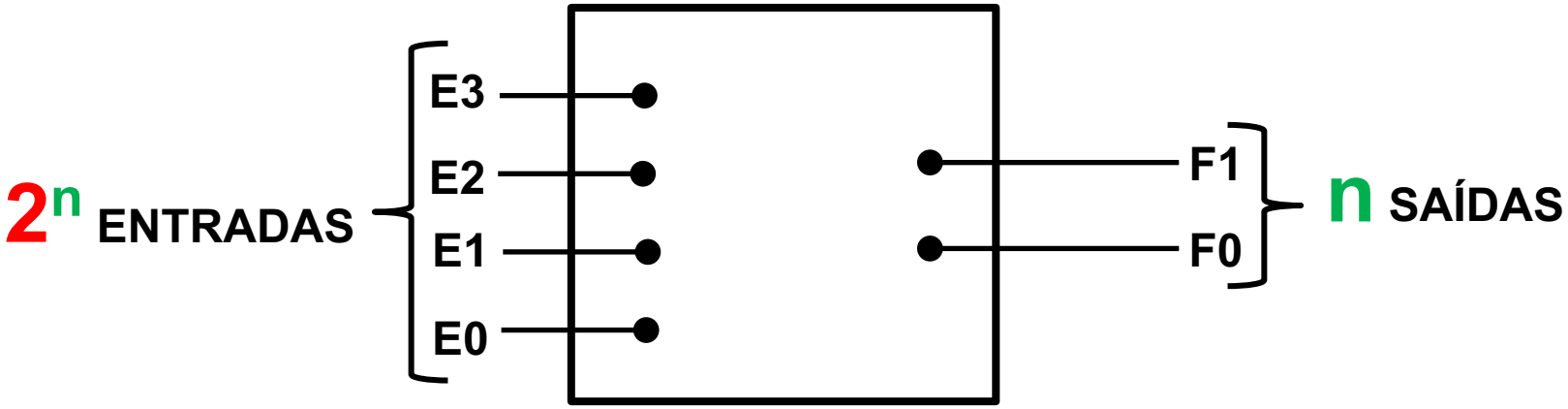
CIRCUITOS DIGITAIS

CODIFICADORES

Prof. Marcelo Grandi Mandelli
mgmandelli@unb.br

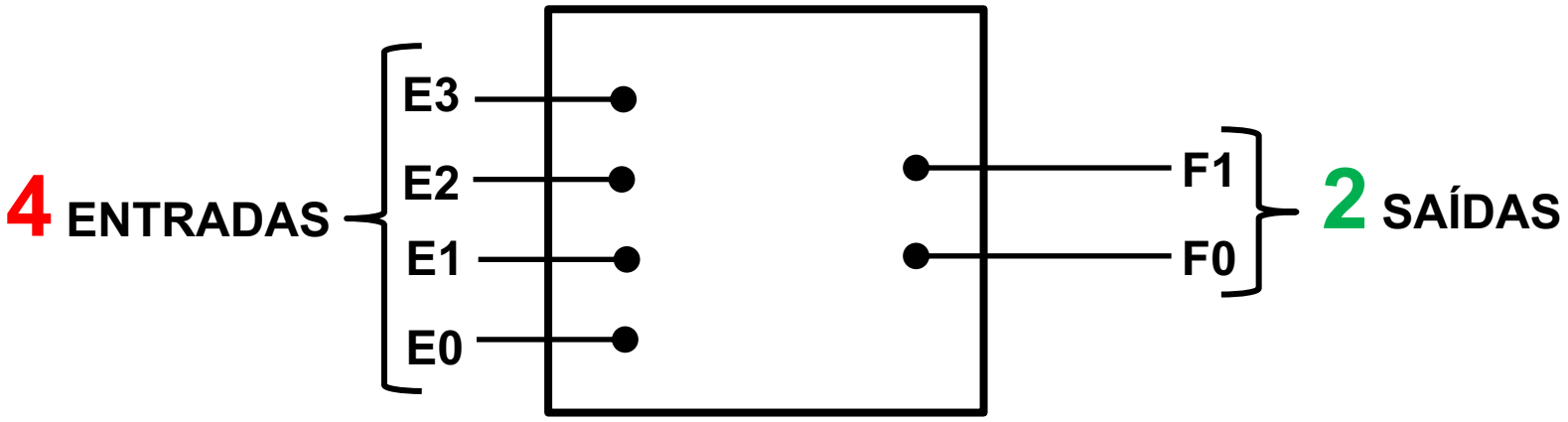
Codificadores

- Tem por objetivo reduzir o tamanho de uma palavra ou vetor binário sem perder a informação contida no mesmo



