Aula 6
CODIFICADOR/DECODIFICADOR BINÁRIO ↔ DECIMAL

Projeto de Ensino

Material didático para lógica digital I: circuitos combinacionais

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Sumário

Codificador "Decimal → Binário"

- No codificador "Decimal → Binário" serão utilizadas 10 entradas, cada uma representando um dígito entre 0 e 9.
- As saídas representam o código BCD 8421.

Decimal	A	B	C	D
e0	0	0	0	0
e1	0	0	0	1
e2	0	0	1	0
e3	0	0	1	1
e4	0	1	0	0
e5	0	1	0	1
e6	0	1	1	0
e7	0	1	1	1
e8	1	0	0	0
e9	1	0	0	1

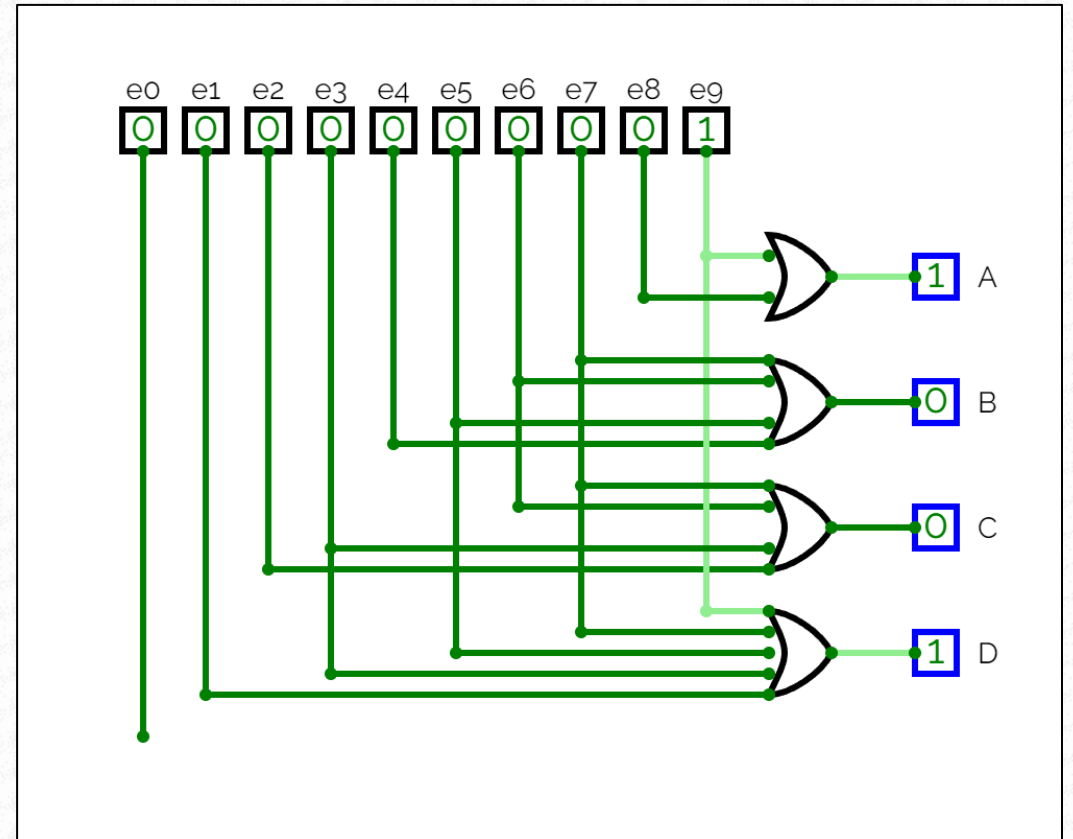# Codificador "Decimal → Binário" – Circuito combinacional

- Através da tabela verdade é possível obter facilmente as expressões mínimas de cada saída.

    - A = e8 + e9
    - B = e4 + e5 + e6 + e7
    - C = e2 + e3 + e6 + e7
    - D = e1 + e3 + e5 + e7 + e9

Decimal	A	B	C	D
e0	0	0	0	0
e1	0	0	0	1
e2	0	0	1	0
e3	0	0	1	1
e4	0	1	0	0
e5	0	1	0	1
e6	0	1	1	0
e7	0	1	1	1
e8	1	0	0	0
e9	1	0	0	1

Codificador "Decimal → Binário" – Simulação

- A = e8 + e9

- B = e4 + e5 + e6 + e7

- C = e2 + e3 + e6 + e7

- D = e1 + e3 + e5 + e7 + e9

- O circuito foi então simulado no CircuitVerse.

