LAB REPORT : 4

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Aim : To design an Arithmetic and Logic Unit (ALU) capable of performing 8 Arith-metic/Logic functions on 1-bit operands.

Operations corresponding to inputs f0, f1, f2 , a, b, c should be as:

f0f f2	ALU functions	Y1	Y2
0 0 0	ZER0	-	0
0 0 1	A OR B	-	A + B
0 1 0	A AND B	-	A * B
0 1 1	A EXOR B	-	A ⊕ B
1 0 0	A PLUS B	CARRY	SUM
1 0 1	A MINUS B	BORROW	DIFFERECE
1 1 0	A PLUS B PLUS C	CARRY	SUM
1 1 1	A MINUS B MINUS C	BORROW	DIFFERECE

Electronic components used : Wires, And gate, OR gate, NOT gate, EXOR gate , Arduino uno, breadboard, LED's, Resistors.
In this expreiment we are already provided with 2 working 8:1 MUX's .

Reference circuit : In both the mux's the input's (i0 -> i7) are given from bottom to top order . I.E i0 is the bottom most input on the left side and i7 is the topmost input on the left side of the mux0 & mux1.

For Mux0 ->(s2=f1) , (s1=f0), (s0=c), mux1 ->(s2=f2) , (s1=f1), (s0=f0)
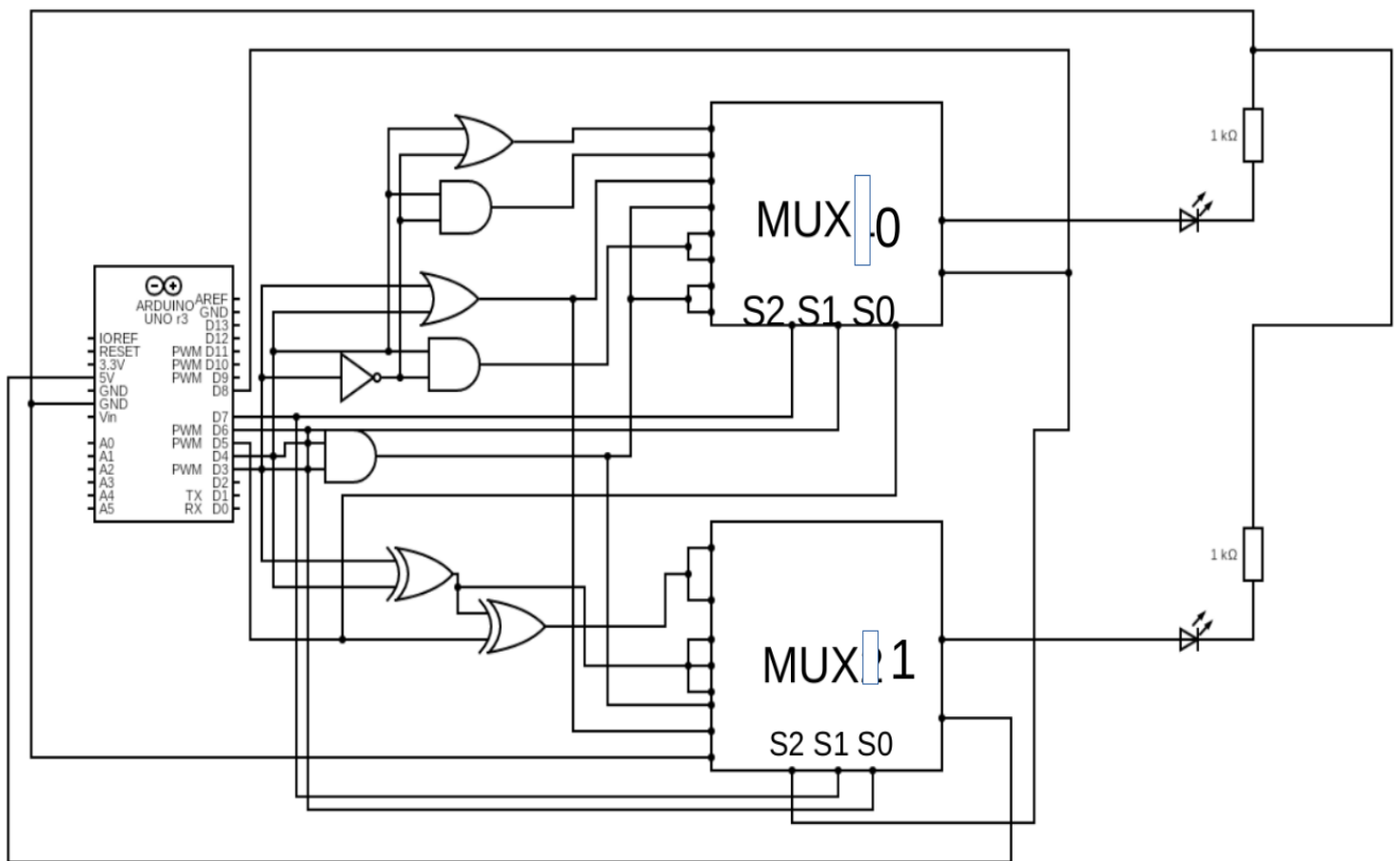
Procedure : 1. A circuit with two 8:1 MUX is provided to us. We have to
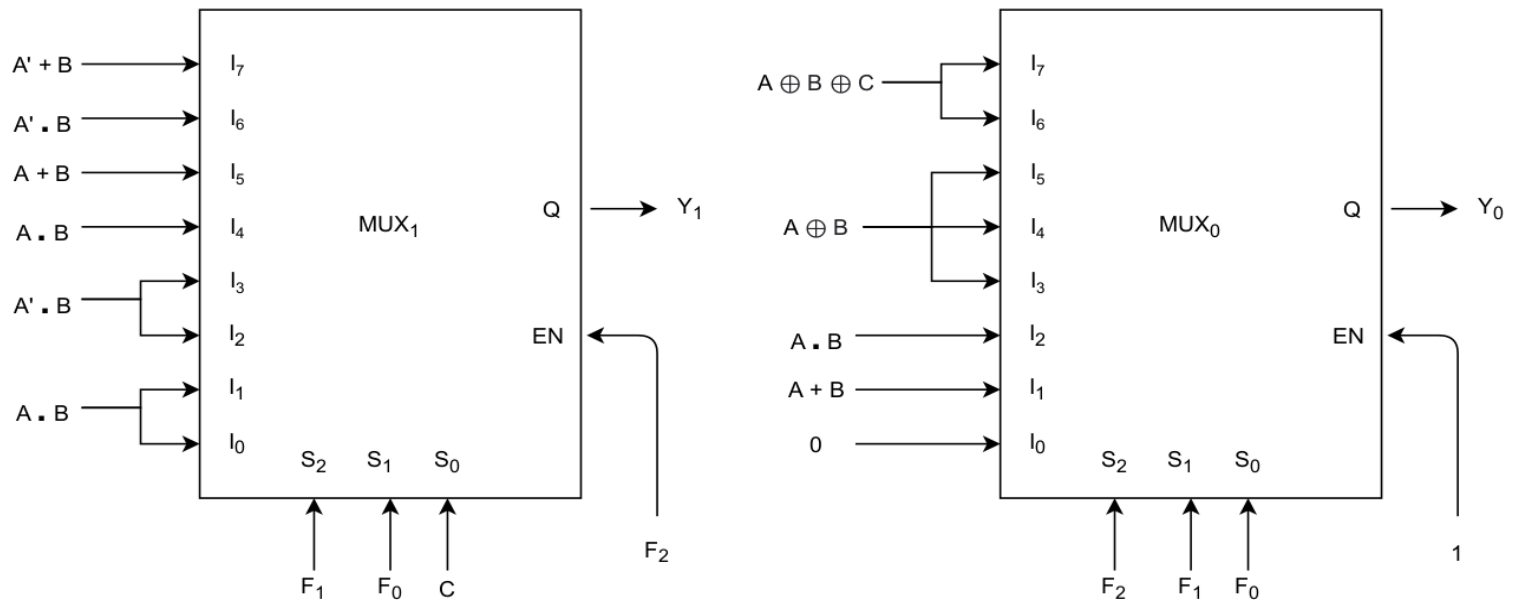tinker and copy these circuits and start using thaem.
Link of the given tinkercad circuits are :
https://www.tinkercad.com/things/8cOz4Q4MVTK

2. First use an Arduino uno to take inputs of a,b,c and we will
perform the operations to get the result as in y1 and y2.

