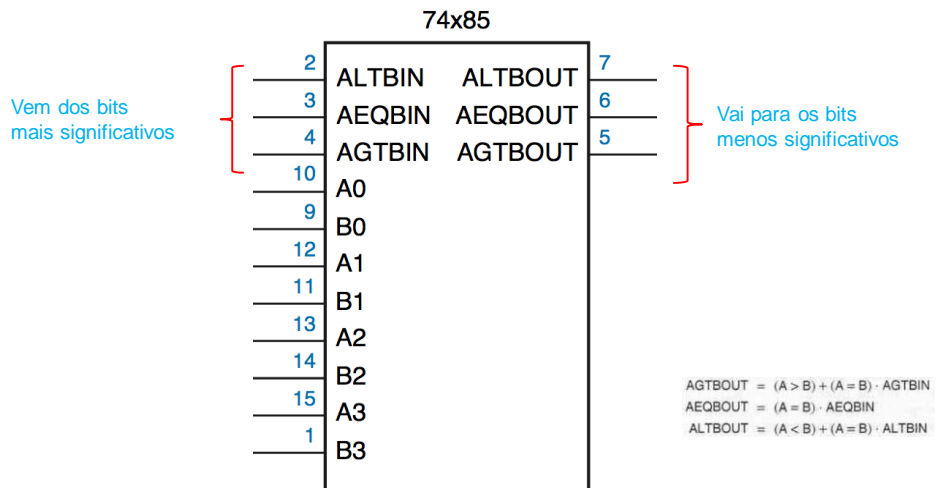
- Comparação entre palavras binárias é uma operação comum em sistemas digitais.
- Comparadores realizam essa função e podem indicar igualdade ($=$, \neq), e em alguns casos, relação aritmética ($>$, $<$).



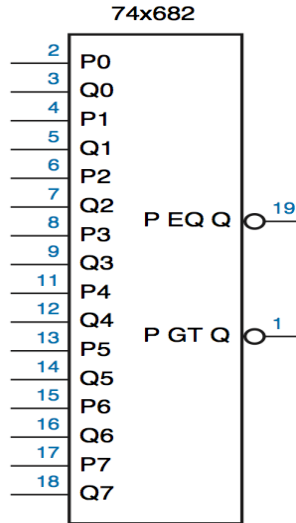
Comparador de magnitude



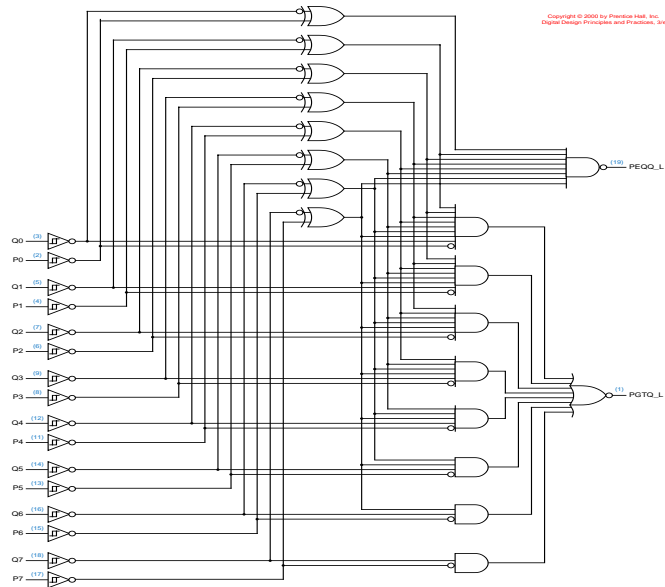
74x85 – Comparador de 4 bits



74x682 – Comparador de 8 bits

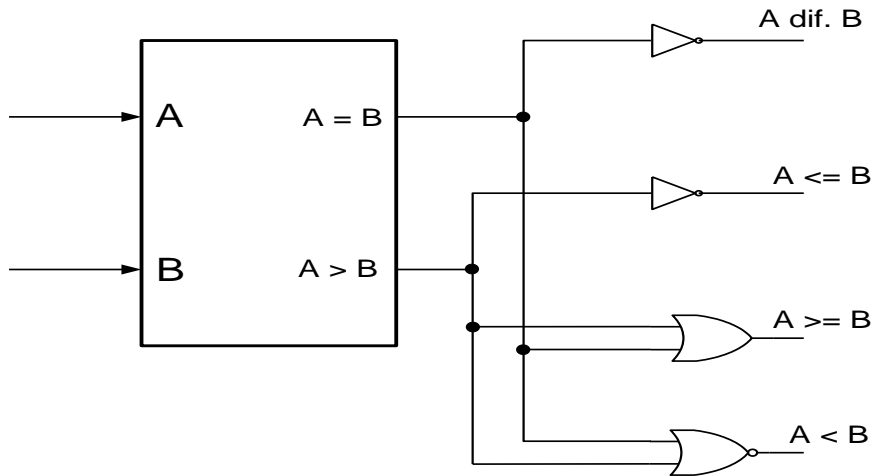


74x682 – Diagrama Lógico



Comparador de magnitude

- Como obter as demais relações?