- Disponível em: https://circuitverse.org/users/166835/projects/decimal-binario

Codificador "Decimal → Binário" – Simulação

- Abaixo o circuito encapsulado.

- Disponível em: https://circuitverse.org/users/166835/projects/decimal-binario
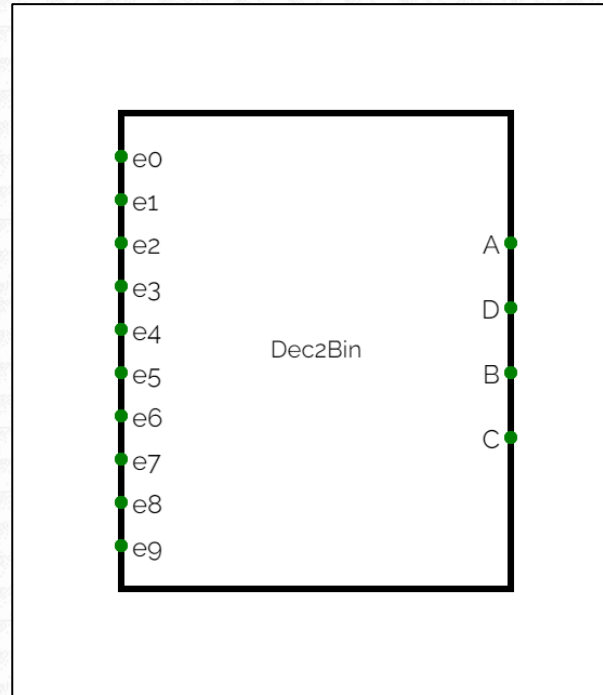
Decodificador "Binário → Decimal"

- Para o codificador "Binário → Decimal" será feita a correspondência entre o código BCD 8421 e o código 9876543210. Ambos abordados na "Aula 05".

- A seguir a tabela verdade que relaciona esses dois códigos:

Decodificador "Binário → Decimal"

A	B	C	D	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
0	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	1	0	1	0	0	0	0	0	0	0	0
0	0	1	0	0	0	1	0	0	0	0	0	0	0
0	0	1	1	0	0	0	1	0	0	0	0	0	0
0	1	0	0	0	0	0	0	1	0	0	0	0	0
0	1	0	1	0	0	0	0	0	1	0	0	0	0
0	1	1	0	0	0	0	0	0	0	1	0	0	0
0	1	1	1	0	0	0	0	0	0	0	1	0	0
1	0	0	0	0	0	0	0	0	0	0	0	1	0
1	0	0	1	0	0	0	0	0	0	0	0	0	1

Decodificador "Binário → Decimal" – Circuito Combinacional

- Para esse circuito existem 4 entradas (A, B, C e D) e 10 saídas.
- A seguir serão feitas as deduções das expressões mínimas para cada saída.
- Como o mapa de Karnaugh para 4 entradas possui 16 casas, casos que não estão explícitos na tabela verdade serão preenchidos com X e podem ser agrupados de acordo a conveniência.

Decodificador "Binário → Decimal" – Circuito Combinacional

	$\overline{C}$		C		
$\overline{A}$	$\overline{A}\overline{B}\overline{C}\overline{D}$	$\overline{A}\overline{B}\overline{C}D$	$\overline{A}\overline{B}CD$	$\overline{A}\overline{B}C\overline{D}$	$\overline{B}$
	$\overline{A}B\overline{C}\overline{D}$	$\overline{A}B\overline{C}D$	$\overline{A}BCD$	$\overline{A}BC\overline{D}$	B
A	$AB\overline{C}\overline{D}$	$AB\overline{C}D$	$ABCD$	$ABC\overline{D}$	
	$A\overline{B}\overline{C}\overline{D}$	$A\overline{B}\overline{C}D$	$A\overline{B}CD$	$A\overline{B}C\overline{D}$	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S0
0	0	0	0	**1**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S0

	$\overline{C}$		C	
	1	0	0	0	$\overline{B}$
$\overline{A}$	0	0	0	0	
	X	X	X	X	B
A	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S0
0	0	0	0	**1**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S0

	$\overline{C}$		C		
	1	0	0	0	$\overline{B}$
$\overline{A}$	0	0	0	0	B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