Codificadores

- Codificador **4:2**

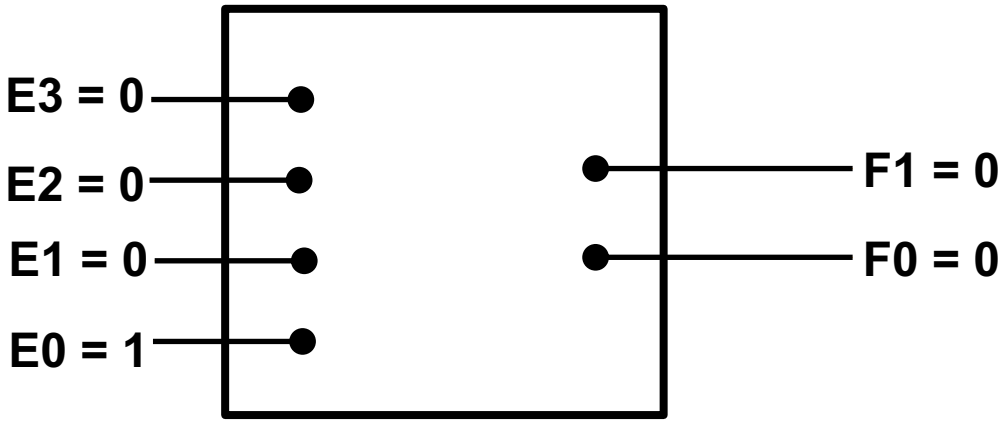


Codificadores

- Codificador **4:2**

Somente uma entrada ativa por vez!

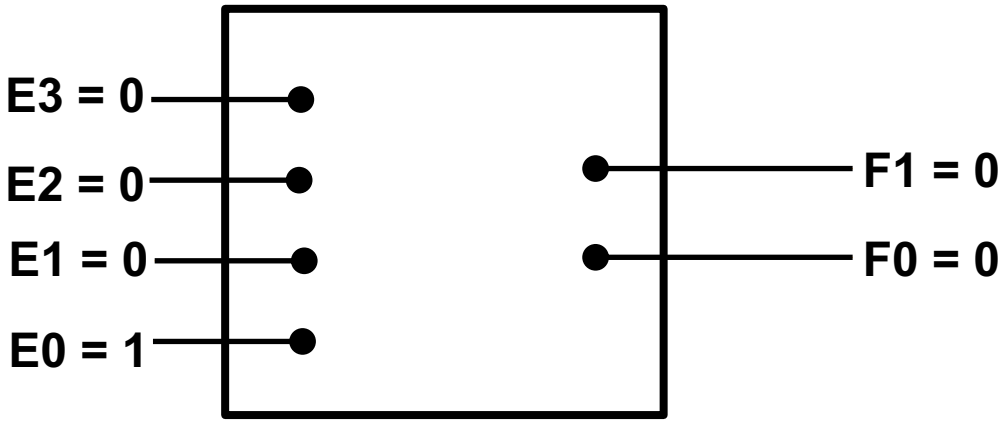
E3	E2	E1	E0	F1	F0
0	0	0	**1**	**0**	**0**
0	0	**1**	0	**0**	**1**
0	**1**	0	0	**1**	**0**
1	0	0	0	**1**	**1**



Codificadores

- Codificador **4:2**

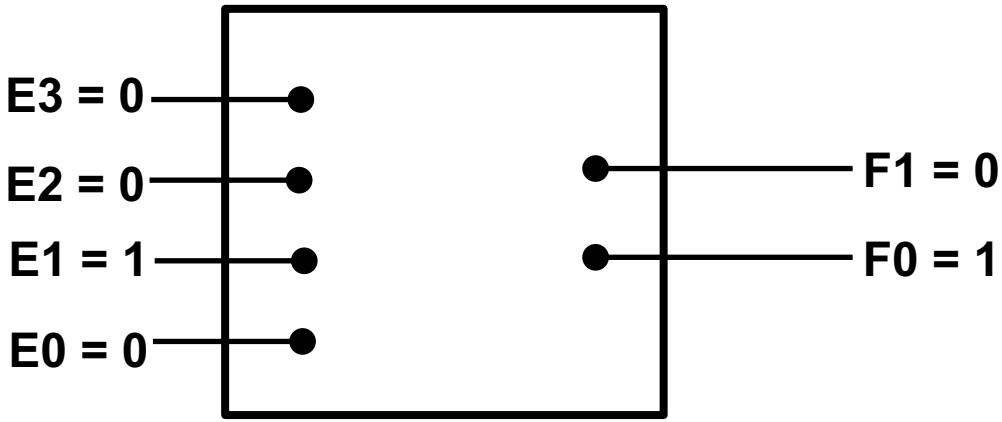
E3	E2	E1	E0	F1	F0
0	0	0	**1**	**0**	**0**
0	0	**1**	0	**0**	**1**
0	**1**	0	0	**1**	**0**
1	0	0	0	**1**	**1**



Codificadores

- Codificador **4:2**

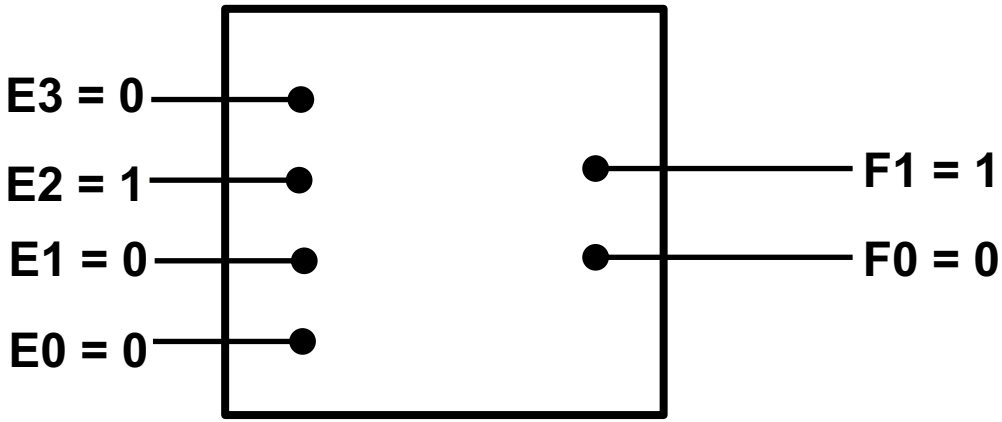
E3	E2	E1	E0	F1	F0
0	0	0	**1**	**0**	**0**
0	0	**1**	0	**0**	**1**
0	**1**	0	0	**1**	**0**
1	0	0	0	**1**	**1**