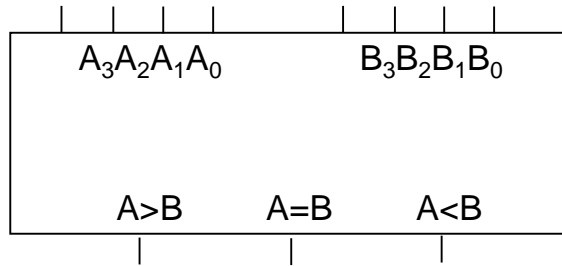


Comparador de magnitude

- Indicam relação aritmética entre as palavras de dados comparadas
- Regra: analisar a desigualdade a partir do mais significativo
- $A > B$ se
 - $A_3 > B_3$ (i.e. $A_3=1$ e $B_3=0$)
 - Ou se $A_3=B_3$ e $A_2 > B_2$
 - Ou se $A_3=B_3$ e $A_2=B_2$ e $A_1 > B_1$
 - Ou se $A_3=B_3$ e $A_2=B_2$ e $A_1=B_1$ e $A_0 > B_0$

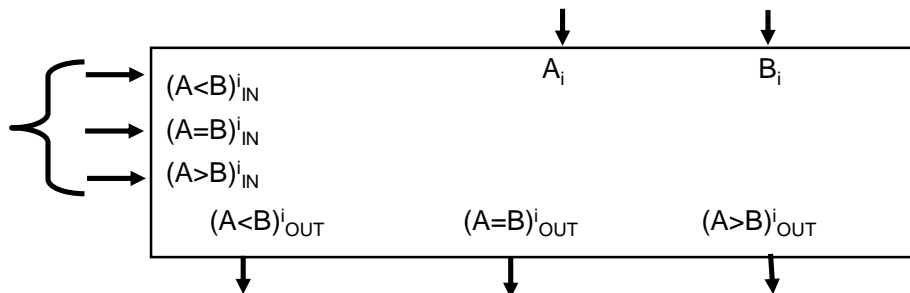
Comparador de magnitude

- $A=B$ se
 - $A_3=B_3$ e
 - $A_2=B_2$ e
 - $A_1=B_1$ e
 - $A_0=B_0$



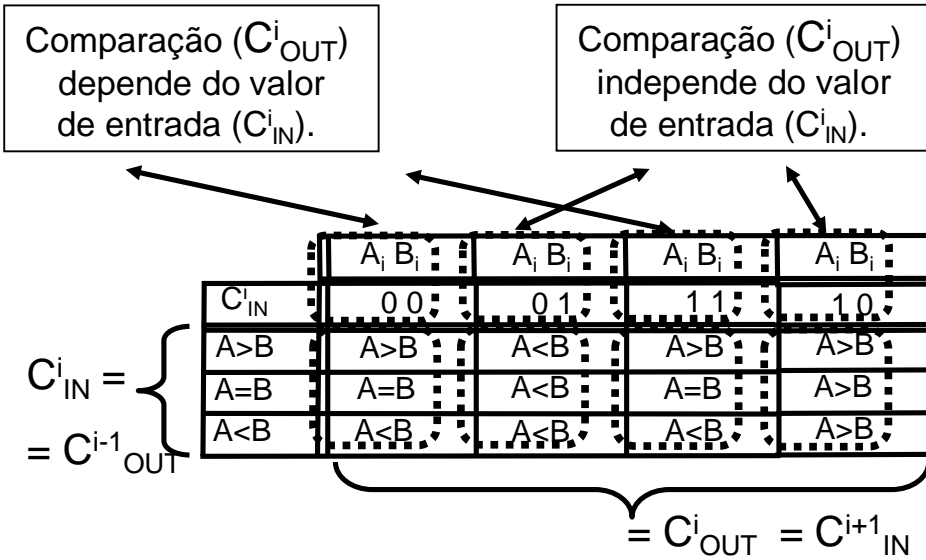
Projeto de um Comparador de Magnitude

C_{IN}^i – Informação proveniente da fatia menos significativa



C_{IN}^i	$(A > B)^i$	$(A = B)^i$	$(A < B)^i$
$A > B$	1	0	0
$A = B$	0	1	0
$A < B$	0	0	1