3.Now we will connect these outputs as inputs (i0 to i7) to get
the desired output with specific set of f0 ,f1, f2.

4. To get the deired output connect the functions of a,b,c as
shown in the diagram below to each of the musk.

MUX₁ inputs:

$A' + B \rightarrow I_7$

$A' \cdot B \rightarrow I_6$

$A + B \rightarrow I_5$

$A \cdot B \rightarrow I_4$

$A' \cdot B \rightarrow I_3$

I_2

$A \cdot B \rightarrow I_1$

I_0

MUX₁ $Q \rightarrow Y_1$ EN

$S_2 \quad S_1 \quad S_0$

$F_1 \quad F_0 \quad C$

F_2

MUX₀ inputs:

$A \oplus B \oplus C \rightarrow I_7$

I_6

I_5

$A \oplus B \rightarrow I_4$

I_3

$A \cdot B \rightarrow I_2$

$A + B \rightarrow I_1$

$0 \rightarrow I_0$

MUX₀ $Q \rightarrow Y_0$ EN

$S_2 \quad S_1 \quad S_0$

$F_2 \quad F_1 \quad F_0$

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5. Outputs y1, y0 are connected to LEDs , they glow if their value is 1 and dontglow for 0.

Code:

//pin name = point of connection in arduino uno.

```
int pin2 = 3;
int pin3 = 4;
int pin4 = 5;
int pin5 = 6;
int pin6 = 7;
int pin7 = 8;
```

//declaring required variables

```
int k,a,b,c,f0,f1,f2;
```

```
void setup()
{
```

```
pinMode(pin2, OUTPUT);
pinMode(pin3, OUTPUT);
pinMode(pin4, OUTPUT);
pinMode(pin5, OUTPUT);
pinMode(pin6, OUTPUT);
pinMode(pin7, OUTPUT);


Serial.begin(9600);
}

void loop()
{



Serial.print("\ a=");
while(Serial.available() == 0){}
a=Serial.read();
a=a-'0';
Serial.println(a);

Serial.print("\ b=");
while(Serial.available() == 0){}
b=Serial.read();
b=b-'0';
Serial.println(b);

Serial.print("\ c=");
while(Serial.available() == 0){}
c=Serial.read();
c=c-'0';
Serial.println(c);

Serial.print("\ f0=");
while(Serial.available() == 0){}
f0=Serial.read();
f0=f0-'0';
Serial.println(f0);
```

```
Serial.print("\ f1=");
while(Serial.available() == 0){}
f1=Serial.read();
f1=f1-'0';
Serial.println(f1);

Serial.print("\ f2=");
while(Serial.available() == 0){}
f2=Serial.read();
f2=f2-'0';
Serial.println(f2);




digitalWrite(pin2,a);
digitalWrite(pin3,b);
digitalWrite(pin4,c);
digitalWrite(pin5,f0);
digitalWrite(pin6,f1);
digitalWrite(pin7,f2);




Serial.println("Enter anything to go to Read again");
while(Serial.available() == 0){}
k=Serial.read();


}
```

Conclusion :

The output comes according to the given table:
(Here i0->i7 are the same as in the diagram in the procedure section).

f2f1f0	ALU functions	c	Y1 (MUX 1)	Y0 (MUX 0)
0 0 0	ZER0	-	-	0 (i0)
0 0 1	A OR B	-	-	A+B (i1)
0 1 0	A AND B	-	-	A*B (i2)
0 1 1	A EXOR B	-	-	A $\oplus$ B (i3)
1 0 0	A PLUS B	-	A*B (i4)	A $\oplus$ B (i4)
1 0 1	A MINUS B	-	A' * B (i5)	A $\oplus$ B (i5)
1 1 0	A PLUS B PLUS C	0 1	A*B (i4) A+B (i5)	A $\oplus$ B $\oplus$C (i6)
1 1 1	A MINUS B MINUS C	0 1	A'*B (i6) A + B (i7)	A $\oplus$ B $\oplus$C (i7)

A	B	A+B	A*B	A'*B	A $\oplus$ B
0	0	0	0	0	0
0	1	1	0	1	1
1	0	1	0	0	1
1	1	1	1	0	0

A	B	C	A $\oplus$ B $\oplus$C
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Link to Tinkercad : https://www.tinkercad.com/things/5uf9nUu3Hgq