Codificadores

- Codificador **4:2**

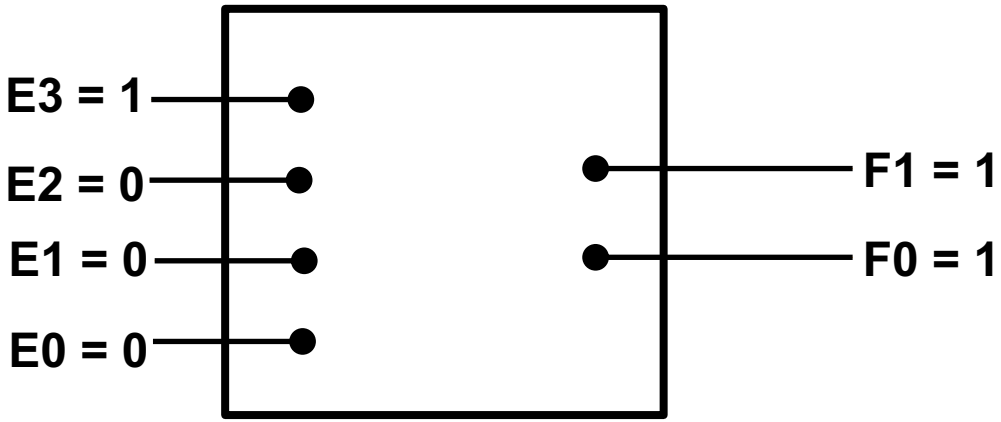
E3	E2	E1	E0	F1	F0
0	0	0	**1**	**0**	**0**
0	0	**1**	0	**0**	**1**
0	**1**	0	0	**1**	**0**
1	0	0	0	**1**	**1**



Codificadores

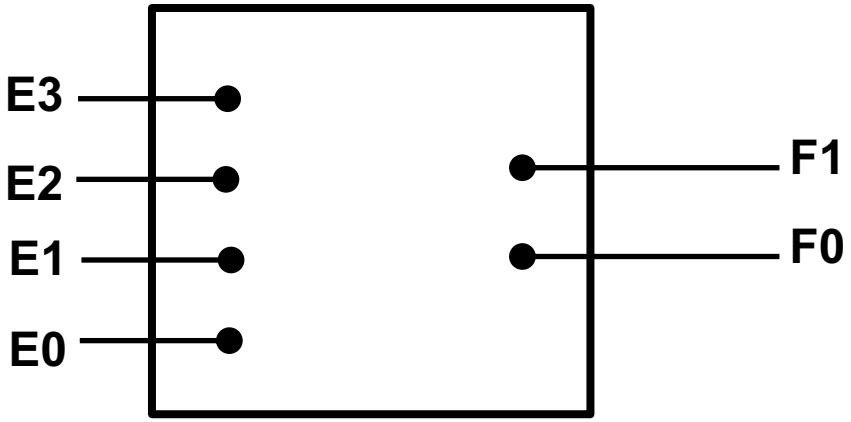
- Codificador **4:2**

E3	E2	E1	E0	F1	F0
0	0	0	**1**	**0**	**0**
0	0	**1**	0	**0**	**1**
0	**1**	0	0	**1**	**0**
1	0	0	0	**1**	**1**



Codificadores

- Codificador **4:2**



E3	E2	E1	E0	F1	F0
0	0	0	1	0	0
0	0	1	0	0	1
0	1	0	0	1	0
1	0	0	0	1	1

$$F1 = E2 + E3$$

$$F0 = E1 + E3$$

Codificadores

- Codificador **4:2**

E3	E2	E1	E0	F1	F0
0	0	0	**1**	**0**	**0**
0	0	**1**	0	**0**	**1**
0	**1**	0	0	**1**	**0**
1	0	0	0	**1**	**1**

E3E2 \ E1E0	00	01	11	10
00	X	0	X	0
01	1	X	X	X
11	X	X	X	X
10	1	X	X	X

$$F1 = E2 + E3$$

Codificadores

- Codificador **4:2**

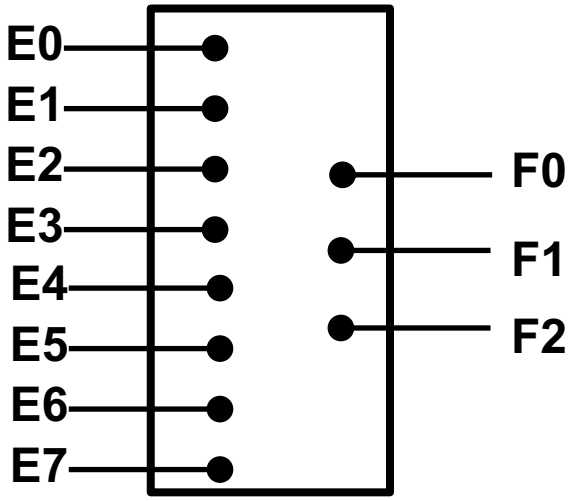
E3	E2	E1	E0	F1	F0
0	0	0	**1**	**0**	**0**
0	0	**1**	0	**0**	**1**
0	**1**	0	0	**1**	**0**
1	0	0	0	**1**	**1**