Projeto de um Comparador de Magnitude



Projeto de um Comparador de Magnitude

$$(A > B)^i_{OUT} = C^{i+1}_{IN}$$

		$A_i B_i$			
$(A > B)^i_{IN}$		0 0	0 1	1 1	1 0
0		0	0	0	1
1		1	0	1	1

$$\begin{aligned}
 (A > B)^i_{OUT} &= \\
 &= A_i \cdot \overline{B_i} + (A > B)^i_{IN} \cdot [A_i \cdot B_i + \overline{A_i} \cdot \overline{B_i}] \\
 & \hspace{15em} = (A = B)^i_{Interno}
 \end{aligned}$$

Projeto de um Comparador de Magnitude

$$(A=B)^i_{OUT} = C^{i+1}_{IN}$$

		$A_i B_i$			
		00	01	11	10
$(A=B)^i_{IN}$	0	0	0	0	0
	1	1	0	1	0

$$(A=B)^i_{OUT} = (A=B)^i_{IN} \cdot [A_i \cdot B_i + \overline{A_i} \cdot \overline{B_i}]$$

$$= (A=B)^i_{Interno}$$

Projeto de um Comparador de Magnitude

$$(A < B)^i_{OUT} = C^{i+1}_{IN}$$

		$A_i B_i$			
		00	01	11	10
$(A < B)^i_{IN}$	0	0	1	0	0
	1	1	1	1	0

$$(A < B)^i_{OUT} =$$

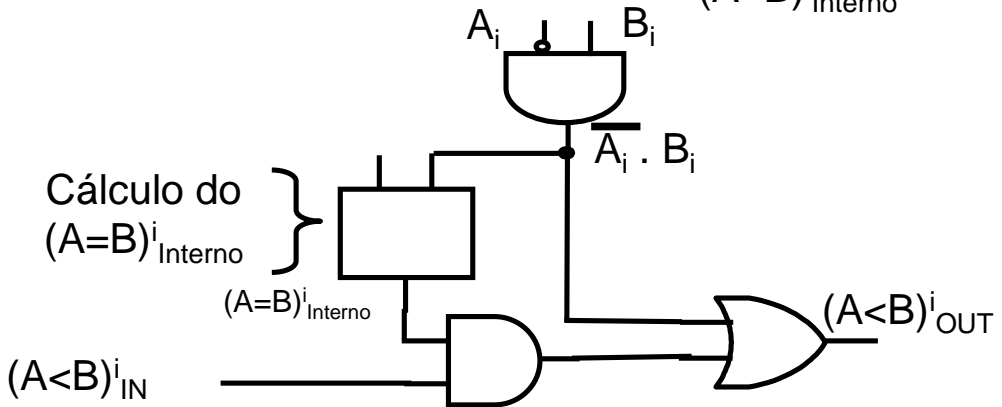
$$= \overline{A_i} \cdot B_i + (A < B)^i_{IN} \cdot [A_i \cdot B_i + \overline{A_i} \cdot \overline{B_i}]$$

$$= (A < B)^i_{Interno}$$

Projeto de um Comparador de Magnitude

$$(A < B)^i_{OUT} = A_i \cdot \overline{B_i} + (A < B)^i_{IN} \cdot [A_i \cdot B_i + \overline{A_i} \cdot \overline{B_i}]$$