DEC	EXPRESSÃO
0	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$
1	
2	
3	
4	
5	
6	
7	
8	
9	

Decodificador "Binário → Decimal" – Circuito Combinacional

	$\overline{C}$		C		
$\overline{A}$	$\overline{A}\overline{B}\overline{C}\overline{D}$	$\overline{A}\overline{B}\overline{C}D$	$\overline{A}\overline{B}CD$	$\overline{A}\overline{B}C\overline{D}$	$\overline{B}$
	$\overline{A}B\overline{C}\overline{D}$	$\overline{A}B\overline{C}D$	$\overline{A}BCD$	$\overline{A}BC\overline{D}$	B
A	$AB\overline{C}\overline{D}$	$AB\overline{C}D$	$ABCD$	$ABC\overline{D}$	
	$A\overline{B}\overline{C}\overline{D}$	$A\overline{B}\overline{C}D$	$A\overline{B}CD$	$A\overline{B}C\overline{D}$	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S1
0	0	0	0	**0**
0	0	0	1	**1**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S1

	$\overline{C}$		C		
$\overline{A}$	0	1	0	0	$\overline{B}$
	0	0	0	0	B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S1
0	0	0	0	**0**
0	0	0	1	**1**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S1

	$\overline{C}$		C		
	0	1	0	0	$\overline{B}$
$\overline{A}$	0	0	0	0	
					B
	X	X	X	X	
A	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

DEC	EXPRESSÃO
0	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$
1	$\overline{A}\,\overline{B}\,\overline{C}\,D$
2	
3	
4	
5	
6	
7	
8	
9	

Decodificador "Binário → Decimal" – Circuito Combinacional

	$\overline{C}$		C		
$\overline{A}$	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$	$\overline{A}\,\overline{B}\,\overline{C}\,D$	$\overline{A}\,\overline{B}\,C\,D$	$\overline{A}\,\overline{B}\,C\,\overline{D}$	$\overline{B}$
	$\overline{A}\,B\,\overline{C}\,\overline{D}$	$\overline{A}\,B\,\overline{C}\,D$	$\overline{A}\,B\,C\,D$	$\overline{A}\,B\,C\,\overline{D}$	B
A	$A\,B\,\overline{C}\,\overline{D}$	$A\,B\,\overline{C}\,D$	$A\,B\,C\,D$	$A\,B\,C\,\overline{D}$	
	$A\,\overline{B}\,\overline{C}\,\overline{D}$	$A\,\overline{B}\,\overline{C}\,D$	$A\,\overline{B}\,C\,D$	$A\,\overline{B}\,C\,\overline{D}$	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S2
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**1**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S2

	$\overline{C}$		C		
	0	0	0	1	$\overline{B}$
$\overline{A}$	0	0	0	0	
					B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S2
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**1**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S2

	$\overline{C}$		C	
$\overline{A}$	0	0	0	1	$\overline{B}$
	0	0	0	0	B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D	$\overline{D}$	

DEC	EXPRESSÃO
0	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$
1	$\overline{A}\,\overline{B}\,\overline{C}\,D$
2	$\overline{B}\,C\,\overline{D}$
3	
4	
5	
6	
7	
8	
9	

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Decodificador "Binário → Decimal" – Circuito Combinacional

	$\overline{C}$		C		
	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$	$\overline{A}\,\overline{B}\,\overline{C}\,D$	$\overline{A}\,\overline{B}\,C\,D$	$\overline{A}\,\overline{B}\,C\,\overline{D}$	$\overline{B}$
$\overline{A}$	$\overline{A}\,B\,\overline{C}\,\overline{D}$	$\overline{A}\,B\,\overline{C}\,D$	$\overline{A}\,B\,C\,D$	$\overline{A}\,B\,C\,\overline{D}$	B
A	$A\,B\,\overline{C}\,\overline{D}$	$A\,B\,\overline{C}\,D$	$A\,B\,C\,D$	$A\,B\,C\,\overline{D}$	
	$A\,\overline{B}\,\overline{C}\,\overline{D}$	$A\,\overline{B}\,\overline{C}\,D$	$A\,\overline{B}\,C\,D$	$A\,\overline{B}\,C\,\overline{D}$	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S3
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**1**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S3

	$\overline{C}$		C		
$\overline{A}$	0	0	1	0	$\overline{B}$
	0	0	0	0	B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S3
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**1**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S3

K-map (S3):

