CSE 232 LOGIC CIRCUIT AND DESIGN

PROJECT 2

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C Code:

mult = 0;

while(a > 0){

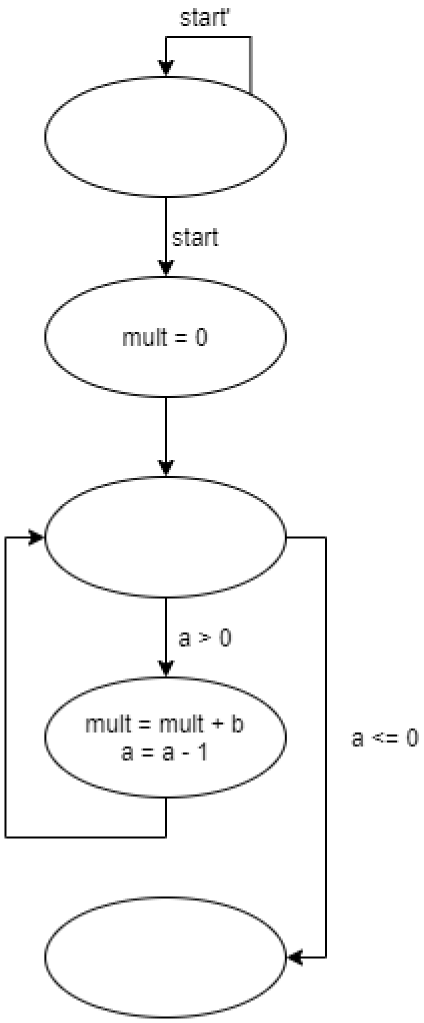
mult = mult + b;

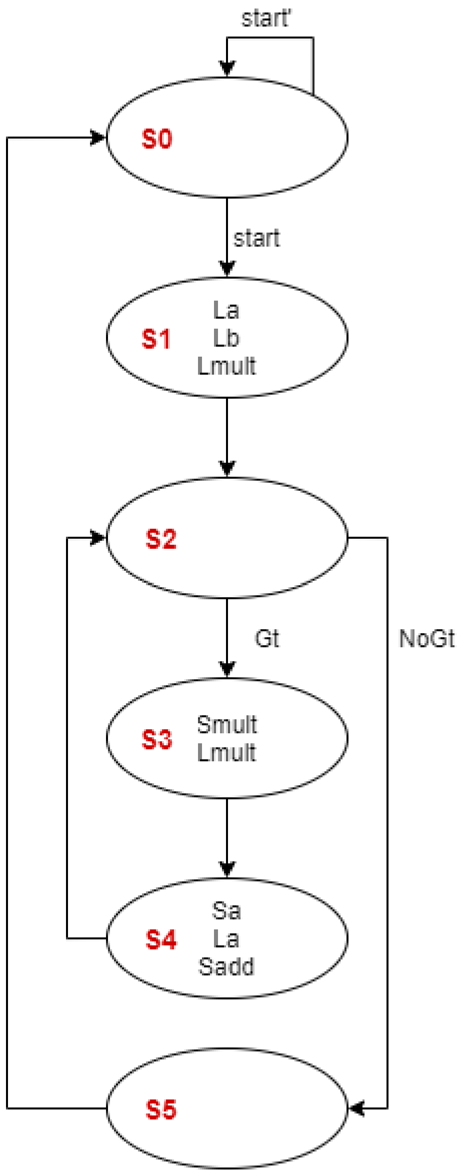
a = a – 1;

}

State Diagram:

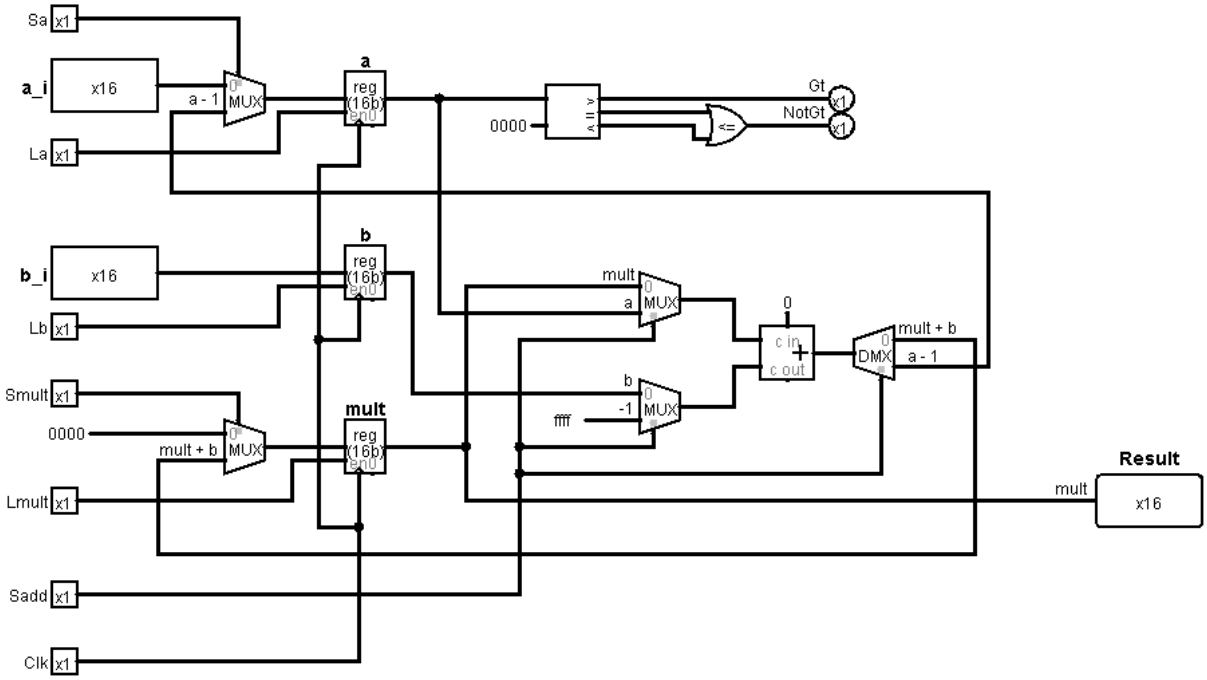
In this diagram, the signals inside the states are 1 and the remaining signals are 0.





At first, when I was determining the states of the diagram, I thought of mult + b and a - 1 operations in the same state. But since I used a single adder, I had to do these things on different states. That's why I increased my states number while updating the diagram.

Datapath:



Sa = Select bit for the register a.

If Sa is equal to 0, then a is equal to a_i.

If Sa is equal to 1, then a is equal to (a – 1).

La = If La is equal to 1 , load the input to the register a; otherwise do not load.

Lb = If Lb is equal to 1 , load the input to the register b; otherwise do not load.

Smult = Select bit for the register mult.

If Smult is equal to 0, then mult is equal to 0.

If Smult is equal to 1, then mult is equal to (mult + b).

Lmult = If Lmult is equal to 1 , load the input to the register mult; otherwise do not load.

Sadd = Select bit for the addition.

If Sadd is equal to 0, then doing addition for mult and b values.

If Sadd is equal to 1, then doing addition for a and -1 values.

In the assignment, I used multiplexers and a demultiplexer, as there must only be one adder. I also used the Sadd signal to choose between 2 addition operations.

Clk = clock

Gt = It is equal to 1, if a is greater than 0.

NotGt = It is equal to 1, if a is not greater than 0.

Truth Table:

Present State			Inputs			Next State		
P2	P1	P0	Gt	NoGt	Start	N2	N1	N0
0	0	0	-	-	0	0	0	0
0	0	0	-	-	1	0	0	1
0	0	1	-	-	-	0	1	0
0	1	0	0	1	-	1	0	1
0	1	0	1	0	-	0	1	1
0	1	1	-	-	-	1	0	0
1	0	0	-	-	-	0	1	0
1	0	1	-	-	-	0	0	0

Present State			Outputs					
P2	P1	P0	Sa	La	Lb	Smult	Lmult	Sadd
0	0	0	0	0	0	0	0	0
0	0	1	0	1	1	0	1	0
0	1	0	0	0	0	0	0	0
0	1	1	0	0	0	1	1	0
1	0	0	1	1	0	0	0	1
1	0	1	0	0	0	0	0	0

Boolean Expression:

N2 = P2’.P1.P0’.NoGt + P2’.P1.P0
= P2’.P1.(P0’.NoGt + P0)

N1 = P2’.P1’.P0 + P2’.P1.P0’.Gt + P2.P1’.P0’
= P1’.(P2’.P0 + P2.P0’) + P2’.P1.P0’.Gt
= P1’(P2 XOR P0) + P2’.P1.P0’.Gt

N0 = P2’.P1’.P0’.Start + P2’.P1.P0’.NoGt + P2’.P1.P0’.Gt
= P2’.P1’.P0’.Start + P2’.P1.P0’.(NoGt + Gt)
= P2’.P0’.(P1’.Start + P1.(NoGt + Gt)

Sa = P2.P1’.P0’

La = P2’.P1’.P0 + P2.P1’.P0’
= P1’.(P2’.P0 + P2.P0’)
= P1’.(P2 XOR P0)

Lb = P2’.P1’.P0

Smult = P2’.P1.P0

Lmult = P2’.P1’.P0 + P2’.P1.P0
= P2’.P0.(P1’ + P1)
= P2’.P0

Sadd = P2.P1’.P0’

Note:

My project works when the number a is positive. This project does not include the bonus part of the assignment.