E3E2 \ E1E0	00	01	11	10
00	X	0	X	1
01	0	X	X	X
11	X	X	X	X
10	1	X	X	X

$$F0 = E1 + E3$$

Codificadores

- Codificador **8:3**



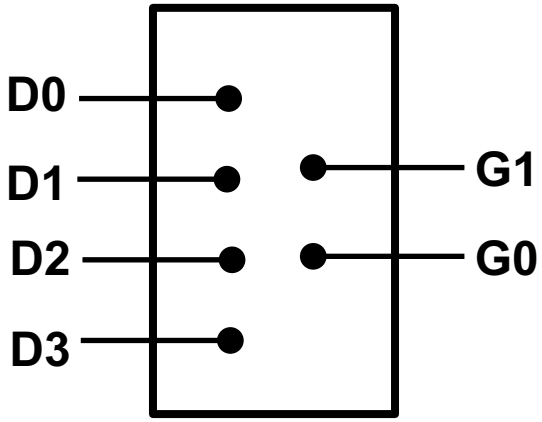
E7	E6	E5	E4	E3	E2	E1	E0	F2	F1	F0
0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	1	0	0	0	1
0	0	0	0	0	1	0	0	0	1	0
0	0	0	0	1	0	0	0	0	1	1
0	0	0	1	0	0	0	0	1	0	0
0	0	1	0	0	0	0	0	1	0	1
0	1	0	0	0	0	0	0	1	1	0
1	0	0	0	0	0	0	0	1	1	1

$$F2 = E4 + E5 + E6 + E7$$

$$F1 = E2 + E3 + E6 + E7$$

$$F0 = E1 + E3 + E5 + E7$$

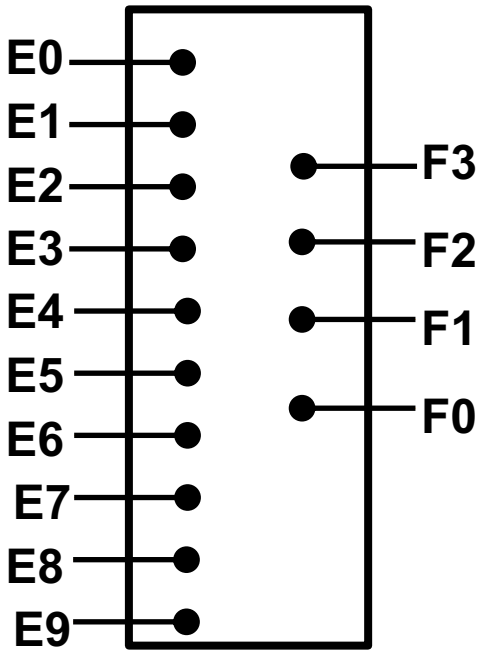
Codificador Decimal para Gray



D3	D2	D1	D0	G1	G0
0	0	0	**1**	**0**	**0**
0	0	**1**	0	**0**	**1**
0	**1**	0	0	**1**	**1**
1	0	0	0	**1**	**0**

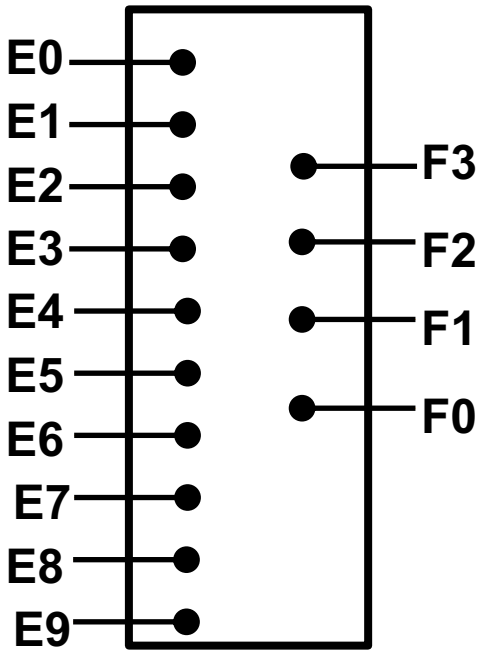
$$G1 = D2 + D3 \qquad G0 = D1 + D2$$

Codificador Decimal para BCD



E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	F3	F2	F1	F0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	0	0	0	1	0
0	0	0	1	0	0	0	0	0	0	0	0	1	1
0	0	0	0	1	0	0	0	0	0	0	1	0	0
0	0	0	0	0	1	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	1	1	0
0	0	0	0	0	0	0	1	0	0	0	1	1	1
0	0	0	0	0	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	1	1	0	0	1
Demais casos										X	X	X	X

