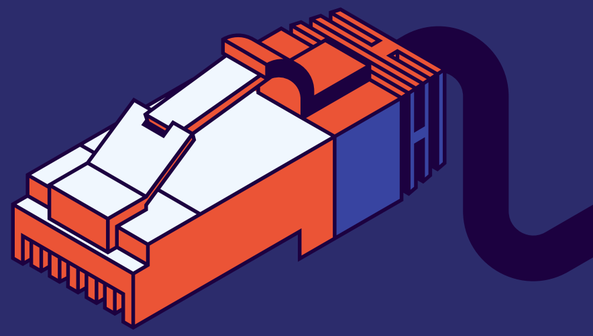
UNIVERSIDADE ESTADUAL DE FEIRA DE SANTANA
MI - PROJETO DE CIRCUITOS DIGITAIS

Unidade
Lógica e Aritmética

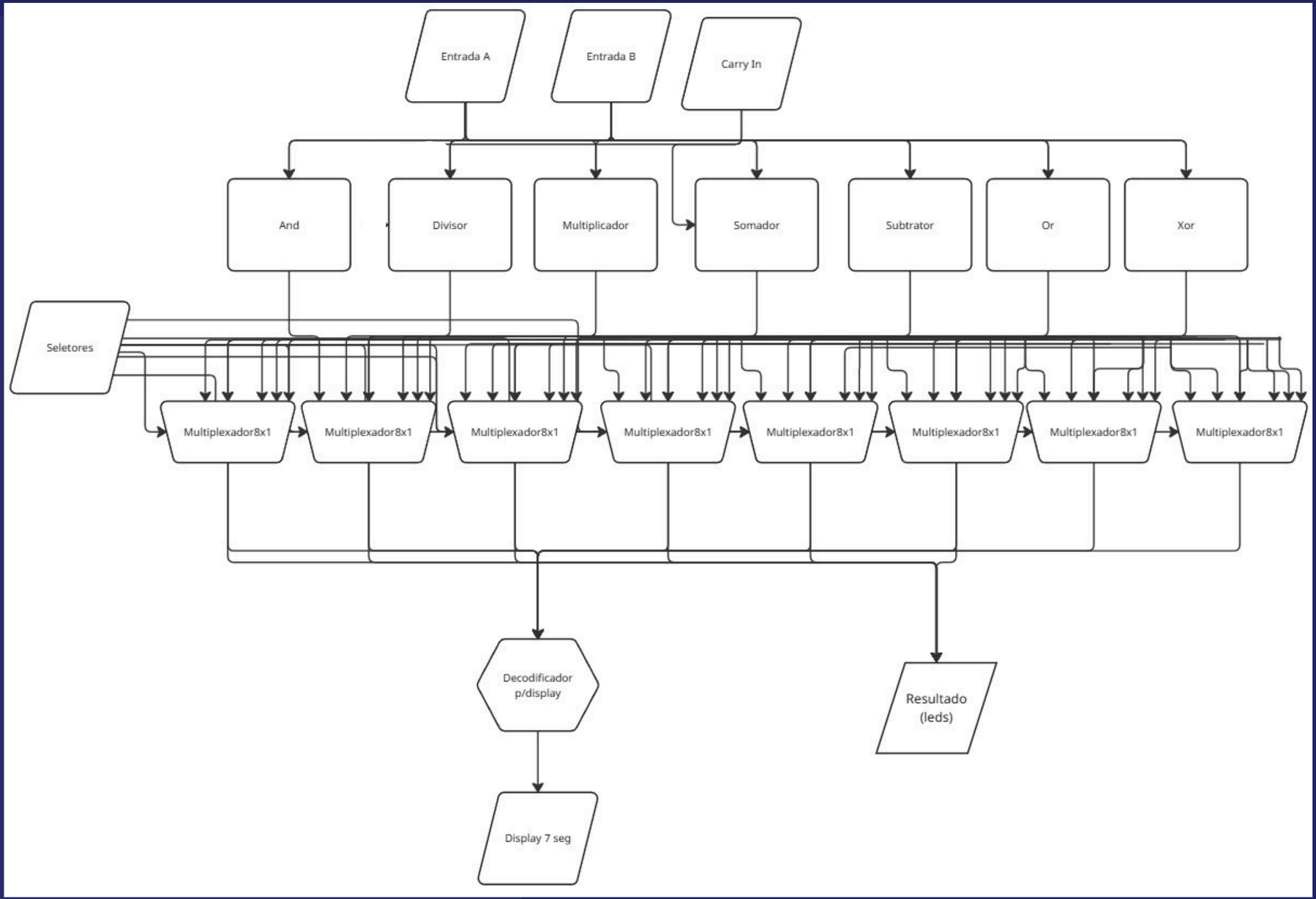
Davi Freitas e Helena Filemon

ROTEIRO:



- Diagrama de Alto Nível
- Módulos
- Flags
- Pinagem
- Casos de Teste

Lógica do circuito



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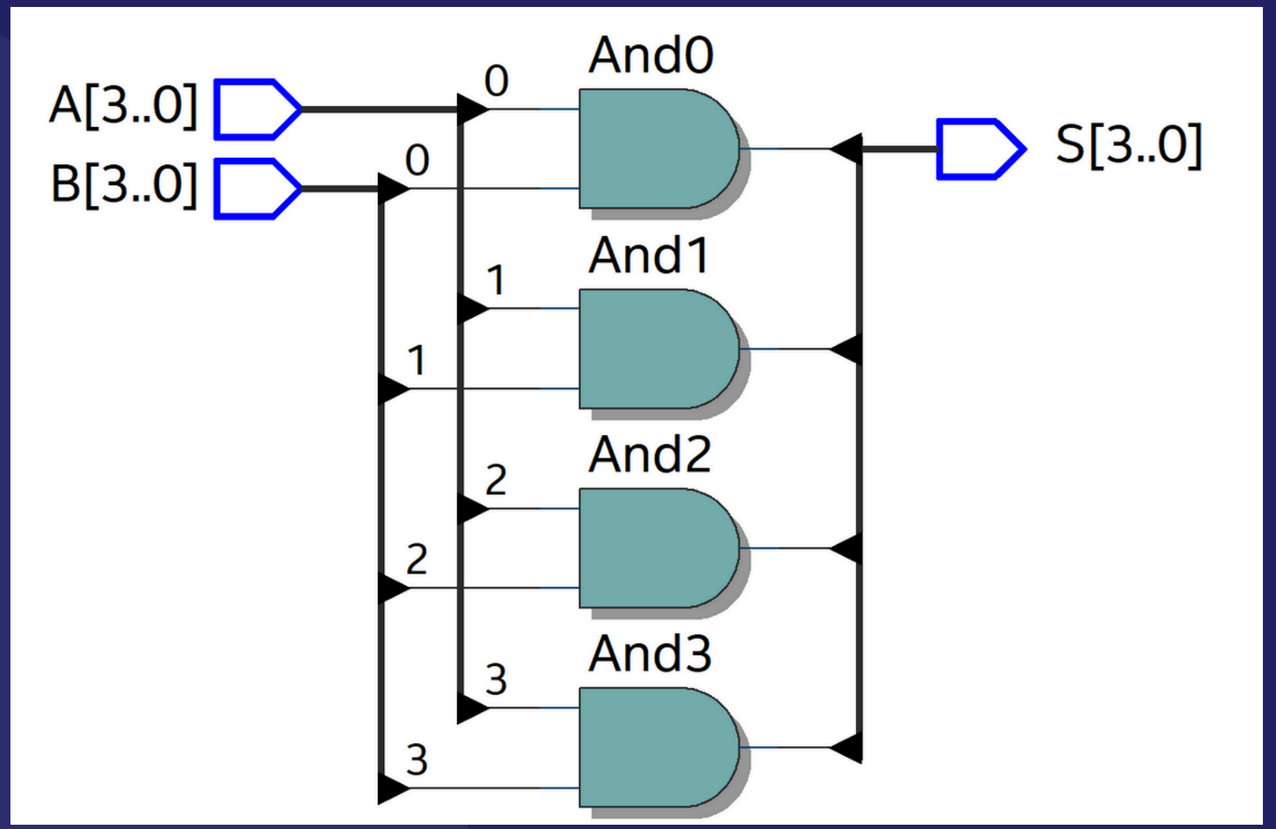
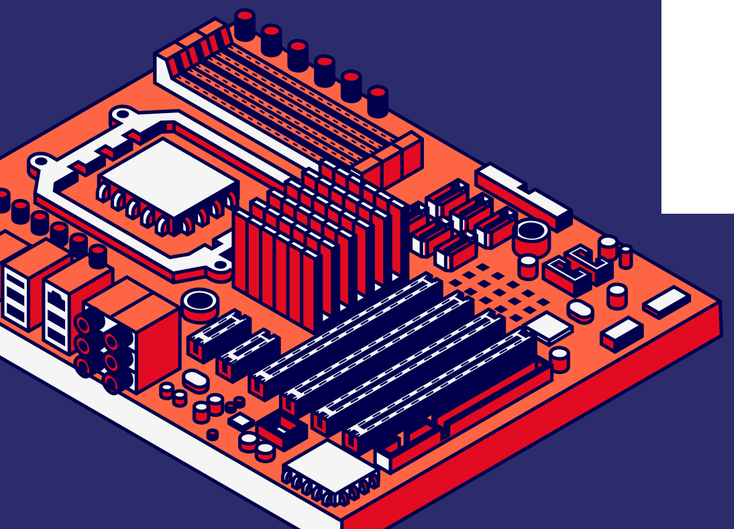
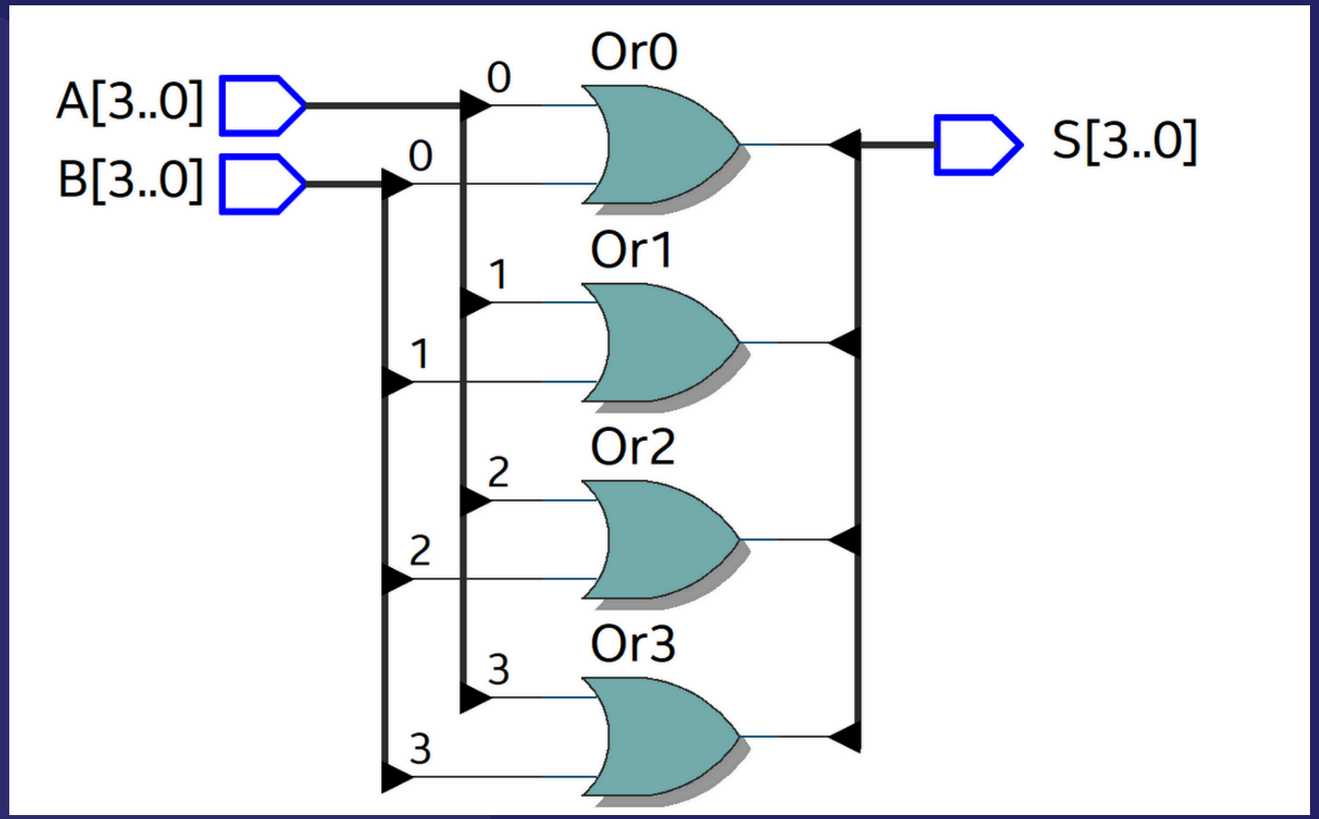
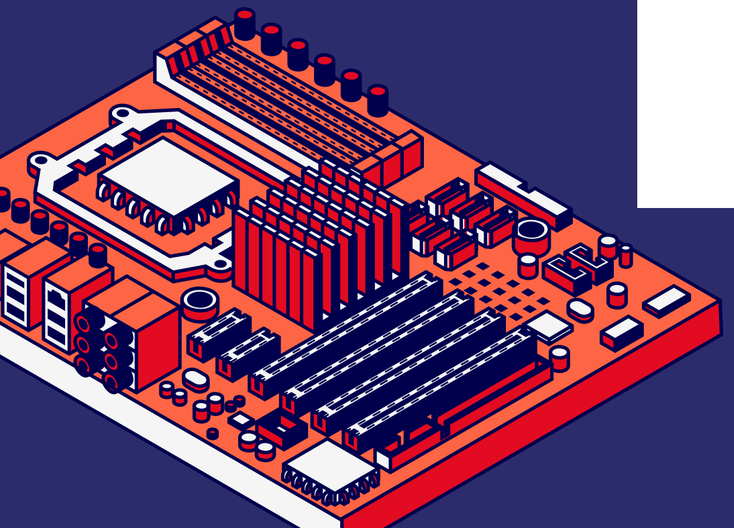