	$\overline{C}$		C		
$\overline{A}$	0	0	1	0	$\overline{B}$
	0	0	0	0	B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

DEC	EXPRESSÃO
0	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$
1	$\overline{A}\,\overline{B}\,\overline{C}\,D$
2	$\overline{B}\,C\,\overline{D}$
3	$\overline{B}\,C\,D$
4	
5	
6	
7	
8	
9	

Decodificador "Binário ➔ Decimal" – Circuito Combinacional

	$\overline{C}$		C		
	$\overline{A}\overline{B}\overline{C}\overline{D}$	$\overline{A}\overline{B}\overline{C}D$	$\overline{A}\overline{B}CD$	$\overline{A}\overline{B}C\overline{D}$	$\overline{B}$
$\overline{A}$	$\overline{A}B\overline{C}\overline{D}$	$\overline{A}B\overline{C}D$	$\overline{A}BCD$	$\overline{A}BC\overline{D}$	
	$AB\overline{C}\overline{D}$	$AB\overline{C}D$	$ABCD$	$ABC\overline{D}$	B
A	$A\overline{B}\overline{C}\overline{D}$	$A\overline{B}\overline{C}D$	$A\overline{B}CD$	$A\overline{B}C\overline{D}$	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S4
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**1**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S4

	$\overline{C}$		C	
$\overline{A}$	0	0	0	0	$\overline{B}$
	1	0	0	0	B
	X	X	X	X	
A	0	0	X	X	$\overline{B}$
	$\overline{D}$	D	$\overline{D}$	

A	B	C	D	S4
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**1**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S4

	$\overline{C}$		C		
	0	0	0	0	$\overline{B}$
$\overline{A}$					
	1	0	0	0	
					B
	X	X	X	X	
A					
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

DEC	EXPRESSÃO
0	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$
1	$\overline{A}\,\overline{B}\,\overline{C}\,D$
2	$\overline{B}\,C\,\overline{D}$
3	$\overline{B}\,C\,D$
4	$B\,\overline{C}\,\overline{D}$
5	
6	
7	
8	
9	

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Decodificador "Binário → Decimal" – Circuito Combinacional

	$\overline{C}$		C		
$\overline{A}$	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$	$\overline{A}\,\overline{B}\,\overline{C}\,D$	$\overline{A}\,\overline{B}\,C\,D$	$\overline{A}\,\overline{B}\,C\,\overline{D}$	$\overline{B}$
	$\overline{A}\,B\,\overline{C}\,\overline{D}$	$\overline{A}\,B\,\overline{C}\,D$	$\overline{A}\,B\,C\,D$	$\overline{A}\,B\,C\,\overline{D}$	B
A	$A\,B\,\overline{C}\,\overline{D}$	$A\,B\,\overline{C}\,D$	$A\,B\,C\,D$	$A\,B\,C\,\overline{D}$	
	$A\,\overline{B}\,\overline{C}\,\overline{D}$	$A\,\overline{B}\,\overline{C}\,D$	$A\,\overline{B}\,C\,D$	$A\,\overline{B}\,C\,\overline{D}$	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S5
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**1**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S5

	$\overline{C}$		C	
$\overline{A}$	0	0	0	0	$\overline{B}$
	0	1	0	0	B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S5
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**1**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S5

	$\overline{C}$		C	
$\overline{A}$	0	0	0	0	$\overline{B}$
	0	1	0	0	B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

DEC	EXPRESSÃO
0	$\overline{A}\overline{B}\overline{C}\overline{D}$
1	$\overline{A}\overline{B}\overline{C}D$
2	$\overline{B}C\overline{D}$
3	$\overline{B}CD$
4	$B\overline{C}\overline{D}$
5	$B\overline{C}D$
6	
7	
8	
9	

Decodificador "Binário → Decimal" – Circuito Combinacional

	$\bar{C}$		C		
$\bar{A}$	$\bar{A}\bar{B}\bar{C}\bar{D}$	$\bar{A}\bar{B}\bar{C}D$	$\bar{A}\bar{B}CD$	$\bar{A}\bar{B}C\bar{D}$	$\bar{B}$
	$\bar{A}B\bar{C}\bar{D}$	$\bar{A}B\bar{C}D$	$\bar{A}BCD$	$\bar{A}BC\bar{D}$	B
A	$AB\bar{C}\bar{D}$	$AB\bar{C}D$	$ABCD$	$ABC\bar{D}$	
	$A\bar{B}\bar{C}\bar{D}$	$A\bar{B}\bar{C}D$	$A\bar{B}CD$	$A\bar{B}C\bar{D}$	$\bar{B}$
	$\bar{D}$	D		$\bar{D}$	