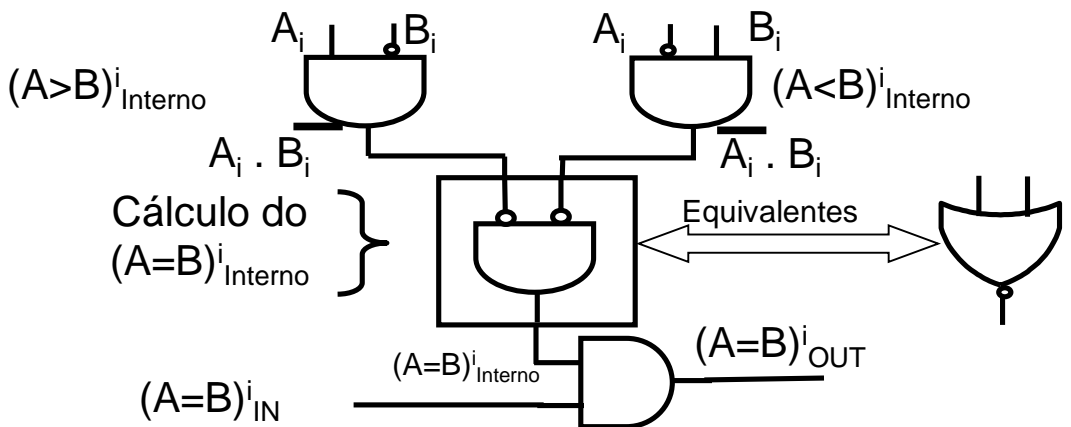
$(A = B)^i_{Interno}$



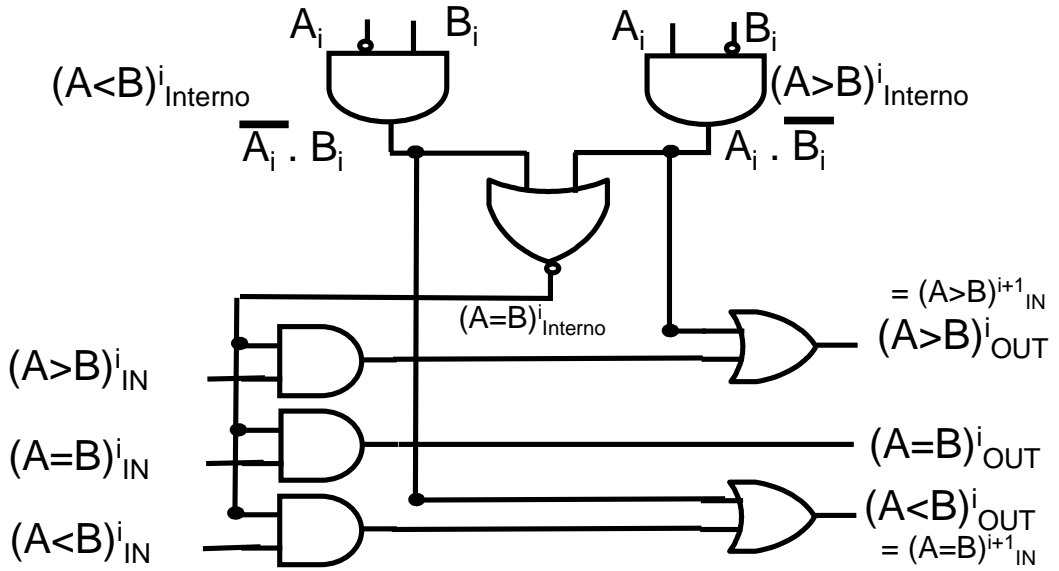
Projeto de um Comparador de Magnitude

$$(A = B)^i_{OUT} = (A > B)^i_{IN} \cdot [A_i \cdot B_i + \overline{A_i} \cdot \overline{B_i}]$$