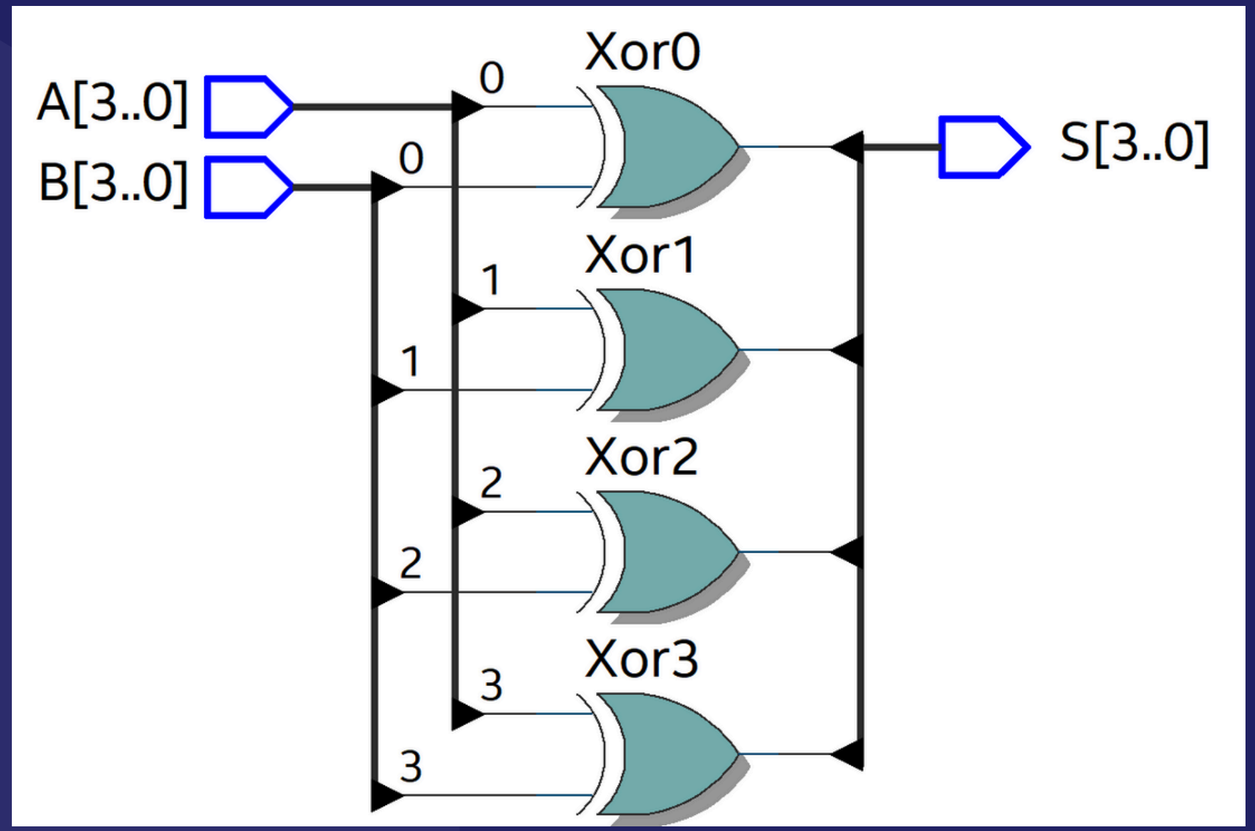


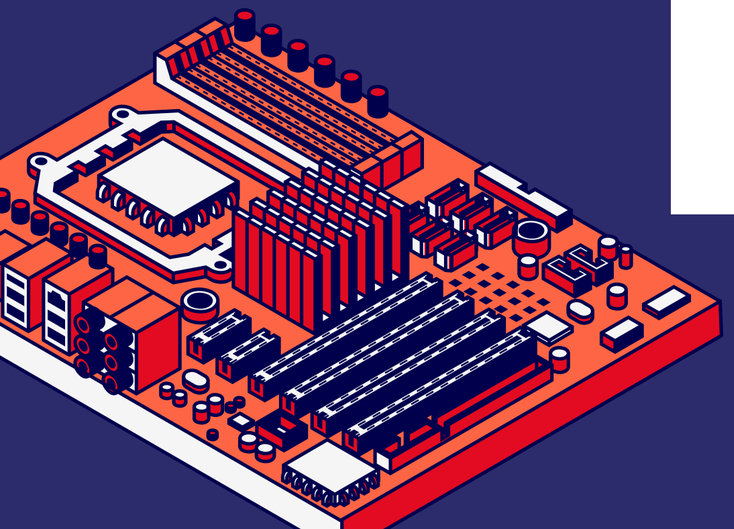
OR



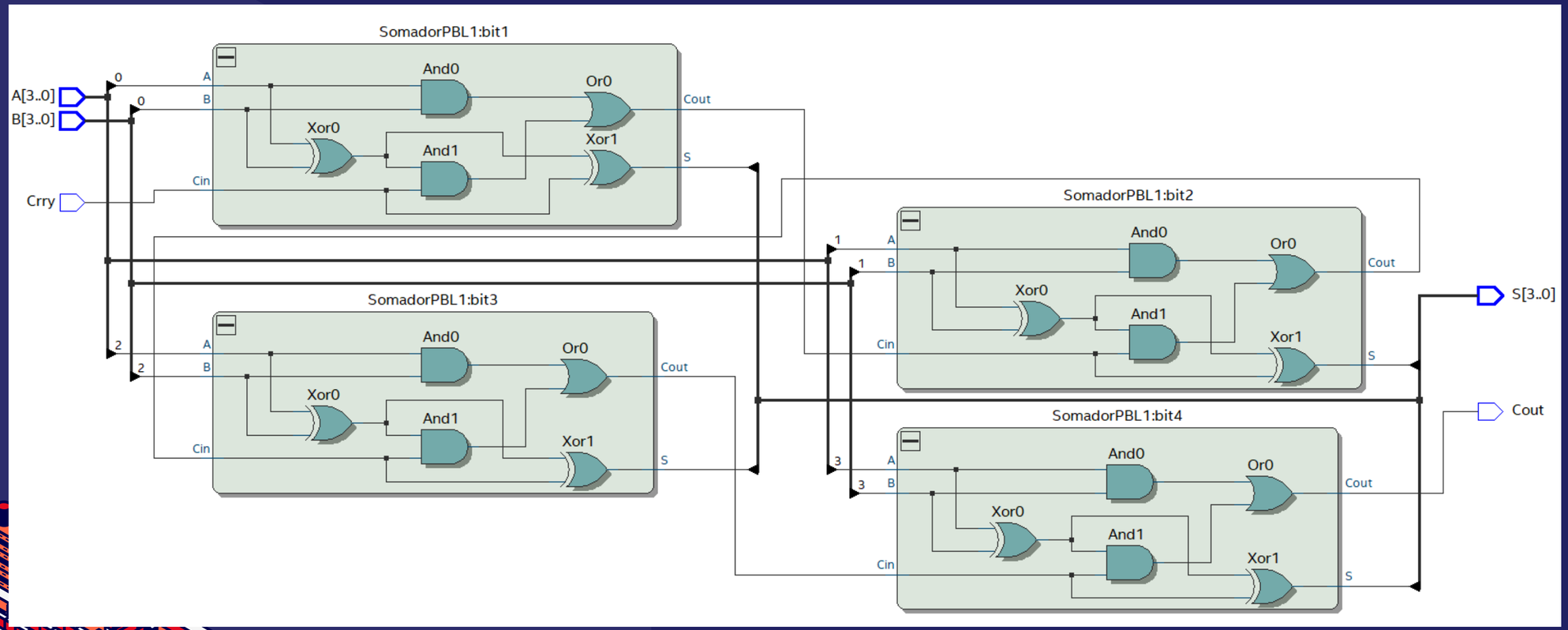


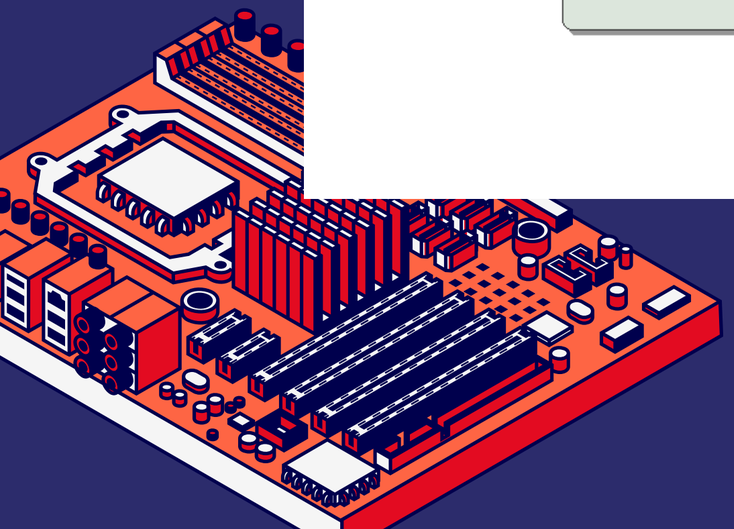
XOR



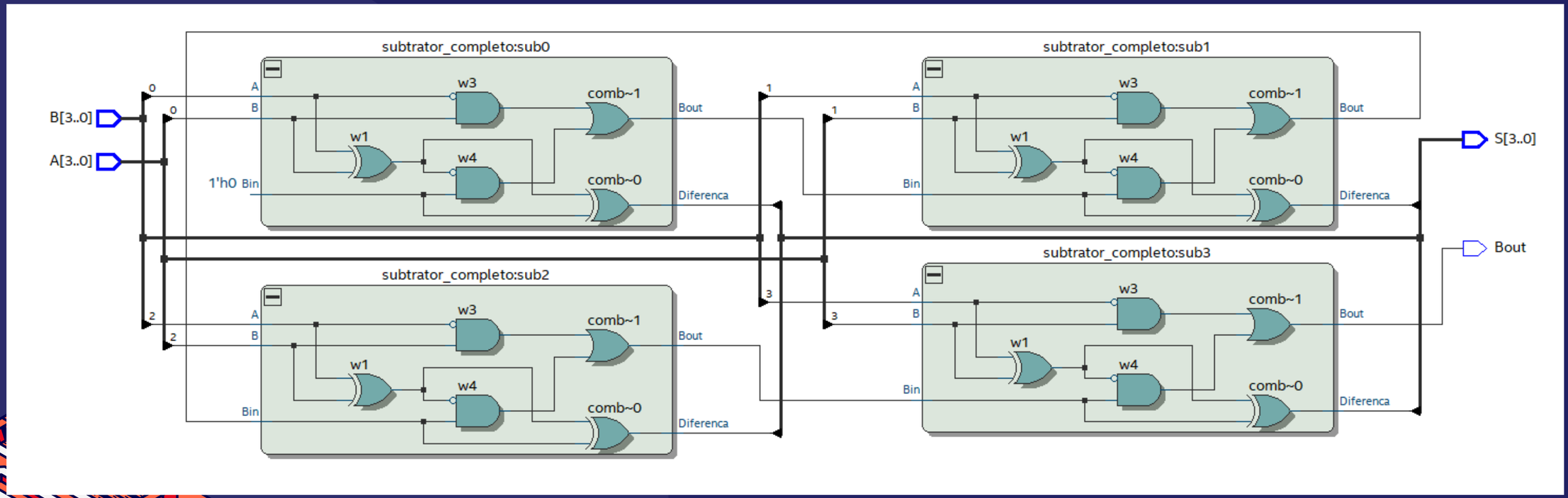


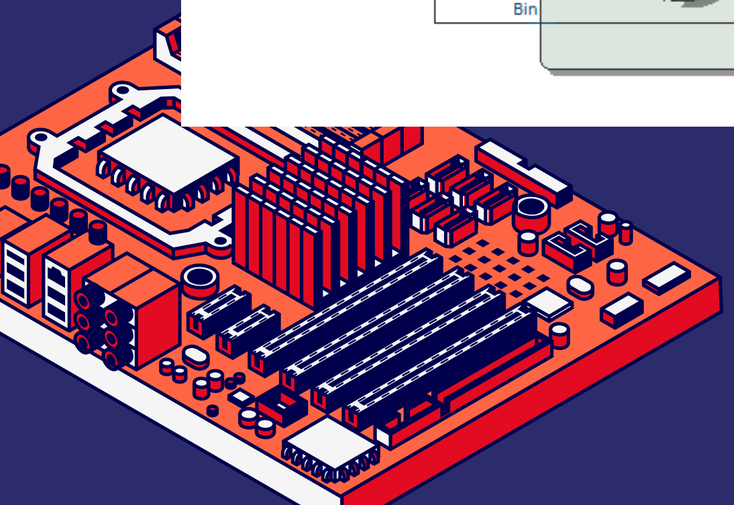
Somador


SomadorPBL1:bit1
SomadorPBL1:bit2
SomadorPBL1:bit3
SomadorPBL1:bit4
A[3..0]
B[3..0]
Crry
S[3..0]
Cout
And0
Or0
Xor0
And1
Xor1
A
B
Cin
Cout
S



Subtrator





Subtrações com resultado negativo não funcionam corretamente, acendendo a led de “borrow out” para mostrar que é um resultado negativo