A	B	C	D	S6
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**1**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S6

	$\overline{C}$		C	
	0	0	0	0	$\overline{B}$
$\overline{A}$	0	0	0	1	B
	X	X	X	X	
A	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S6
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**1**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S6

	$\overline{C}$		C		
$\overline{A}$	0	0	0	0	$\overline{B}$
	0	0	0	1	B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D	$\overline{D}$		

DEC	EXPRESSÃO
0	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$
1	$\overline{A}\,\overline{B}\,\overline{C}\,D$
2	$\overline{B}\,C\,\overline{D}$
3	$\overline{B}\,C\,D$
4	$B\,\overline{C}\,\overline{D}$
5	$B\,\overline{C}\,D$
6	$B\,C\,\overline{D}$
7	
8	
9	

Decodificador "Binário → Decimal" – Circuito Combinacional

	$\overline{C}$		C		
$\overline{A}$	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$	$\overline{A}\,\overline{B}\,\overline{C}\,D$	$\overline{A}\,\overline{B}\,C\,D$	$\overline{A}\,\overline{B}\,C\,\overline{D}$	$\overline{B}$
	$\overline{A}\,B\,\overline{C}\,\overline{D}$	$\overline{A}\,B\,\overline{C}\,D$	$\overline{A}\,B\,C\,D$	$\overline{A}\,B\,C\,\overline{D}$	B
A	$A\,B\,\overline{C}\,\overline{D}$	$A\,B\,\overline{C}\,D$	$A\,B\,C\,D$	$A\,B\,C\,\overline{D}$	
	$A\,\overline{B}\,\overline{C}\,\overline{D}$	$A\,\overline{B}\,\overline{C}\,D$	$A\,\overline{B}\,C\,D$	$A\,\overline{B}\,C\,\overline{D}$	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S7
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**1**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S7

	$\overline{C}$		C	
	0	0	0	0	$\overline{B}$
$\overline{A}$	0	0	1	0	B
	X	X	X	X	
A	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S7
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**1**
1	0	0	0	**0**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S7

K-map for S7:

	$\overline{C}$		C		
$\overline{A}$	0	0	0	0	$\overline{B}$
	0	0	1	0	B
A	X	X	X	X	
	0	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

DEC	EXPRESSÃO
0	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$
1	$\overline{A}\,\overline{B}\,\overline{C}\,D$
2	$\overline{B}\,C\,\overline{D}$
3	$\overline{B}\,C\,D$
4	$B\,\overline{C}\,\overline{D}$
5	$B\,\overline{C}\,D$
6	$B\,C\,\overline{D}$
7	$B\,C\,D$
8	
9	

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Decodificador "Binário → Decimal" – Circuito Combinacional

	$\overline{\text{C}}$		C		
$\overline{\text{A}}$	$\overline{\text{A}}\overline{\text{B}}\overline{\text{C}}\overline{\text{D}}$	$\overline{\text{A}}\overline{\text{B}}\overline{\text{C}}\text{D}$	$\overline{\text{A}}\overline{\text{B}}\text{C}\text{D}$	$\overline{\text{A}}\overline{\text{B}}\text{C}\overline{\text{D}}$	$\overline{\text{B}}$
	$\overline{\text{A}}\text{B}\overline{\text{C}}\overline{\text{D}}$	$\overline{\text{A}}\text{B}\overline{\text{C}}\text{D}$	$\overline{\text{A}}\text{B}\text{C}\text{D}$	$\overline{\text{A}}\text{B}\text{C}\overline{\text{D}}$	B
A	$\text{A}\text{B}\overline{\text{C}}\overline{\text{D}}$	$\text{A}\text{B}\overline{\text{C}}\text{D}$	$\text{A}\text{B}\text{C}\text{D}$	$\text{A}\text{B}\text{C}\overline{\text{D}}$	
	$\text{A}\overline{\text{B}}\overline{\text{C}}\overline{\text{D}}$	$\text{A}\overline{\text{B}}\overline{\text{C}}\text{D}$	$\text{A}\overline{\text{B}}\text{C}\text{D}$	$\text{A}\overline{\text{B}}\text{C}\overline{\text{D}}$	$\overline{\text{B}}$
	$\overline{\text{D}}$	D		$\overline{\text{D}}$	

