

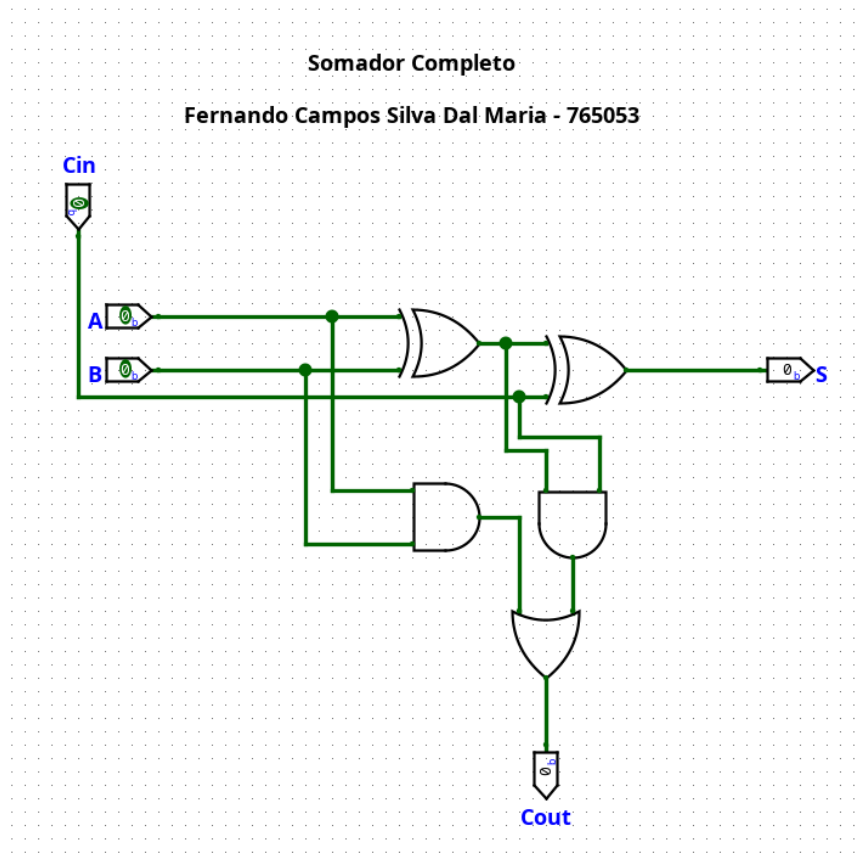
## **Exercício Prático 2**

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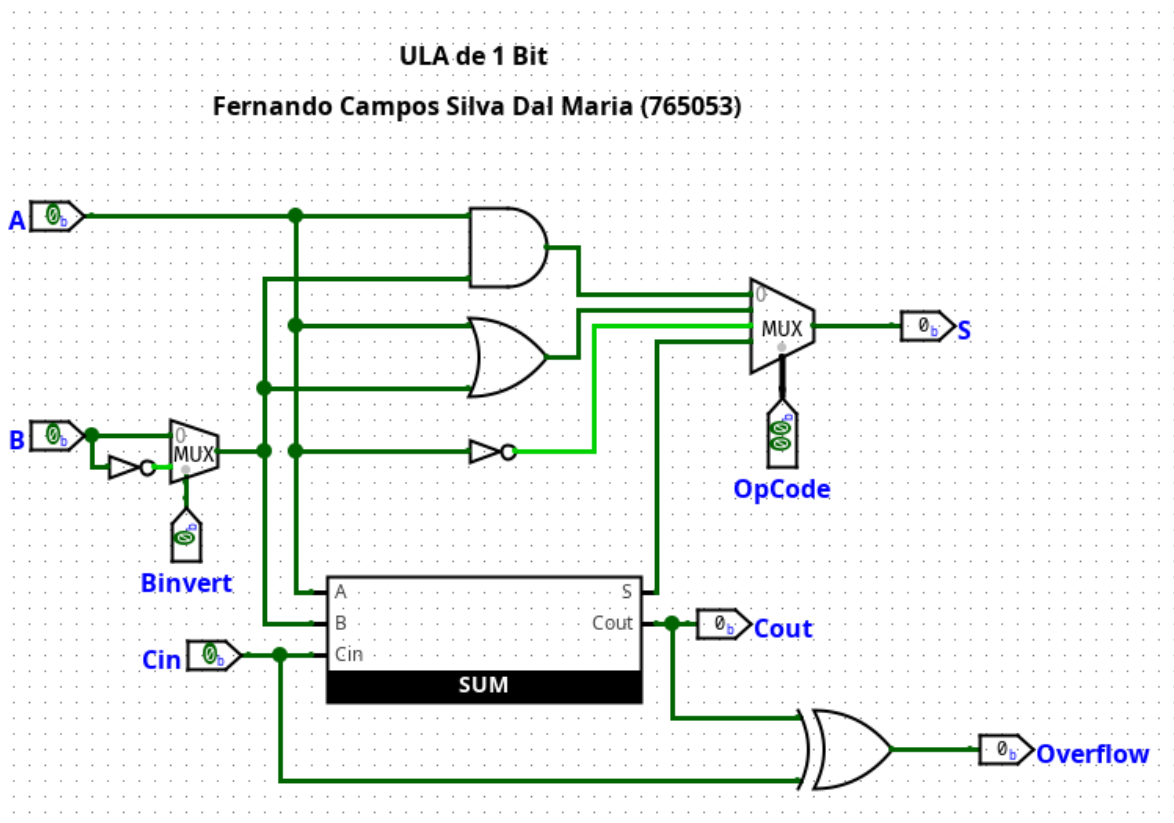
*Professor: Romanelli Lodron Zuim*