Multiplicador

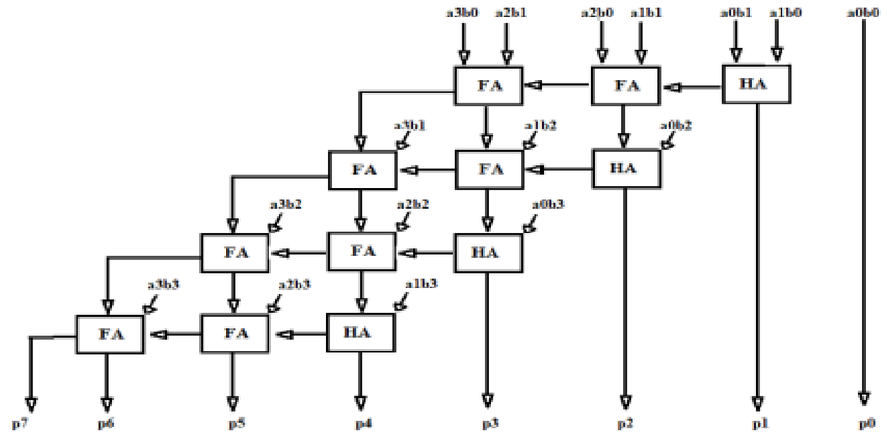
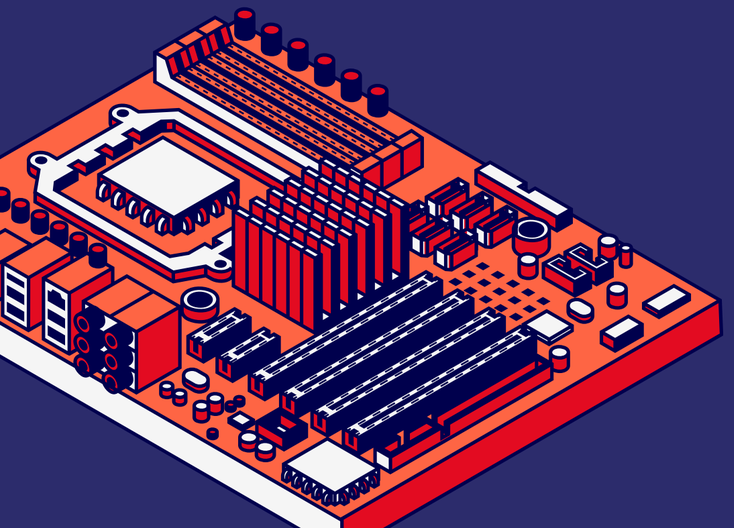
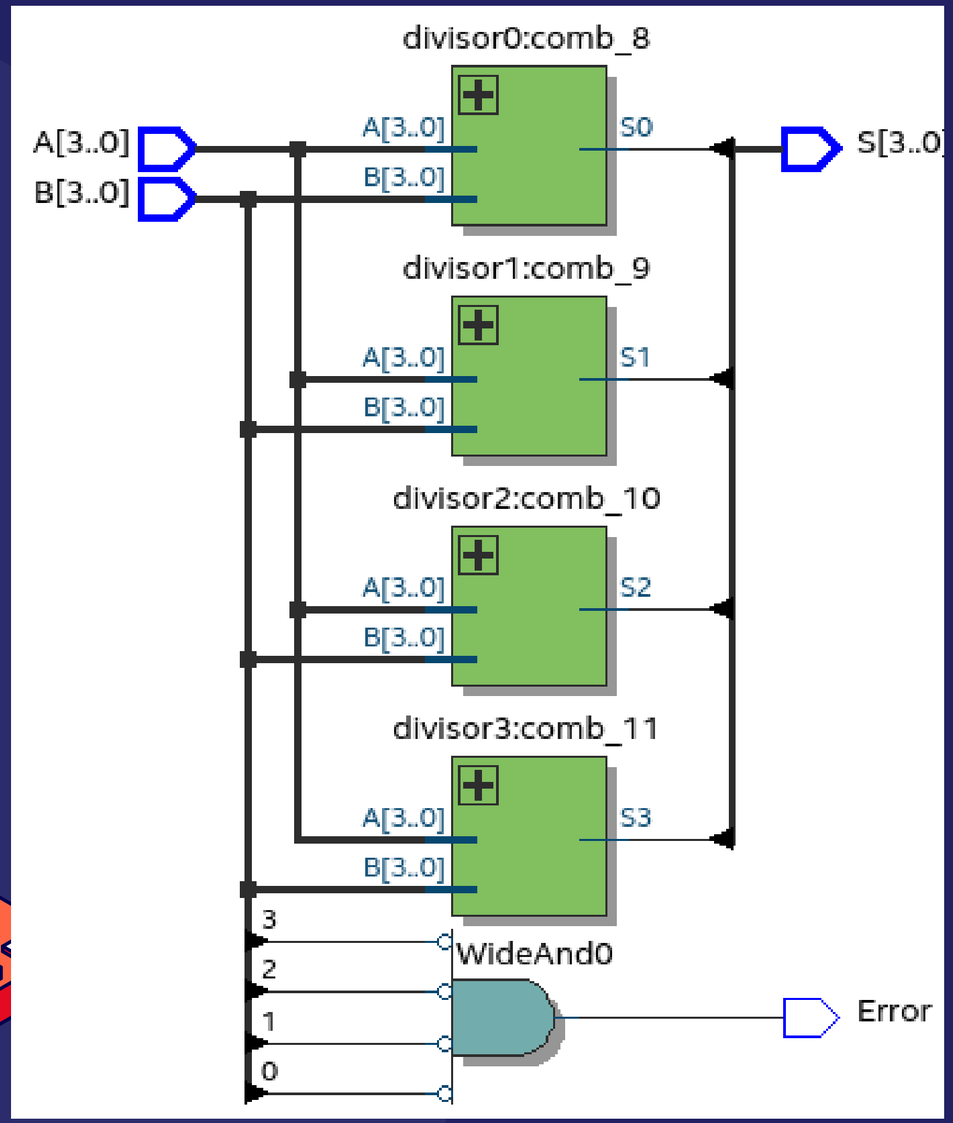


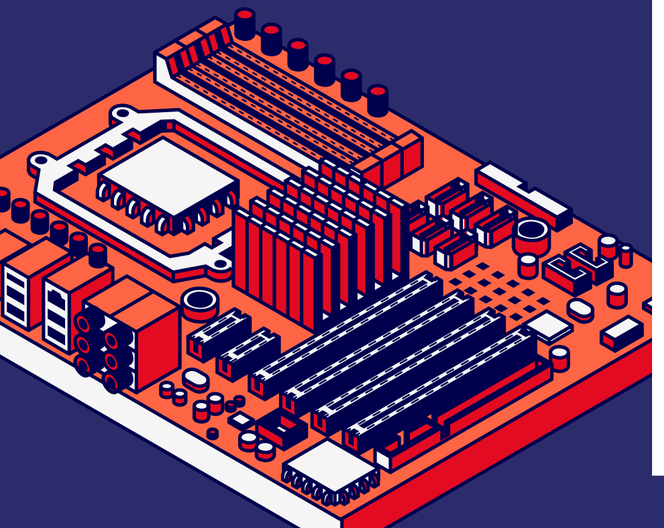
Fig.1 4x4 Array Multiplier



Nosso multiplicador foi feito pelo método de array, simulando a multiplicação feita no papel, com 16 portas and para realizar as multiplicações parciais e depois a utilização de meios somadores e somadores completos para gerar o resultado.