Codificador Decimal para BCD



E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	F3	F2	F1	F0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	0	0	0	1	0
0	0	0	1	0	0	0	0	0	0	0	0	1	1
0	0	0	0	1	0	0	0	0	0	0	1	0	0
0	0	0	0	0	1	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	1	1	0
0	0	0	0	0	0	0	1	0	0	0	1	1	1
0	0	0	0	0	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	1	1	0	0	1
Demais casos										X	X	X	X

$$F3 = E8 + E9$$

$$F2 = E4 + E5 + E6 + E7$$

$$F1 = E2 + E3 + E6 + E7$$

$$F0 = E1 + E3 + E5 + E7 + E9$$

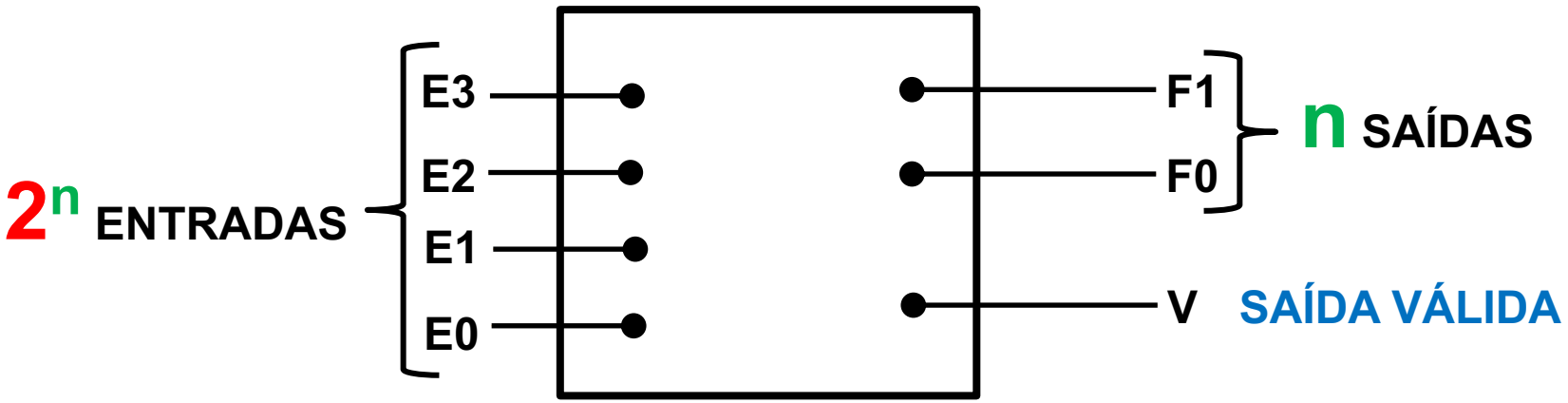
Codificadores

- **Problemas**
  - **Todas entradas iguais a 0→ valor inválido**
  - **Mais de uma de entrada iguais a 1→ valor inválido**

Codificadores com Prioridade

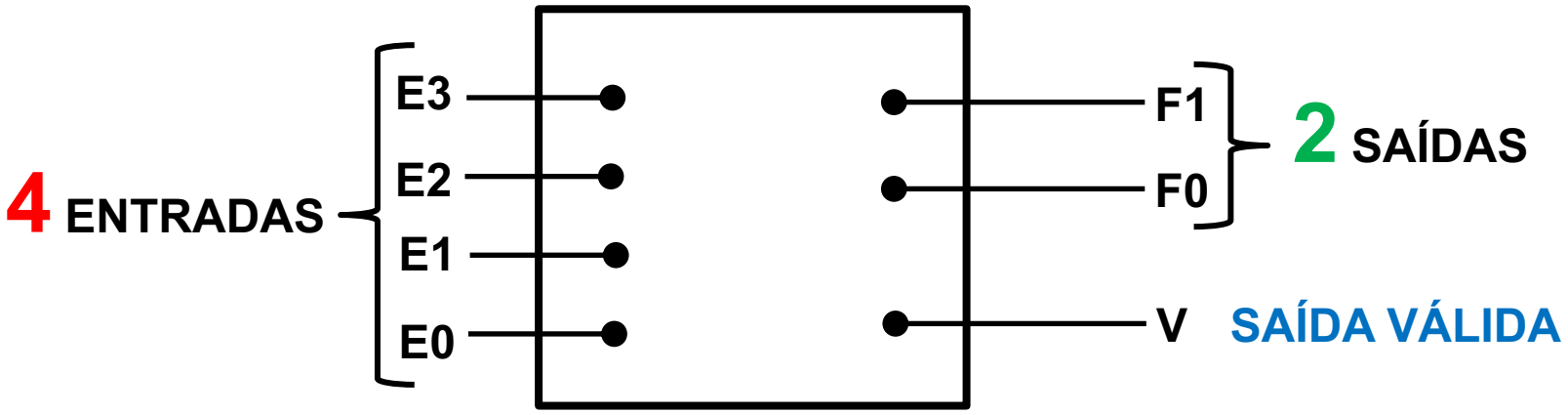
- Se duas entradas tem valor 1 ao mesmo tempo, a entrada de bit mais significativo tem prioridade