## Exemplo de implementação de uma ULA de 4 bits no Logisim:

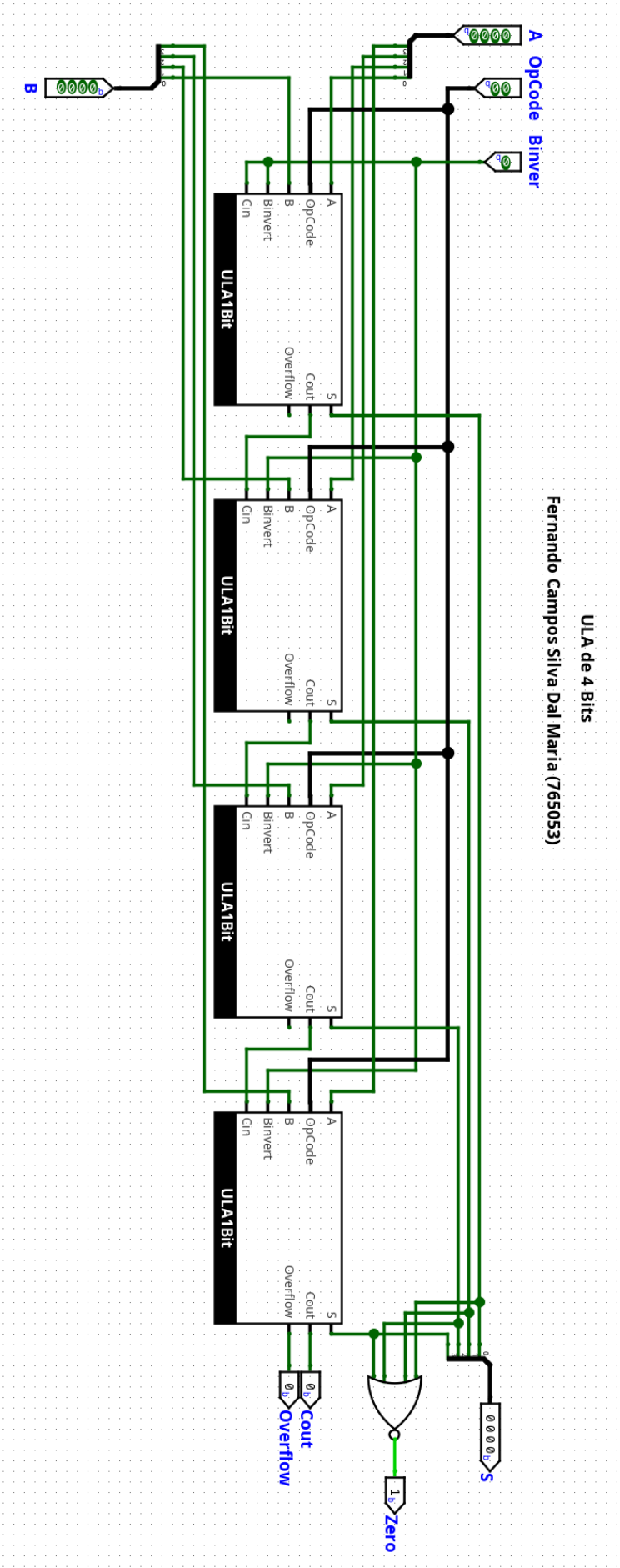
- 1) Implementação de um somador completo:



- 2) Implementação de uma ULA de 1 Bit:

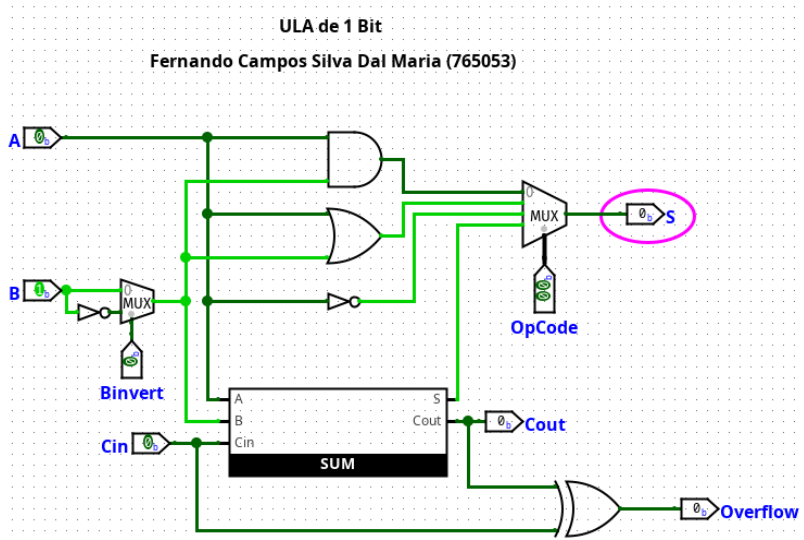


3) Implementação de uma ULA de 4 Bits:

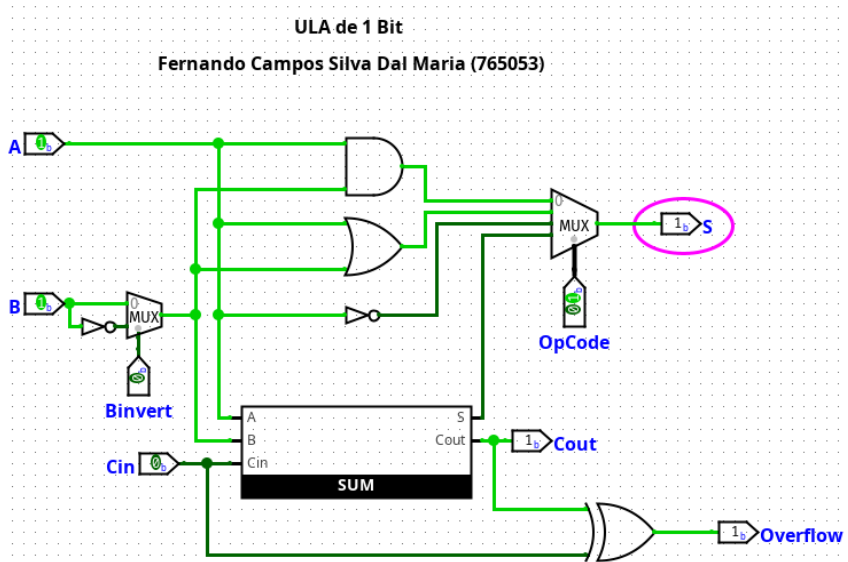


## Testes propostos para a ULA de 1 Bit:

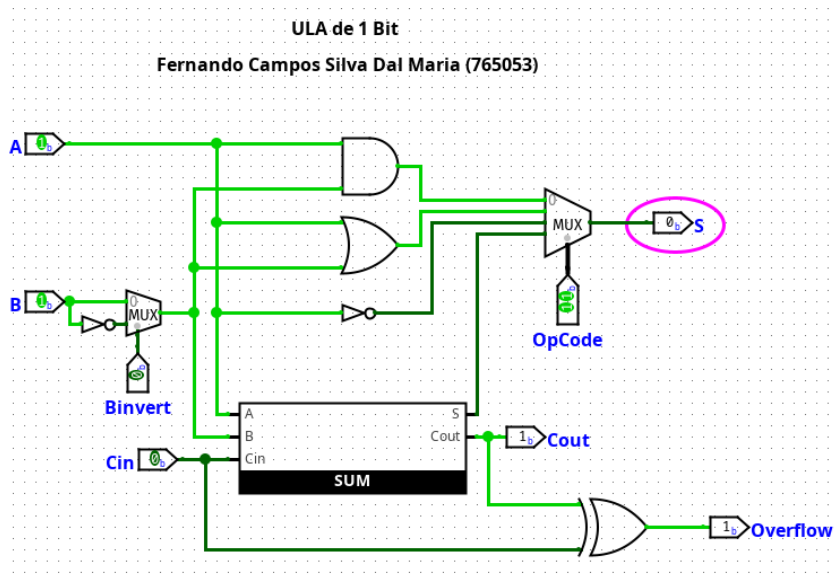
1) AND(A, B)