A	B	C	D	S8
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**1**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S8

	$\overline{C}$		C		
	0	0	0	0	$\overline{B}$
$\overline{A}$	0	0	0	0	B
	X	X	X	X	
A	1	0	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S8
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**1**
1	0	0	1	**0**

Decodificador "Binário → Decimal" – Circuito Combinacional

S8

K-map with columns $\overline{C}$, C and rows $\overline{A}$, A:

	$\overline{C}$		C		
$\overline{A}$	0	0	0	0	$\overline{B}$
	0	0	0	0	
	X	X	X	X	B
A	1	0	X	X	$\overline{B}$
	$\overline{D}$	D	D	$\overline{D}$	

DEC	EXPRESSÃO
0	$\overline{A}\overline{B}\overline{C}\overline{D}$
1	$\overline{A}\overline{B}\overline{C}D$
2	$\overline{B}C\overline{D}$
3	$\overline{B}CD$
4	$B\overline{C}\overline{D}$
5	$B\overline{C}D$
6	$BC\overline{D}$
7	BCD
8	$A\overline{D}$
9	

Decodificador "Binário → Decimal" – Circuito Combinacional

	C̄		C		
ĀB̄C̄D̄	ĀB̄C̄D	ĀB̄CD	ĀB̄CD̄	B̄
ĀBC̄D̄	ĀBC̄D	ĀBCD	ĀBCD̄	B
ABC̄D̄	ABC̄D	ABCD	ABCD̄	B
AB̄C̄D̄	AB̄C̄D	AB̄CD	AB̄CD̄	B̄
	D̄	D		D̄

Ā / A on left side; rows grouped.

A	B	C	D	S9
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1

Decodificador "Binário → Decimal" – Circuito Combinacional

S9

	$\overline{C}$		C	
$\overline{A}$	0	0	0	0	$\overline{B}$
	0	0	0	0	B
A	X	X	X	X	
	0	1	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

A	B	C	D	S9
0	0	0	0	**0**
0	0	0	1	**0**
0	0	1	0	**0**
0	0	1	1	**0**
0	1	0	0	**0**
0	1	0	1	**0**
0	1	1	0	**0**
0	1	1	1	**0**
1	0	0	0	**0**
1	0	0	1	**1**

Decodificador "Binário → Decimal" – Circuito Combinacional

S9

	$\overline{C}$		C	
$\overline{A}$	0	0	0	0	$\overline{B}$
	0	0	0	0	B
A	X	X	X	X	
	0	1	X	X	$\overline{B}$
	$\overline{D}$	D		$\overline{D}$	

DEC	EXPRESSÃO
0	$\overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$
1	$\overline{A}\,\overline{B}\,\overline{C}\,D$
2	$\overline{B}\,C\,\overline{D}$
3	$\overline{B}\,C\,D$
4	$B\,\overline{C}\,\overline{D}$
5	$B\,\overline{C}\,D$
6	$B\,C\,\overline{D}$
7	$B\,C\,D$
8	$A\,\overline{D}$
9	$A\,D$

Decodificador "Binário → Decimal" – Circuito Combinacional

- Por fim temos a tabela ao lado, que relaciona as expressões mínimas para cada número de 0 à 9 em decimal.

- Com isso é possível simular o circuito usando portas lógicas.

DEC	EXPRESSÃO
0	$\overline{A}\overline{B}\overline{C}\overline{D}$
1	$\overline{A}\overline{B}\overline{C}D$
2	$\overline{B}C\overline{D}$
3	$\overline{B}CD$
4	$B\overline{C}\overline{D}$
5	$B\overline{C}D$
6	$BC\overline{D}$
7	BCD
8	$A\overline{D}$
9	AD

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Decodificador "Binário → Decimal" – Simulação

- Abaixo o circuito para o "Decodificador binário → decimal".