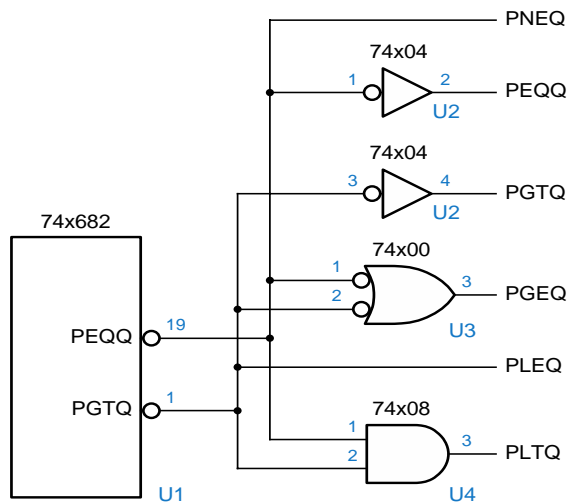
$= (A = B)^i_{Interno}$



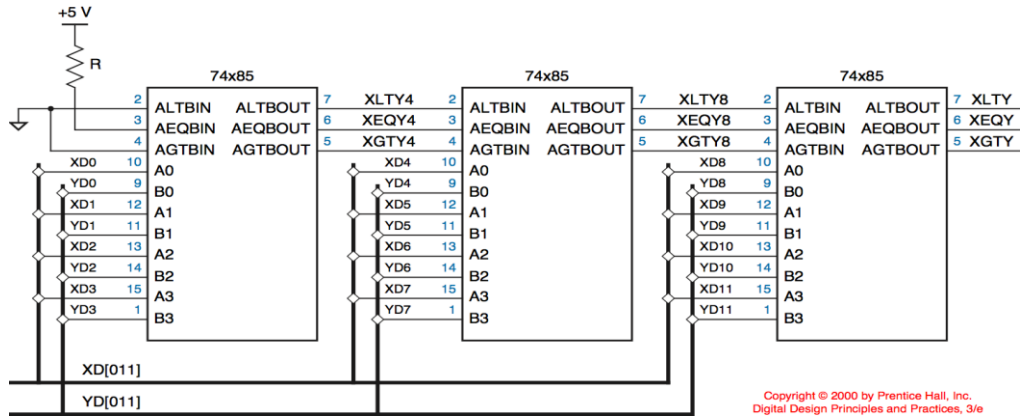
Projeto de um Comparador de Magnitude



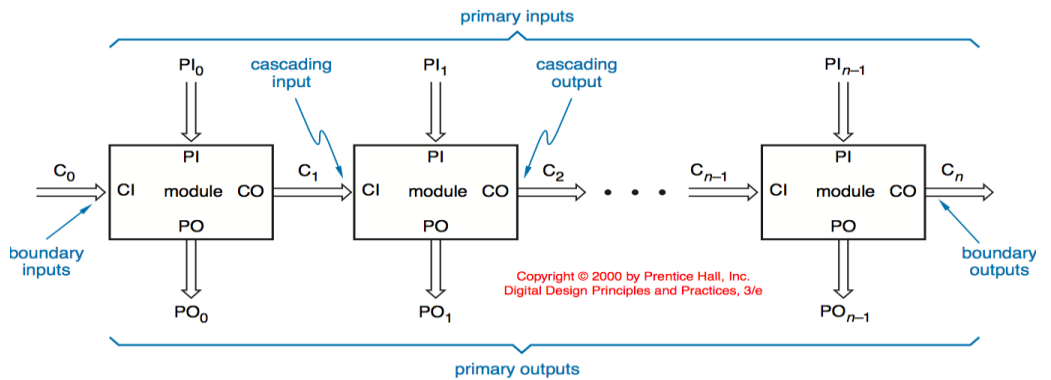
Condições Aritméticas a partir do 74x682



Comparador de 12 bits

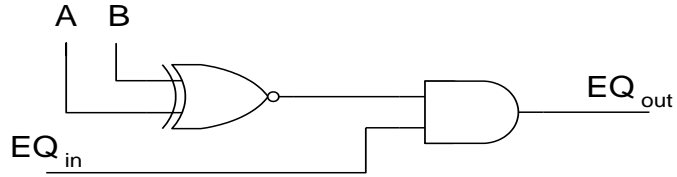


Estrutura Geral de um Circuito Iterativo

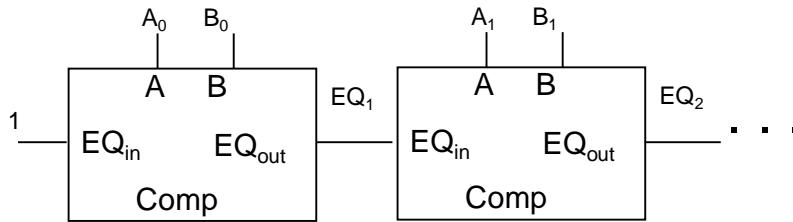


Comparador "iterativo"

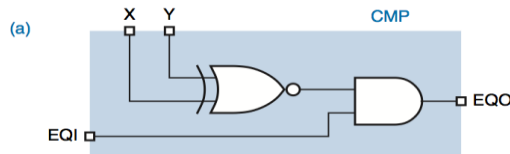
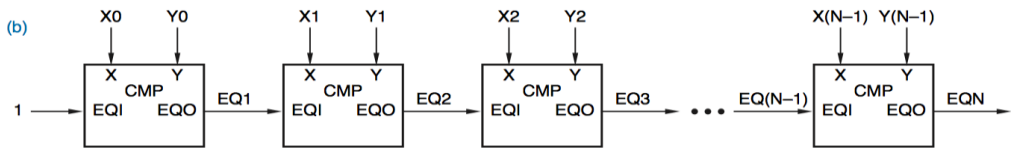
- Módulo combinatório básico do comparador



- Módulos associados do comparador



Comparador Iterativo



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