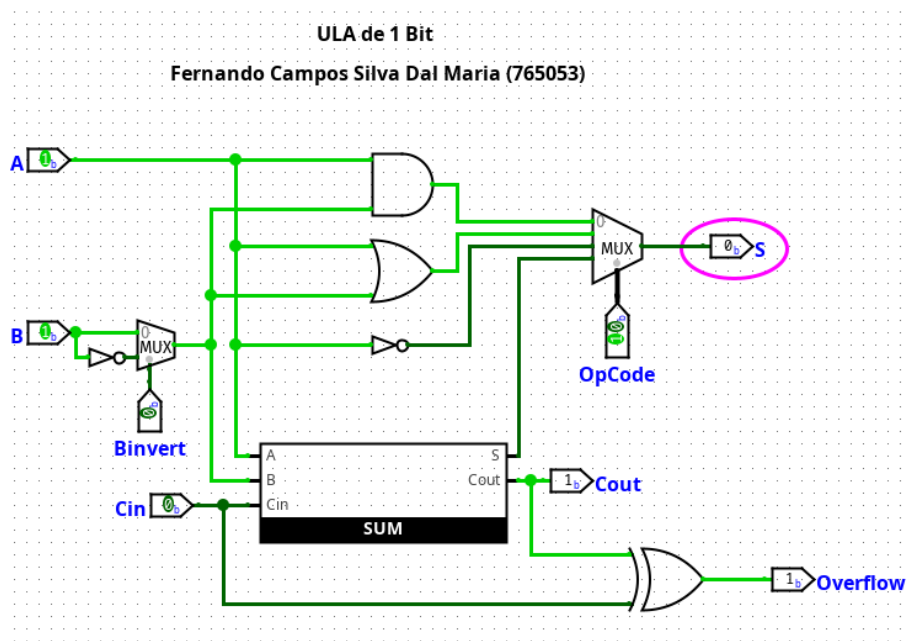
2) OR(A, B)



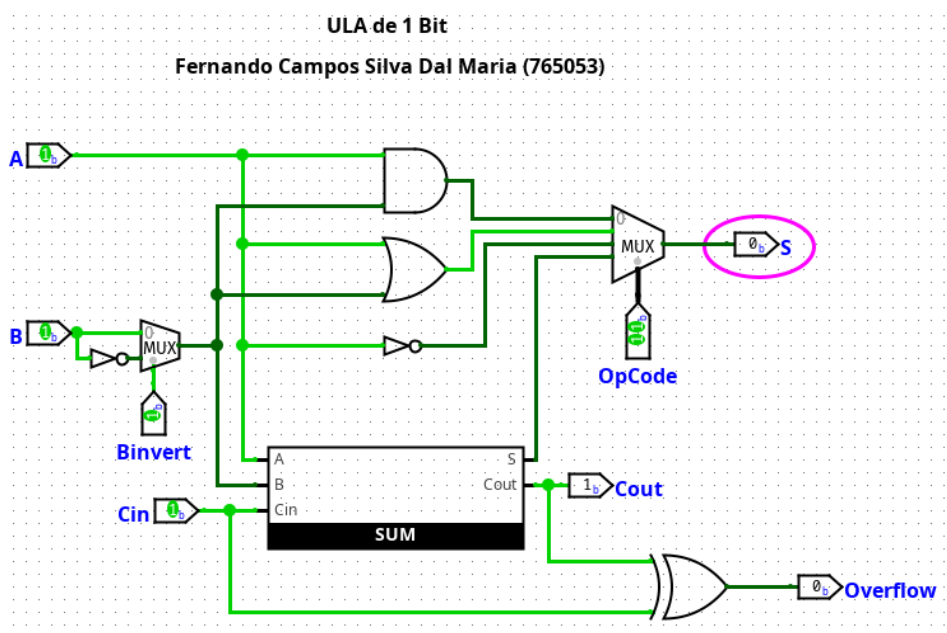
3) SOMA(A, B)



4) NOT(A)

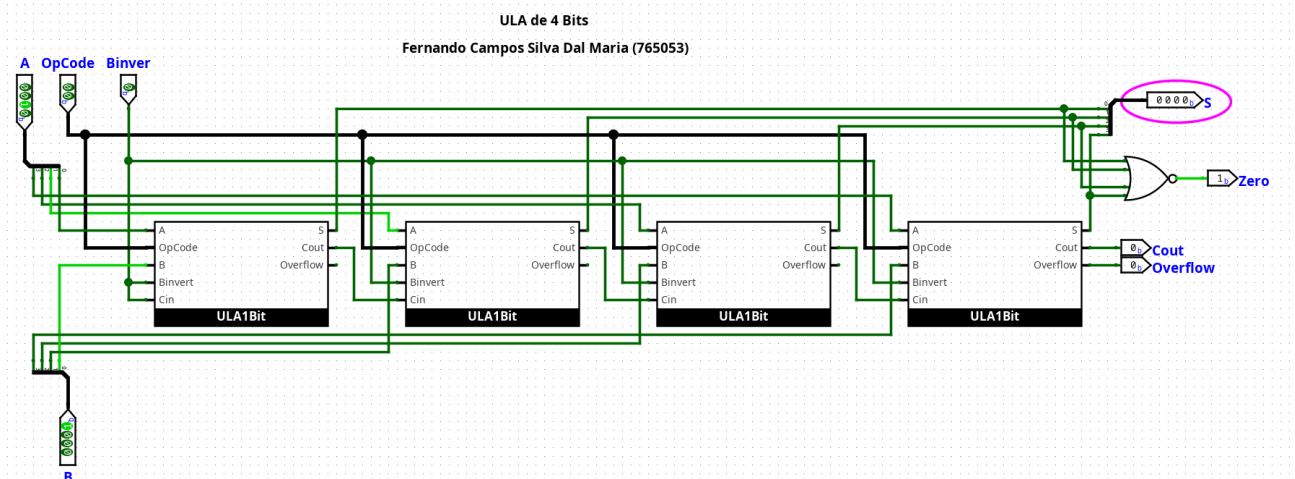


5) SOMA(A, -B)