- Disponível em: https://circuitverse.org/users/166835/projects/decimal-binario
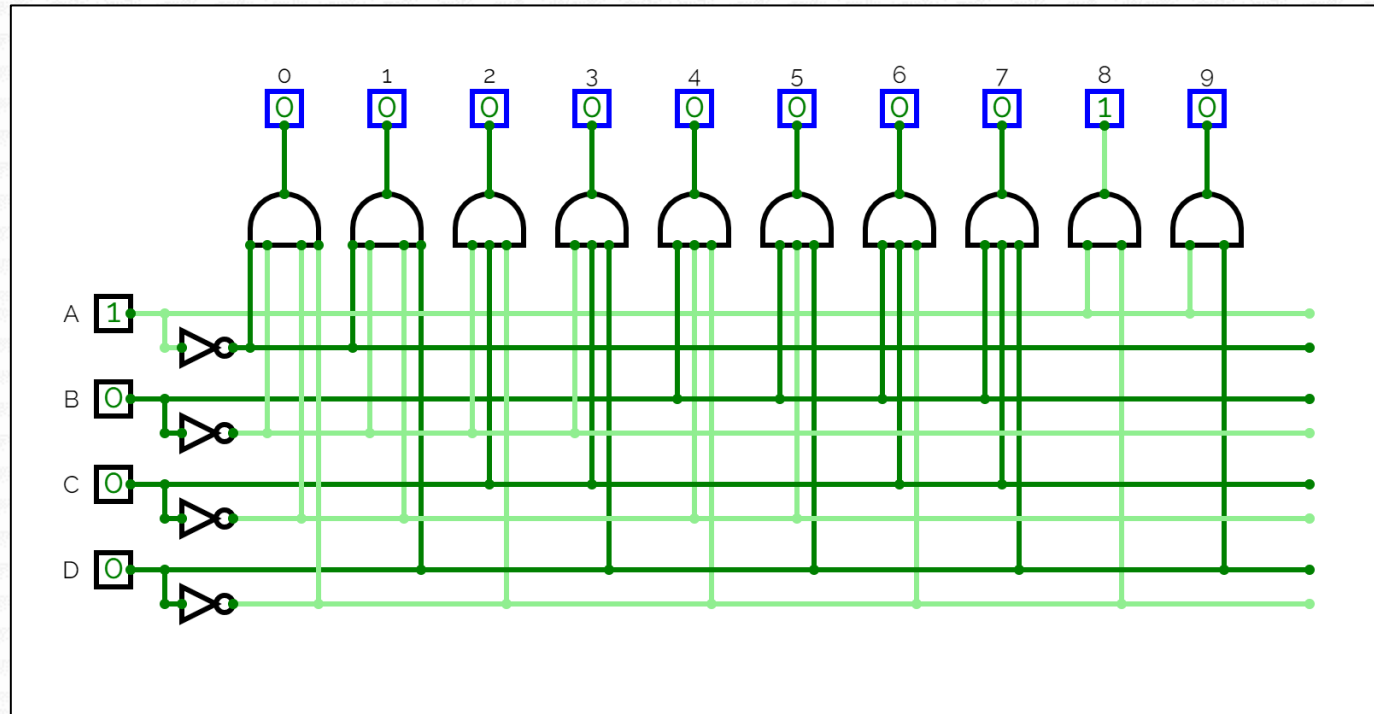
Decodificador "Binário → Decimal" – Simulação

- Em versão componentizada:

- Disponível em: https://circuitverse.org/users/166835/projects/decimal-binario
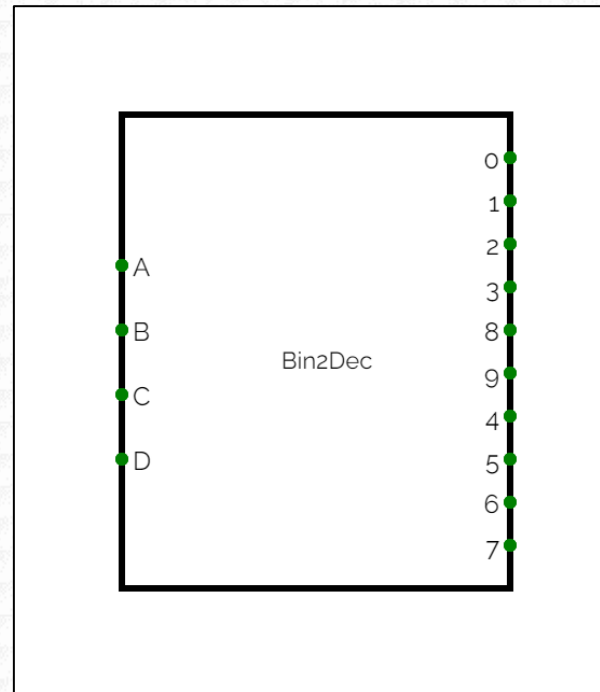
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