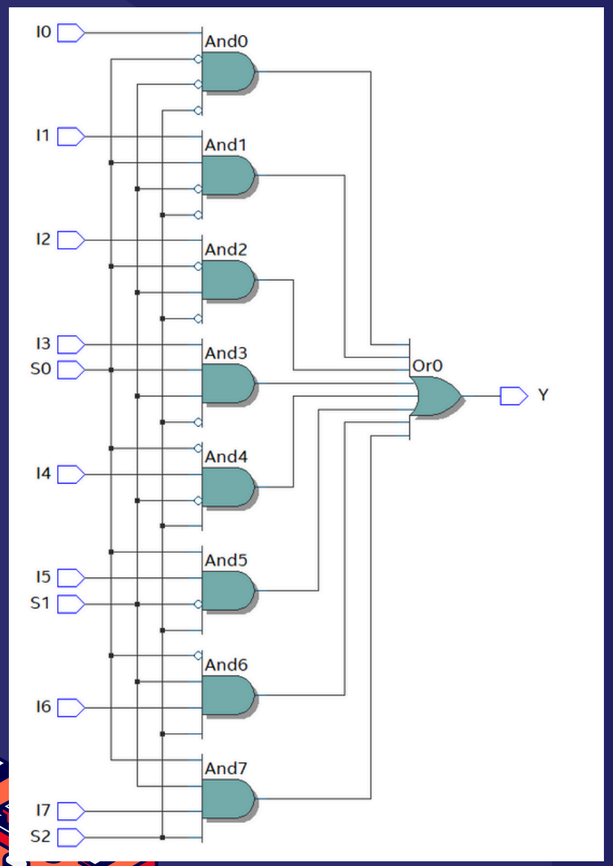
Divisor

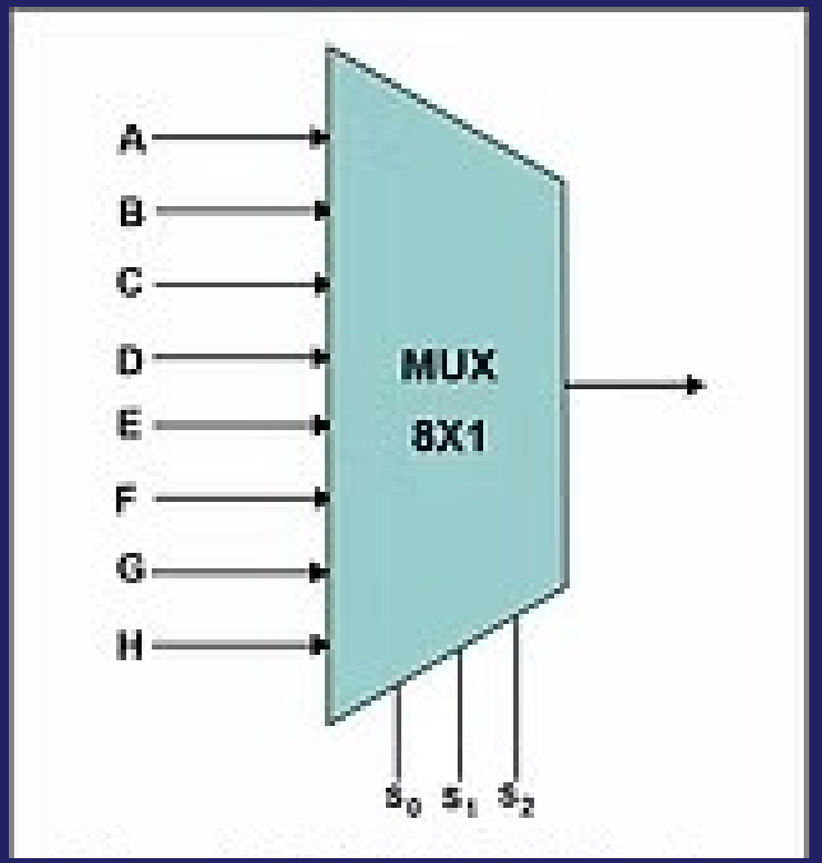


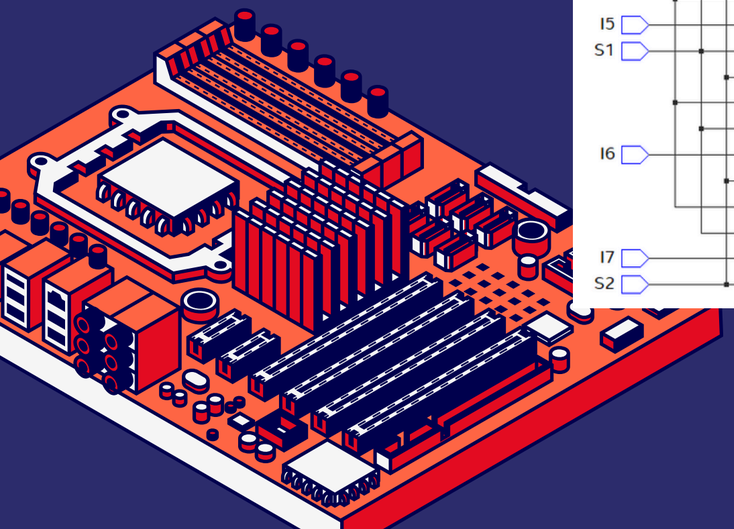


Foi feita uma tabela verdade com 256 possibilidades para cada possibilidade de saída em cada bit, e depois tiramos a expressão pelo método SOP