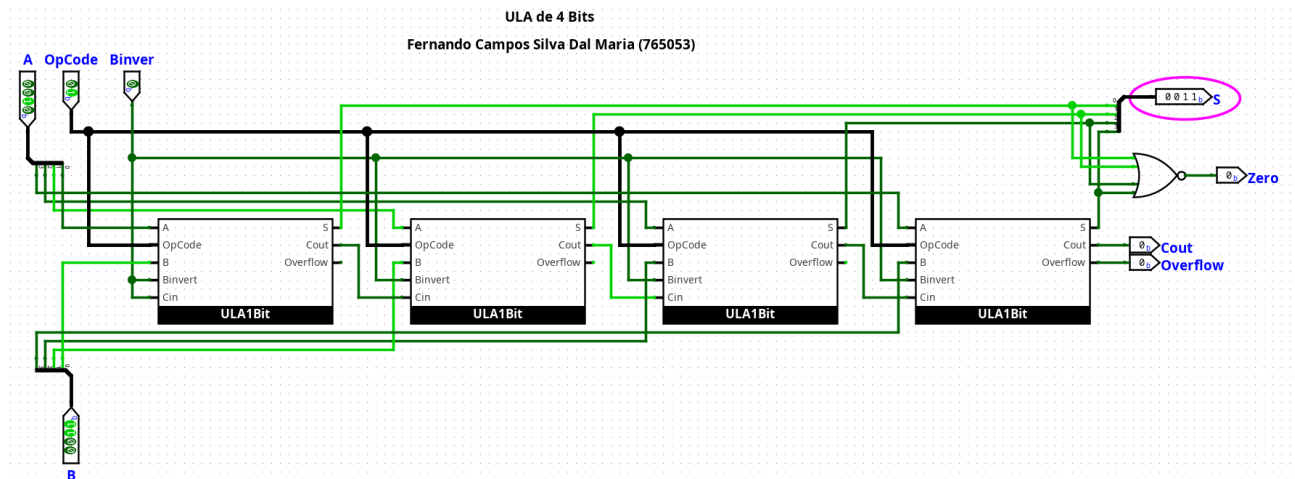


## Testes propostos para a ULA de 4 Bits:

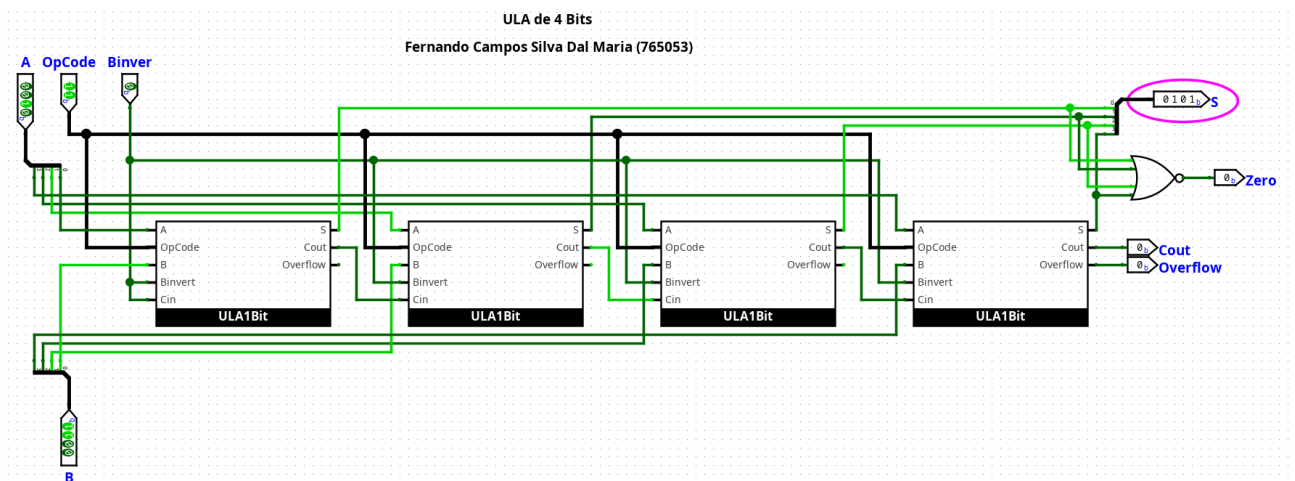
1) AND(A, B)