- Sinal de validade → informa se a saída é válida



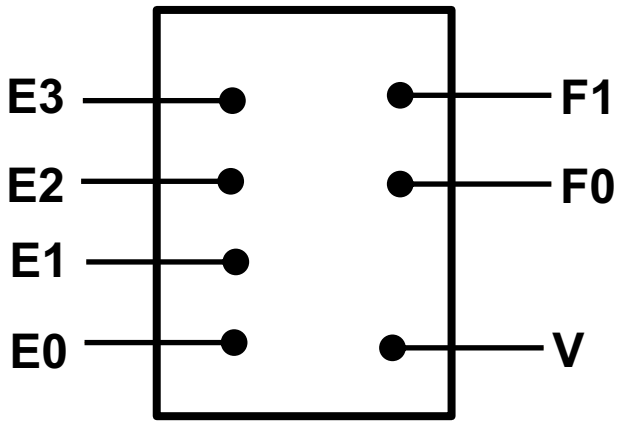
Codificadores com Prioridade

- Codificador **4:2** com prioridade



Codificadores com Prioridade

- Codificador **4:2** com prioridade

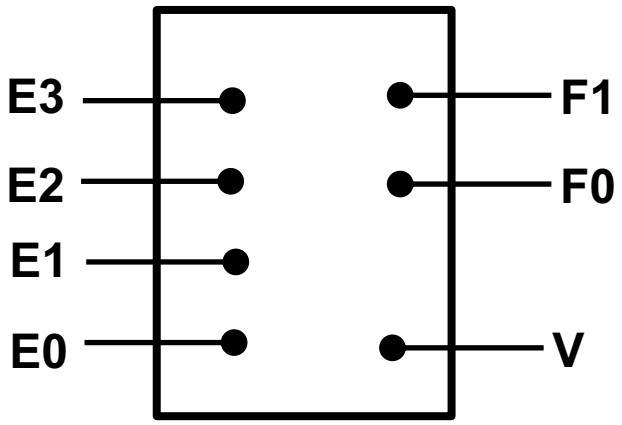


E3	E2	E1	E0	F1	F0	V
0	0	0	**0**	**0**	**0**	**0**
0	0	0	**1**	**0**	**0**	**1**
0	0	**1**	**X**	**0**	**1**	**1**
0	**1**	**X**	**X**	**1**	**0**	**1**
1	**X**	**X**	**X**	**1**	**1**	**1**

Saída é válida somente se uma das entradas for igual a 1

Codificadores com Prioridade

- Codificador **4:2** com prioridade

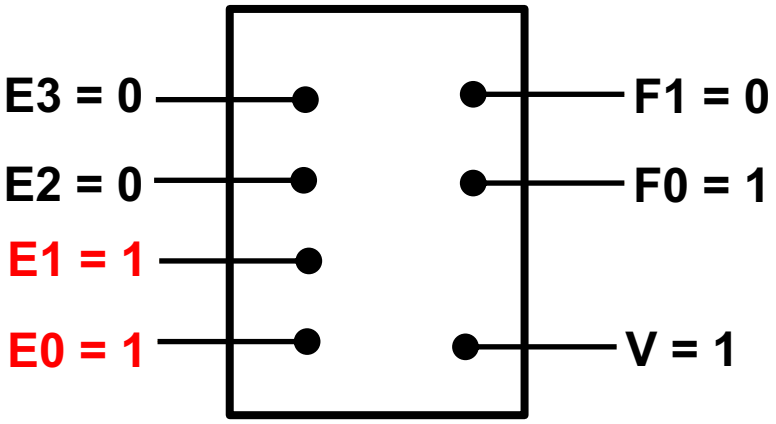


E3	E2	E1	E0	F1	F0	V
0	0	0	**0**	**0**	**0**	**0**
0	0	0	**1**	**0**	**0**	**1**
0	0	**1**	**X**	**0**	**1**	**1**
0	**1**	**X**	**X**	**1**	**0**	**1**
1	**X**	**X**	**X**	**1**	**1**	**1**

Se mais de duas entradas forem iguais a 1
→ bit mais significativo tem prioridade

Codificadores com Prioridade

- Codificador **4:2** com prioridade

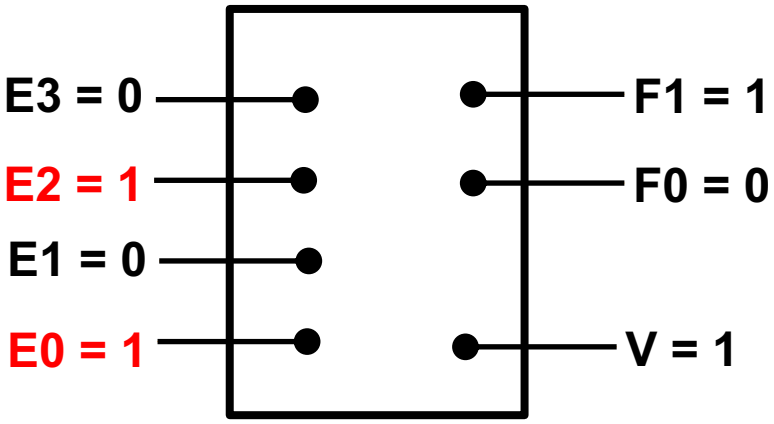


E3	E2	E1	E0	F1	F0	V
0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	X	0	1	1
0	1	X	X	1	0	1
1	X	X	X	1	1	1

Se mais de duas entradas forem iguais a 1
→ bit mais significativo tem prioridade