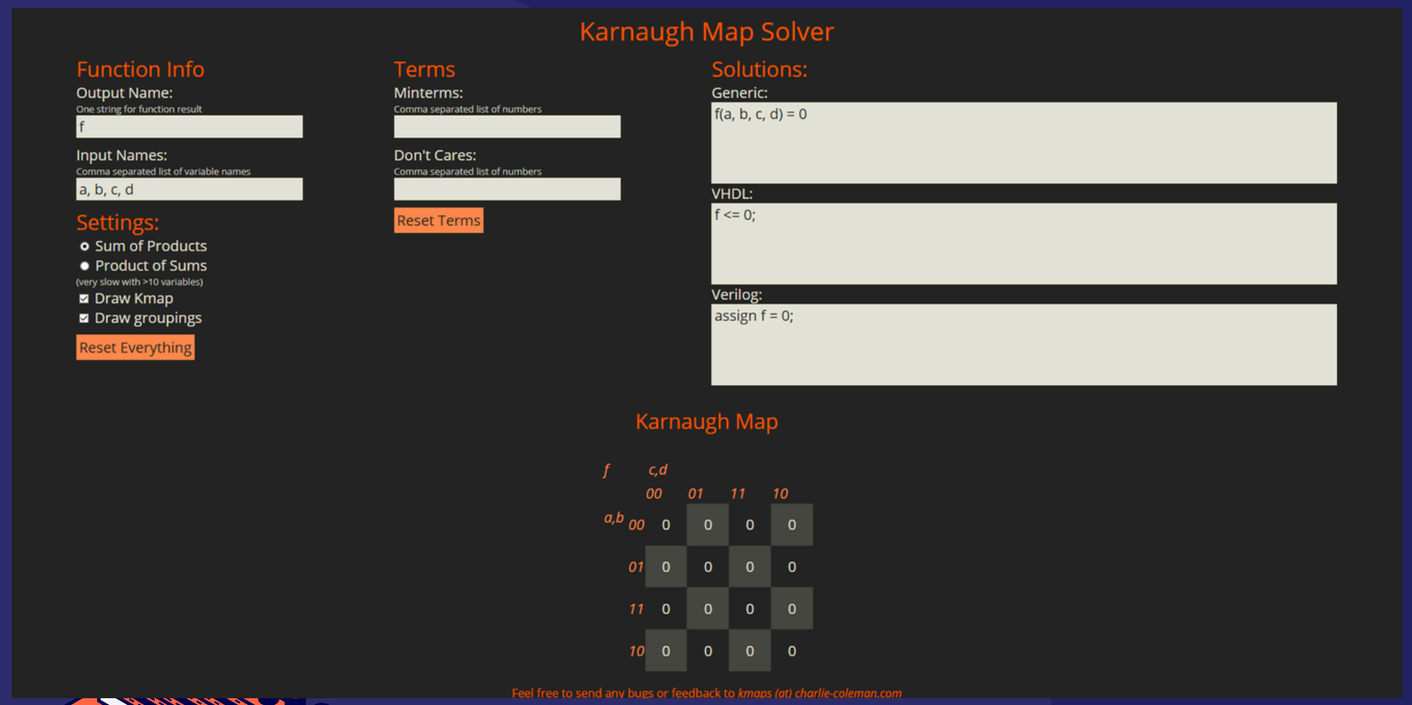
Multiplexador

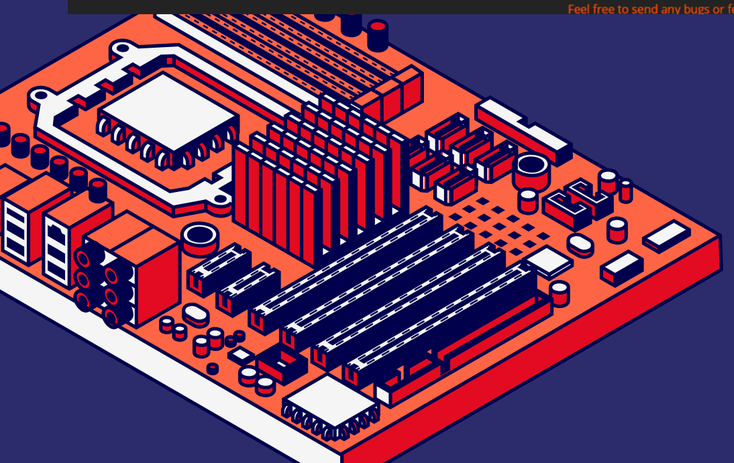






Conversor p/ Display

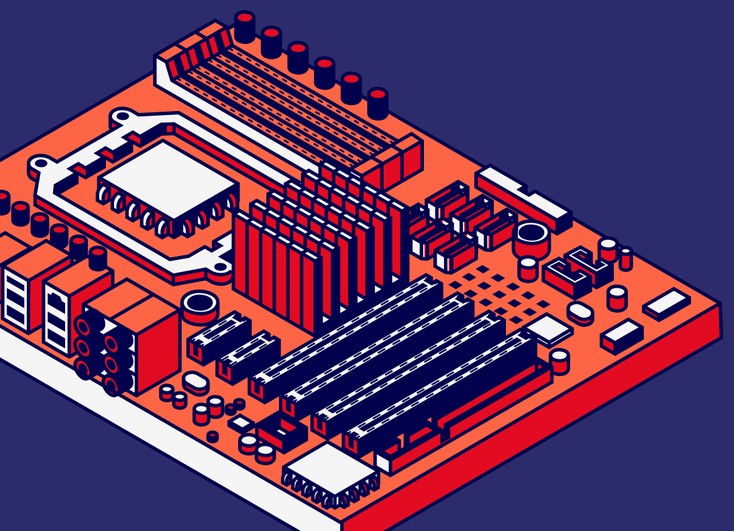


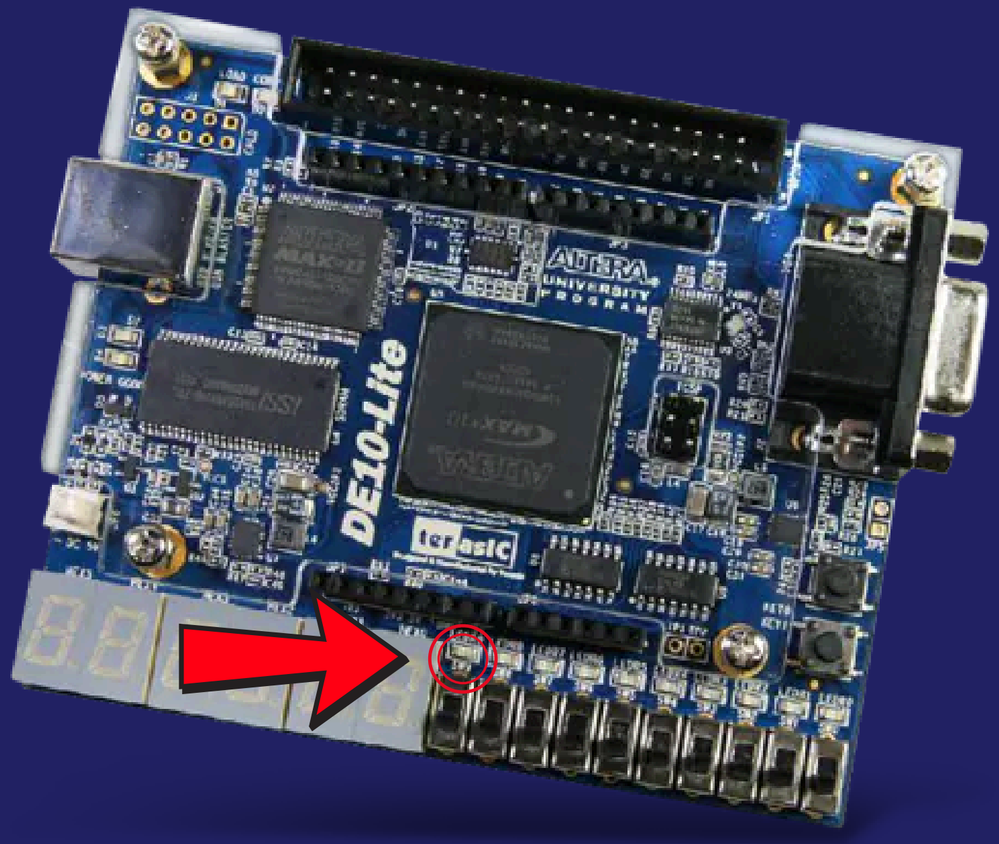


Site utilizado para tirar as expressões de cada segmento dos displays de sete segmentos

Zero

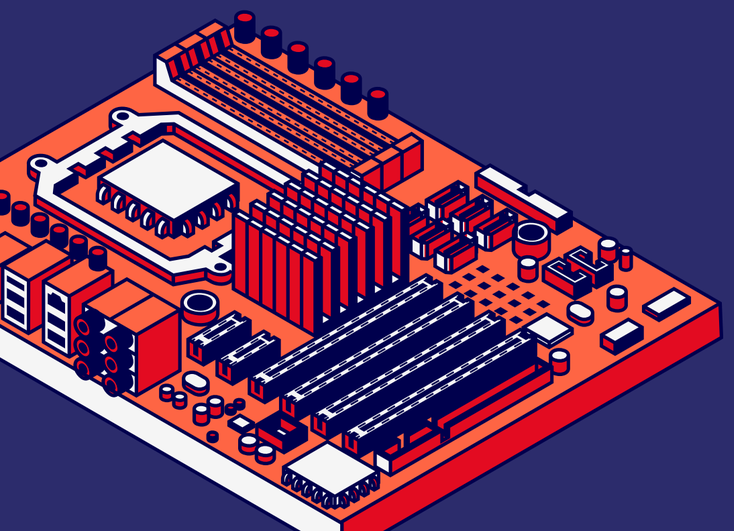
- Led da flag zero acende sempre quando o resultado de qualquer operação for 0