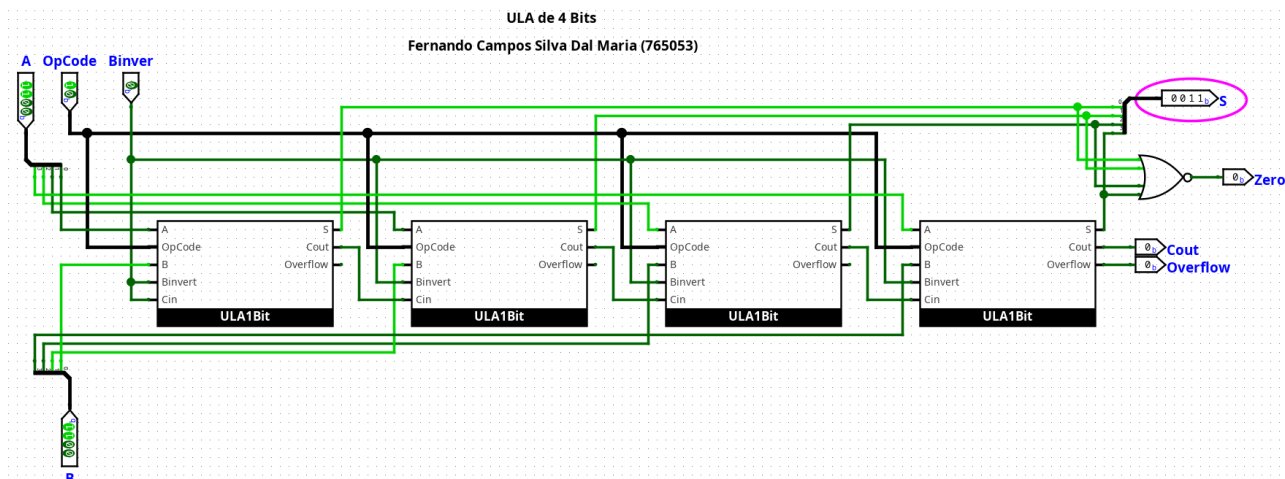
2) OR(A, B)



3) SOMA(A, B)



#### 4) NOT(A)



#### 5) AND(B, A)

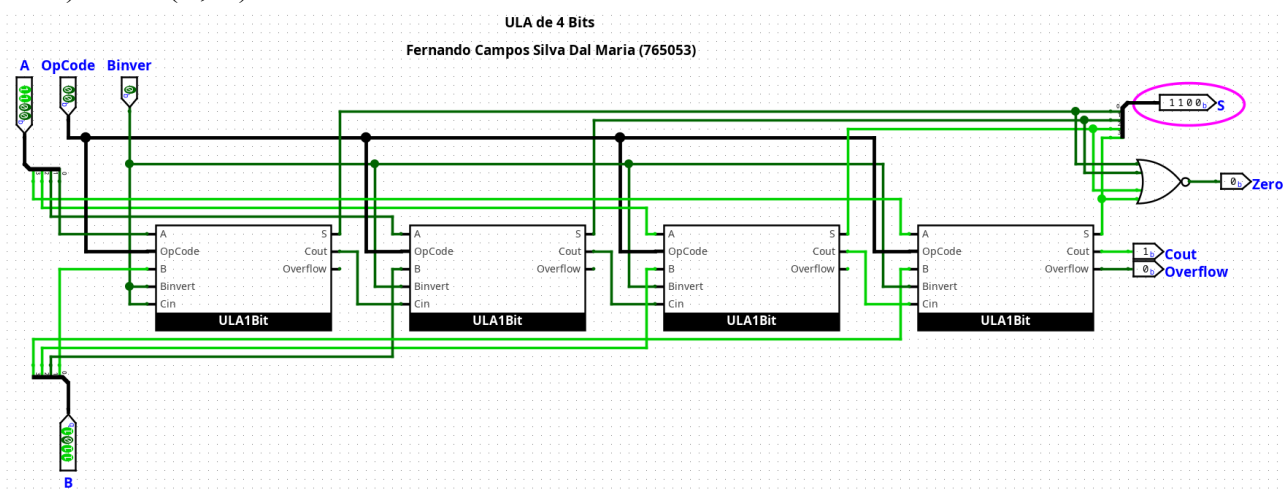


Tabela para o programa de teste da ULA de 4 bits:

Instrução Realizada	Binário (A, B, Op.code)	Valor em Hexa (0x ...)	Resultado em Binário
AND(A, B)	0010 0001 00	(0000 1000 0100) = 0x084	0000
OR(A, B)	0010 0011 01	(0000 1000 1101) = 0x08D	0011
SOMA(A, B)	0010 0011 11	(0000 1000 1111) = 0x08F	0101
NOT(A)	1100 10	(0011 0010) = 0x32	0011
AND(B, A)	1101 1100 00	(0011 0111 0000) = 0x370	1100