Codificadores com Prioridade

- Codificador **4:2** com prioridade

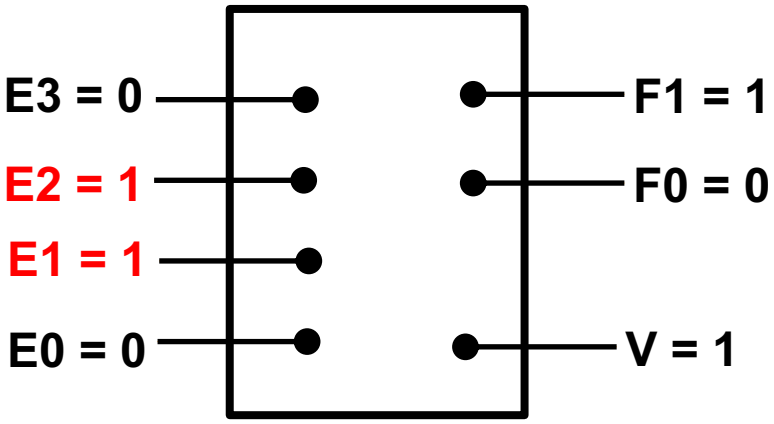


E3	E2	E1	E0	F1	F0	V
0	0	0	**0**	**0**	**0**	**0**
0	0	0	**1**	**0**	**0**	**1**
0	0	**1**	**X**	**0**	**1**	**1**
0	**1**	**X**	**X**	**1**	**0**	**1**
1	**X**	**X**	**X**	**1**	**1**	**1**

Se mais de duas entradas forem iguais a 1
→ bit mais significativo tem prioridade

Codificadores com Prioridade

- Codificador **4:2** com prioridade

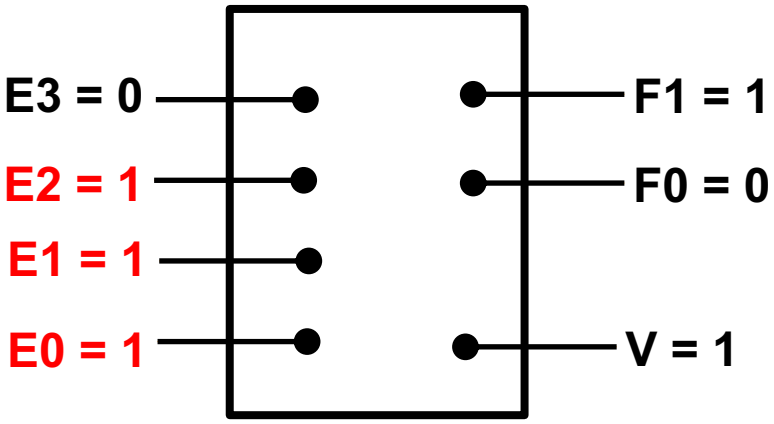


E3	E2	E1	E0	F1	F0	V
0	0	0	**0**	**0**	**0**	**0**
0	0	0	**1**	**0**	**0**	**1**
0	0	**1**	**X**	**0**	**1**	**1**
0	**1**	**X**	**X**	**1**	**0**	**1**
1	**X**	**X**	**X**	**1**	**1**	**1**

Se mais de duas entradas forem iguais a 1
→ bit mais significativo tem prioridade

Codificadores com Prioridade

- Codificador **4:2** com prioridade

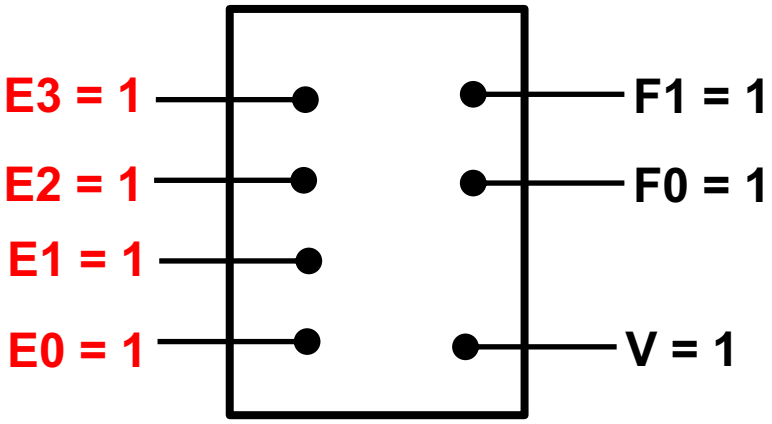


E3	E2	E1	E0	F1	F0	V
0	0	0	**0**	**0**	**0**	**0**
0	0	0	**1**	**0**	**0**	**1**
0	0	**1**	**X**	**0**	**1**	**1**
0	**1**	**X**	**X**	**1**	**0**	**1**
1	**X**	**X**	**X**	**1**	**1**	**1**

Se mais de duas entradas forem iguais a 1
→ bit mais significativo tem prioridade