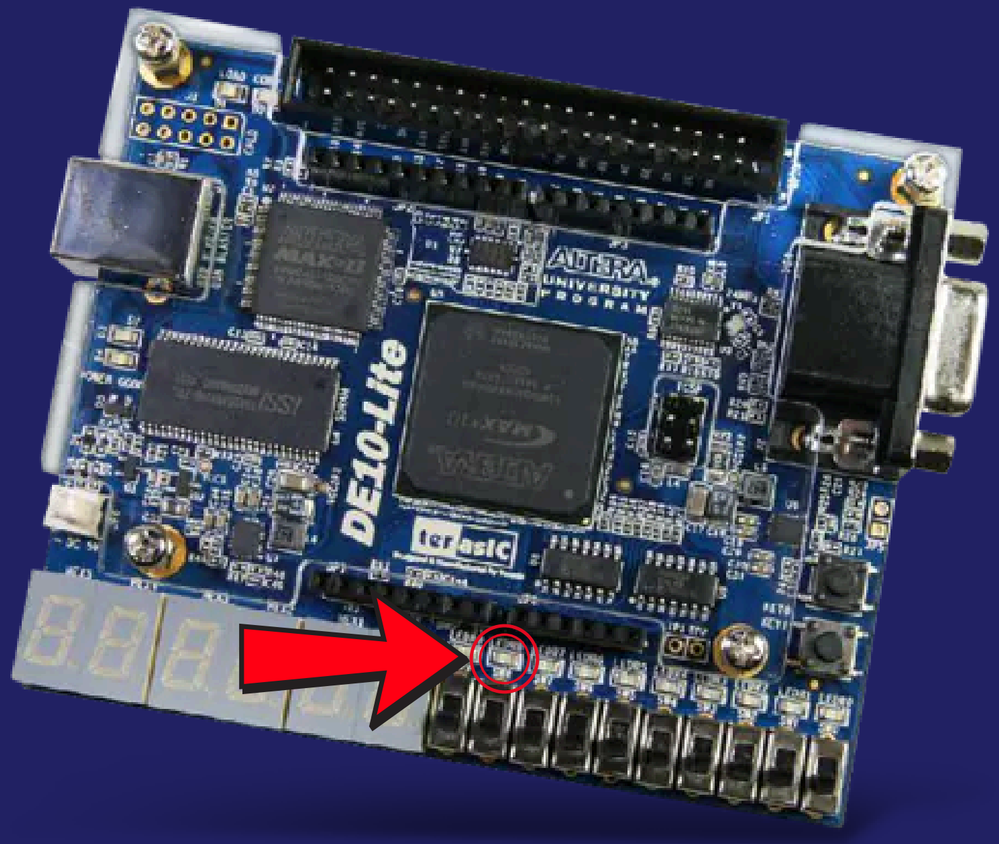




Erro

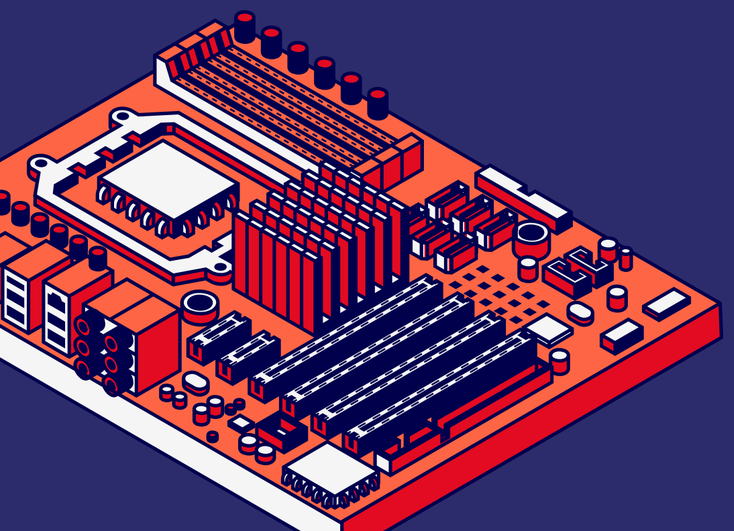
- Led da flag erro acende sempre que tentar ser feita a divisão por 0

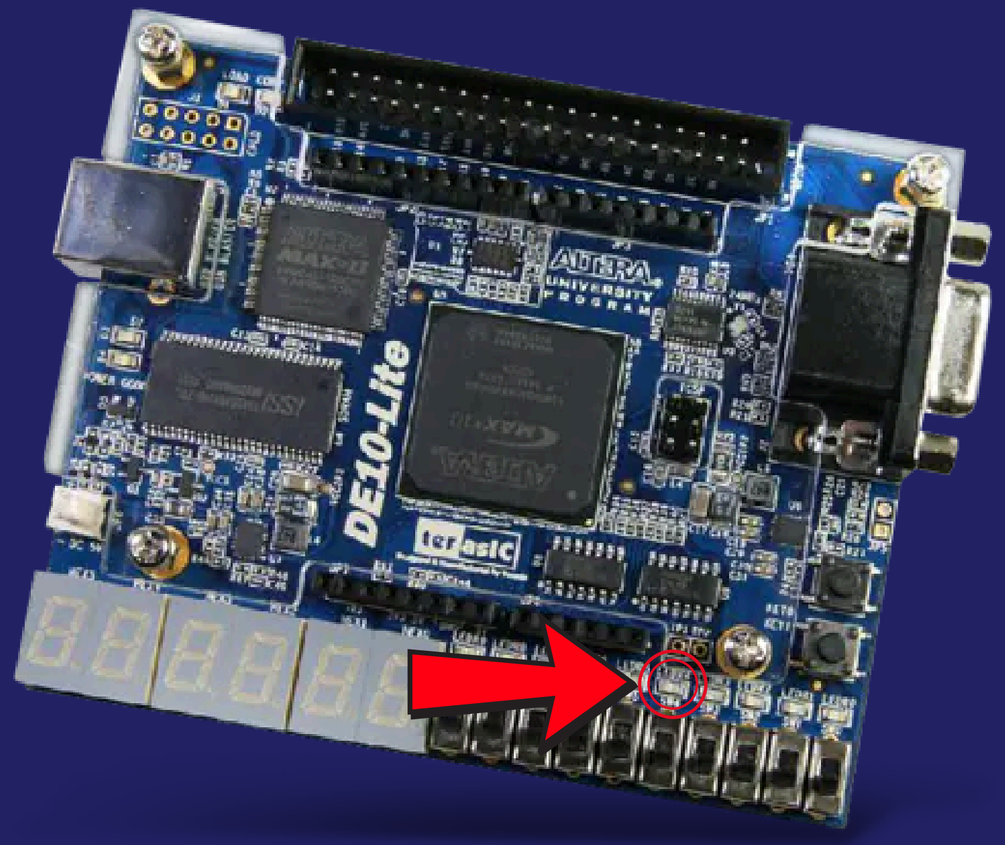




Carry Out

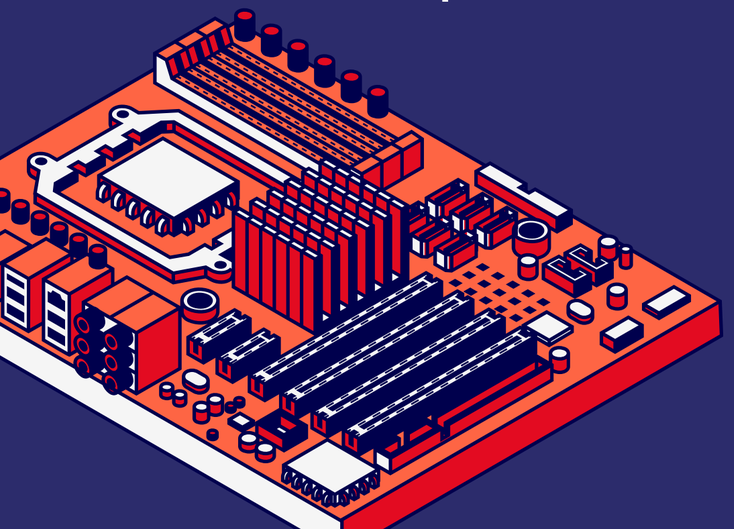
- Led da flag carry out acende sempre quando na soma o resultado passar de 15.

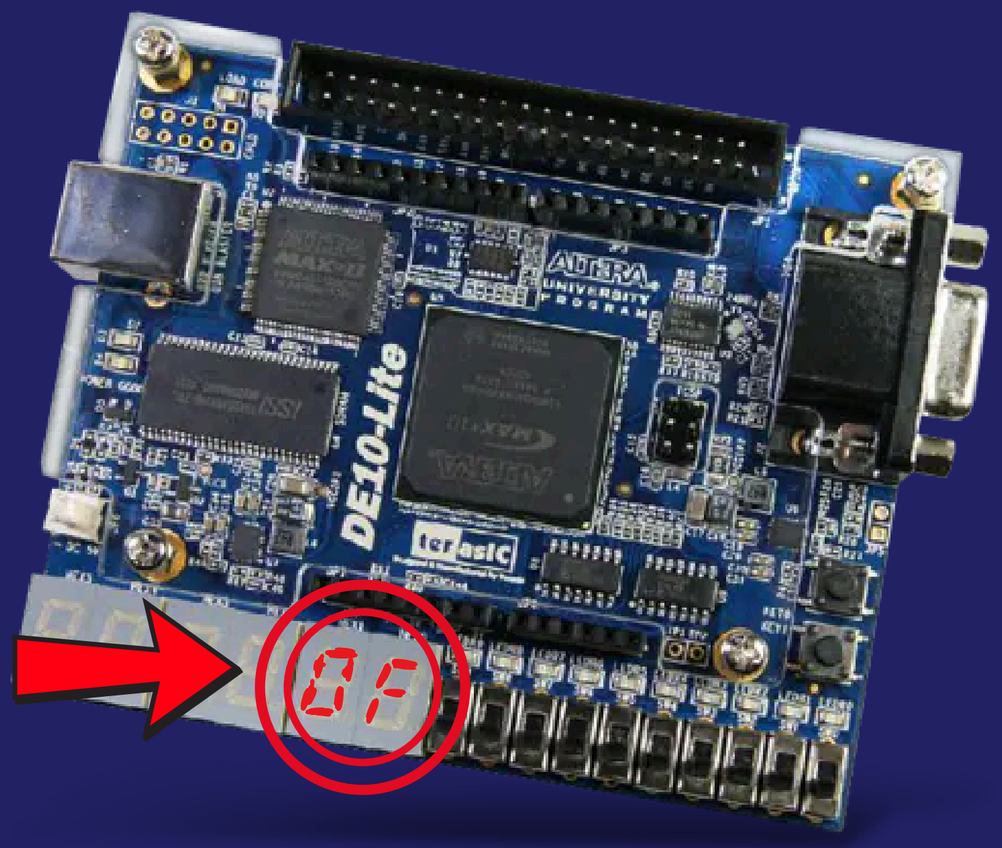




Overflow

- A flag Overflow (OF) aparece no display quando o resultado ultrapassar 99, dando o Overflow de display, porém o resultado é representado nos LEDS