## Exercício 1 Tinkercad: Semáforo:

Código:

```
int vermelho = 13;
int amarelo = 12;
int verde = 11;
int azul = 10;

int tmp = 0;
int value = 3;

void setup() {
  Serial.begin(9600);

  pinMode(vermelho, OUTPUT);
  pinMode(amarelo, OUTPUT);
  pinMode(verde, OUTPUT);
  pinMode(azul, OUTPUT);

  digitalWrite(vermelho, HIGH);
}

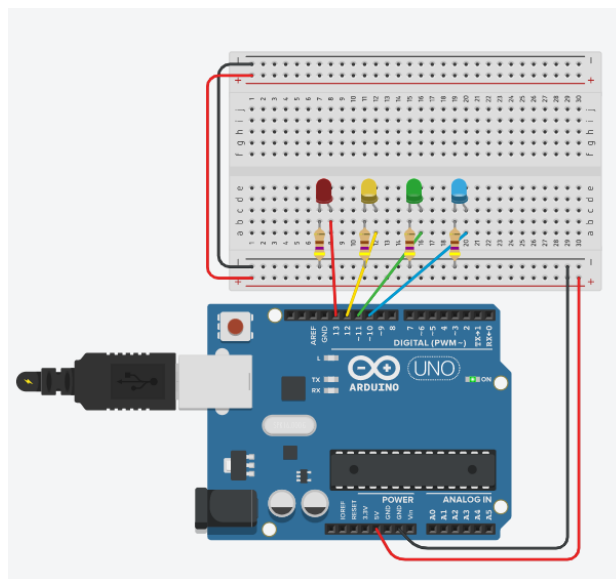
void loop() {
  digitalWrite(azul, HIGH);
  delay(500);
  digitalWrite(azul, LOW);
  delay(500);
  tmp++;

  if(tmp == value) {
    tmp = 0;
    switch(value) {
      case 2:
        digitalWrite(amarelo, LOW);
        digitalWrite(vermelho, HIGH);
        value = 3;
        break;

      case 3:
        digitalWrite(vermelho, LOW);
        digitalWrite(verde, HIGH);
        value = 4;
        break;

      case 4:
        digitalWrite(verde, LOW);
        digitalWrite(amarelo, HIGH);
        value = 2;
        break;
    }
  }
}
```

Estrutura funcionando:





## Exercício 2 Tinkercad ULA 1 bit:

Código:

```
int vermelho = 13;
int amarelo = 12;
int verde = 11;
int azul = 10;

void setup() {
  Serial.begin(9600);

  pinMode(vermelho, OUTPUT);
  pinMode(amarelo, OUTPUT);
  pinMode(verde, OUTPUT);
  pinMode(azul, OUTPUT);
}

void loop() {
  if(Serial.available()) {
    String code = Serial.readString();
    bool bInver = false;
    char ch = '\0';
    int arr[3];

    int i = 0, j = 0;
    while(i < code.length()) {
      ch = code.charAt(i);
      if((ch <= '9' && ch >= '0')) {
        arr[j++] = ch-48;
      } else if(ch == '-') {
        bInver = !bInver;
      }

      i++;
    }

    bool A = arr[0];
    bool B = arr[1];

    digitalWrite(vermelho, A);
    digitalWrite(amarelo, B);

    bool C = bInver;

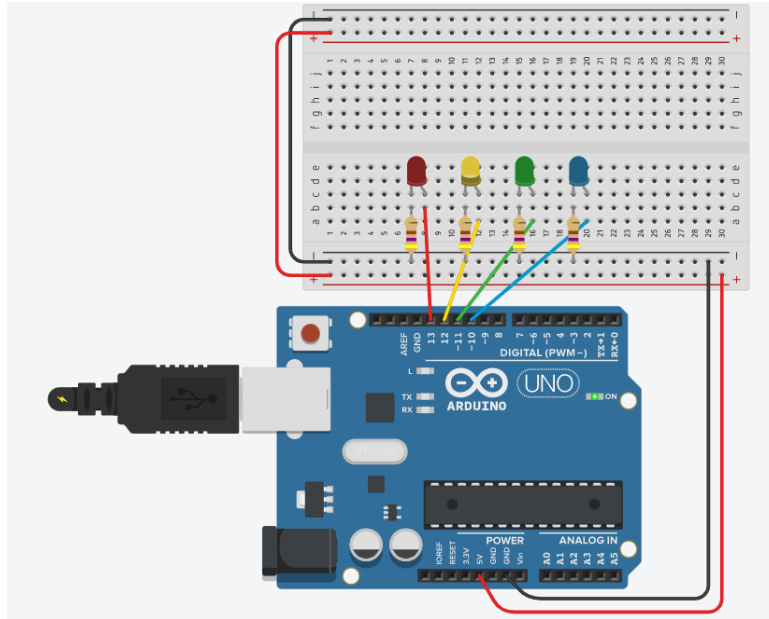
    switch(arr[2]) {
      case 0:
        digitalWrite(verde, A && B);
        break;
      case 1:
        digitalWrite(verde, A || B);
        break;
      case 2:
        digitalWrite(verde, !A);
        break;
      case 3:
        if(bInver) B = !B;
        digitalWrite(verde, A ^ B ^ C);
    }

    digitalWrite(azul, A && B || (A ^ B) && C);

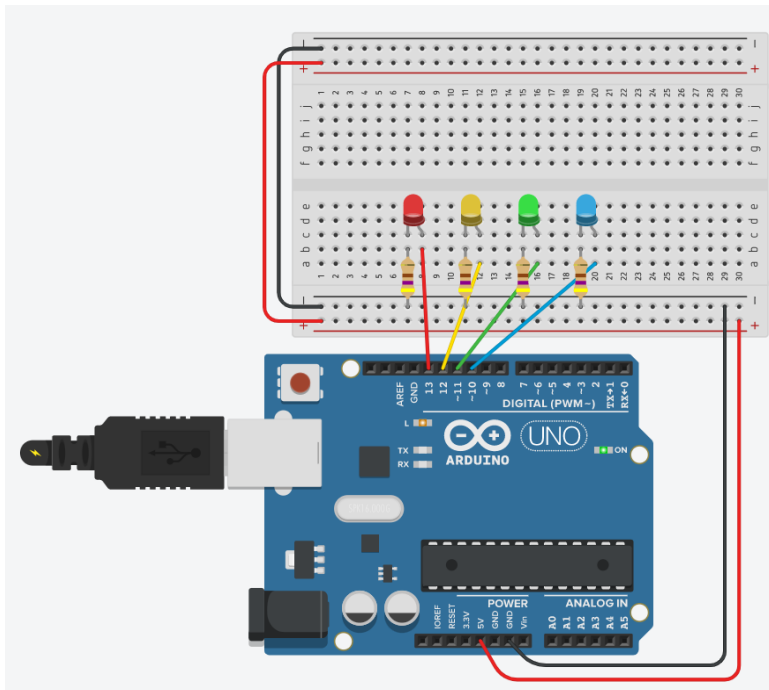
    Serial.println(code);
  }
}
```