Codificadores com Prioridade

- Codificador **4:2** com prioridade

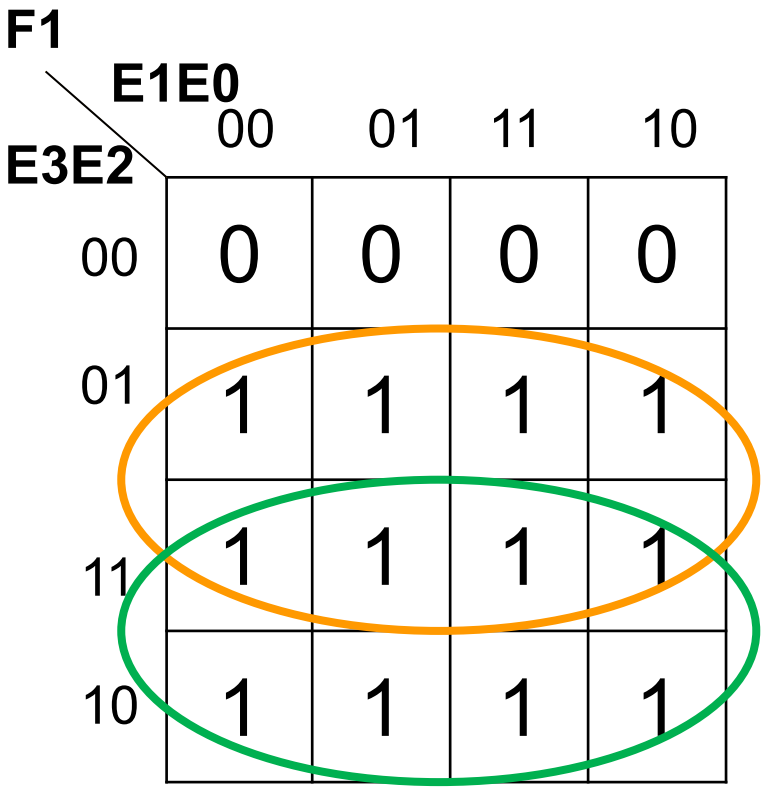


E3	E2	E1	E0	F1	F0	V
0	0	0	**0**	**0**	**0**	**0**
0	0	0	**1**	**0**	**0**	**1**
0	0	**1**	**X**	**0**	**1**	**1**
0	**1**	**X**	**X**	**1**	**0**	**1**
1	**X**	**X**	**X**	**1**	**1**	**1**

Se mais de duas entradas forem iguais a 1
→ bit mais significativo tem prioridade

Codificadores com Prioridade

- Codificador **4:2** com prioridade

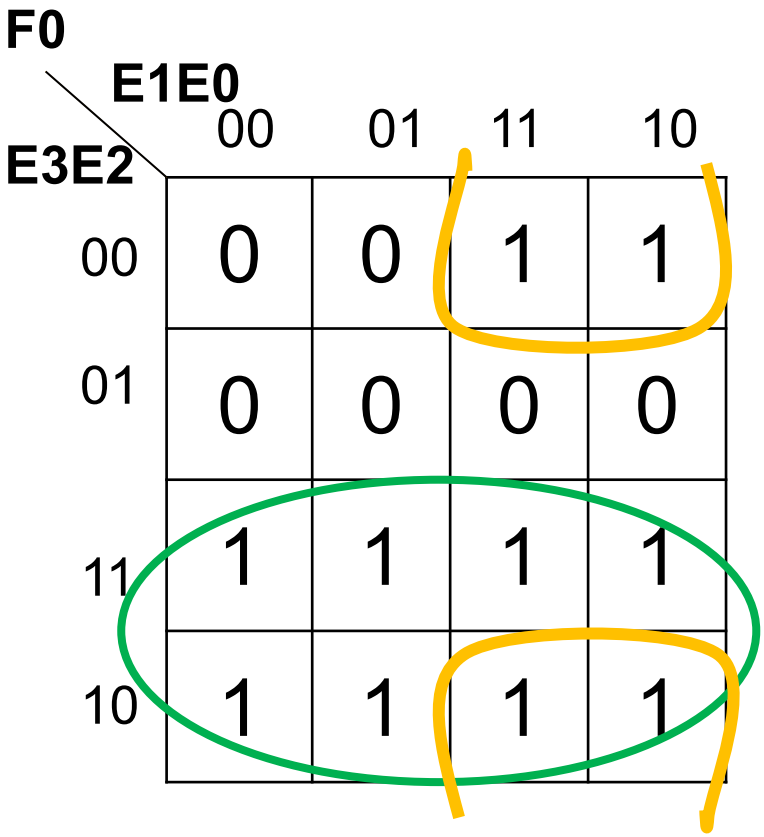


E3	E2	E1	E0	F1	F0	V
0	0	0	**0**	**0**	**0**	**0**
0	0	0	**1**	**0**	**0**	**1**
0	0	**1**	**X**	**0**	**1**	**1**
0	**1**	**X**	**X**	**1**	**0**	**1**
1	**X**	**X**	**X**	**1**	**1**	**1**

$$F1 = E2 + E3$$

Codificadores com Prioridade

- Codificador **4:2** com prioridade



E3	E2	E1	E0	F1	F0	V
0	0	0	0	**0**	**0**	**0**
0	0	0	**1**	**0**	**0**	**1**
0	0	**1**	**X**	**0**	**1**	**1**
0	**1**	**X**	**X**	**1**	**0**	**1**
1	**X**	**X**	**X**	**1**	**1**	**1**

$$F0 = E3 + \overline{E2}E1$$

Codificadores com Prioridade

- Codificador **4:2** com prioridade

$$V = E3 + E2 + E1 + E0$$

E3	E2	E1	E0	F1	F0	V
0	0	0	0	**0**	**0**	**0**
0	0	0	**1**	**0**	**0**	**1**
0	0	**1**	**X**	**0**	**1**	**1**
0	**1**	**X**	**X**	**1**	**0**	**1**
1	**X**	**X**	**X**	**1**	**1**	**1**

Codificadores com Prioridade

- Codificador **4:2** com prioridade