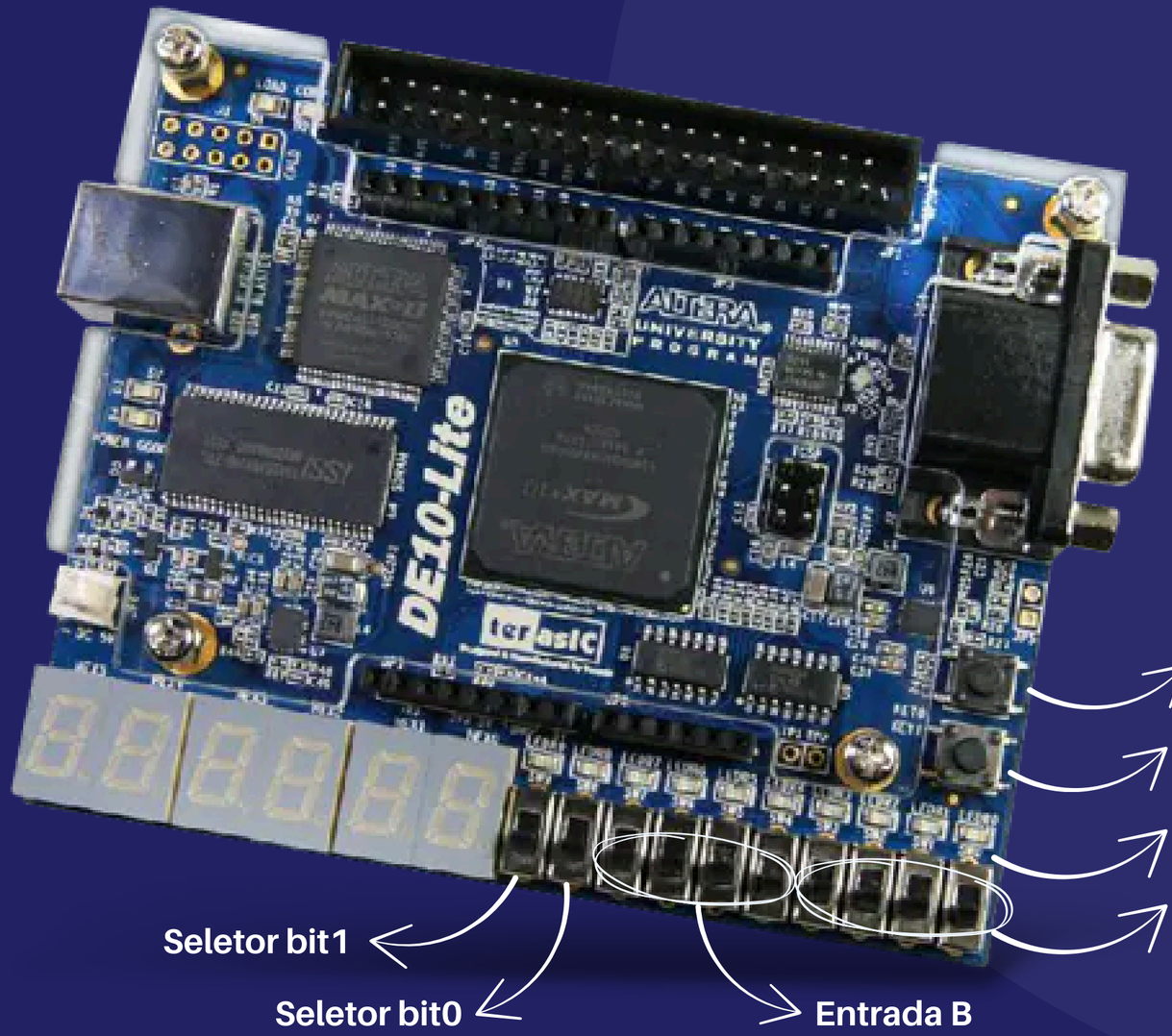


Pinagem

- Na soma e na multiplicação a ordem das entradas (A+B, A*B OU B+A, B*A) não tem diferença.
- Na divisão o divisor é o B e o dividendo é o A
- Na subtração, a lógica está para ser B - A

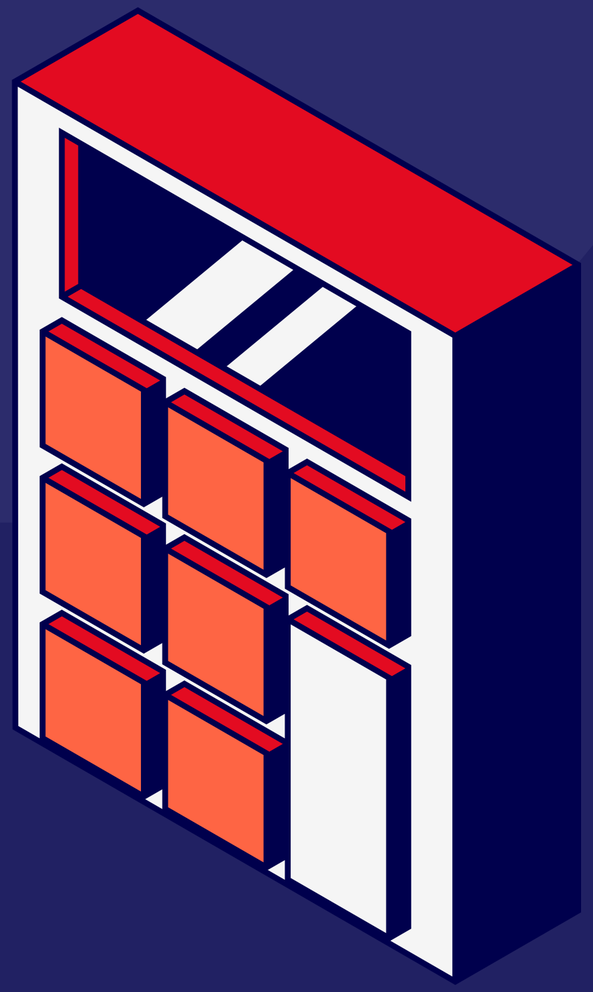
Código das operações

- 000 / DIV
- 001 /AND
- 010 /OR
- 011 /XOR
- 100 /ADD
- 101 /SUB
- 110 /MULT



Casos de teste:

- SOMA, CARRY IN = 0, 8 (1000) + 4 (0100) = 12 (1100) , COM CARRY IN = 13 (1101) .
- SUBTRAÇÃO, 8 (1000) - 2 (0010) = 6 (0110) || 2 (0010) - 8 (1000) = RESULTADO ERRADO E LED BORROW OUT ACESO (1XXXX) || 3 (0011) -3 (0011) = 0 NO DISPLAY E LED DA FLAG ZERO ATIVADA (LEDR9) .
- MULTIPLICAÇÃO, 3 (0011) X 8 (1000) = 24 (11000) || 15 (1111) X 15 (1111) = 225 (11100001) NOS LEDS E OVERFLOW DE DISPLAY.
- DIVISÃO, 10 (1010) / 2 (0010) = 5 (0101) || 8 (1000) / 4 (0100) = 2 (0010) || 4 (0100) / 0 = FLAG DE ERRO ATIVADA (LEDR8).
- OR, NIVÉL ALTO CHAVES ENTRADA “A” 2^0, 2^2 ENTRADA “B” 2^2, 2^3 = $2^0 + 2^2 + 2^3 = 13$
- AND, NIVÉL ALTO CHAVES ENTRADA “A” 2^0, 2^2 ENTRADA “B” 2^0, 2^2 = $2^0 + 2^2 = 5$
- XOR, NIVÉL ALTO CHAVES ENTRADA “A ” 2^0, 2^2 ENTRADA “B” 2^0 = $2^2 = 4$



FIM