## Testes da ULA simulada:

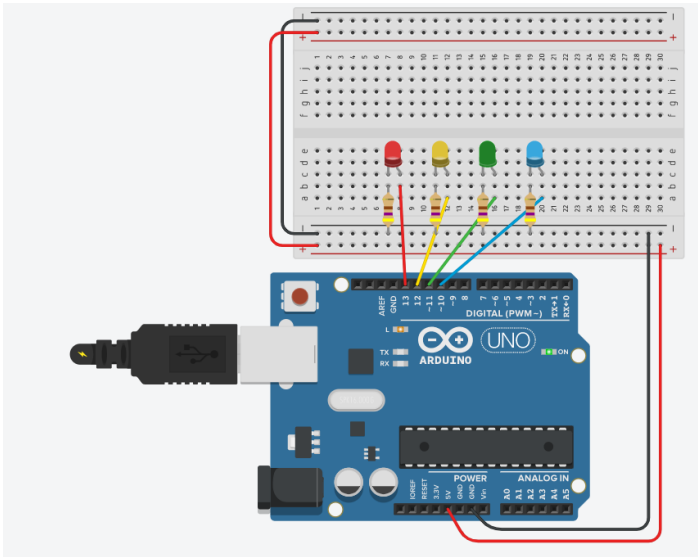
1) AND(A,B)



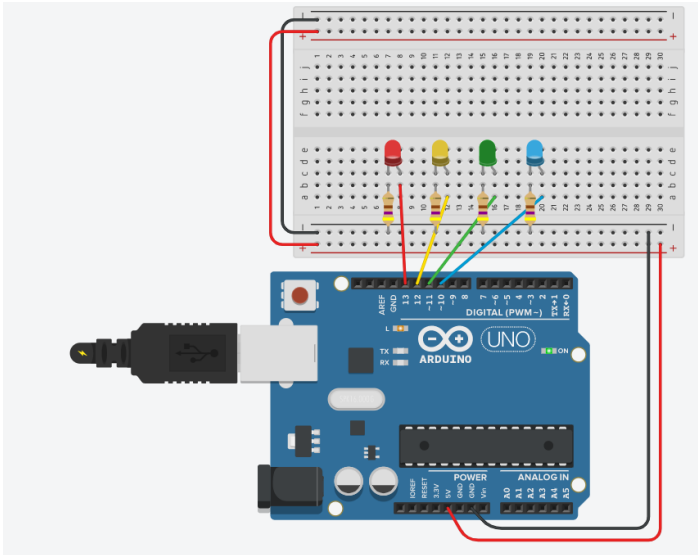
2) OR(A,B)



3)  $SOMA(A,B)$



4)  $NOT(A)$



5)  $SOMA(A,-B)$

