CSE 232 SPRING 2020

PROJECT 2

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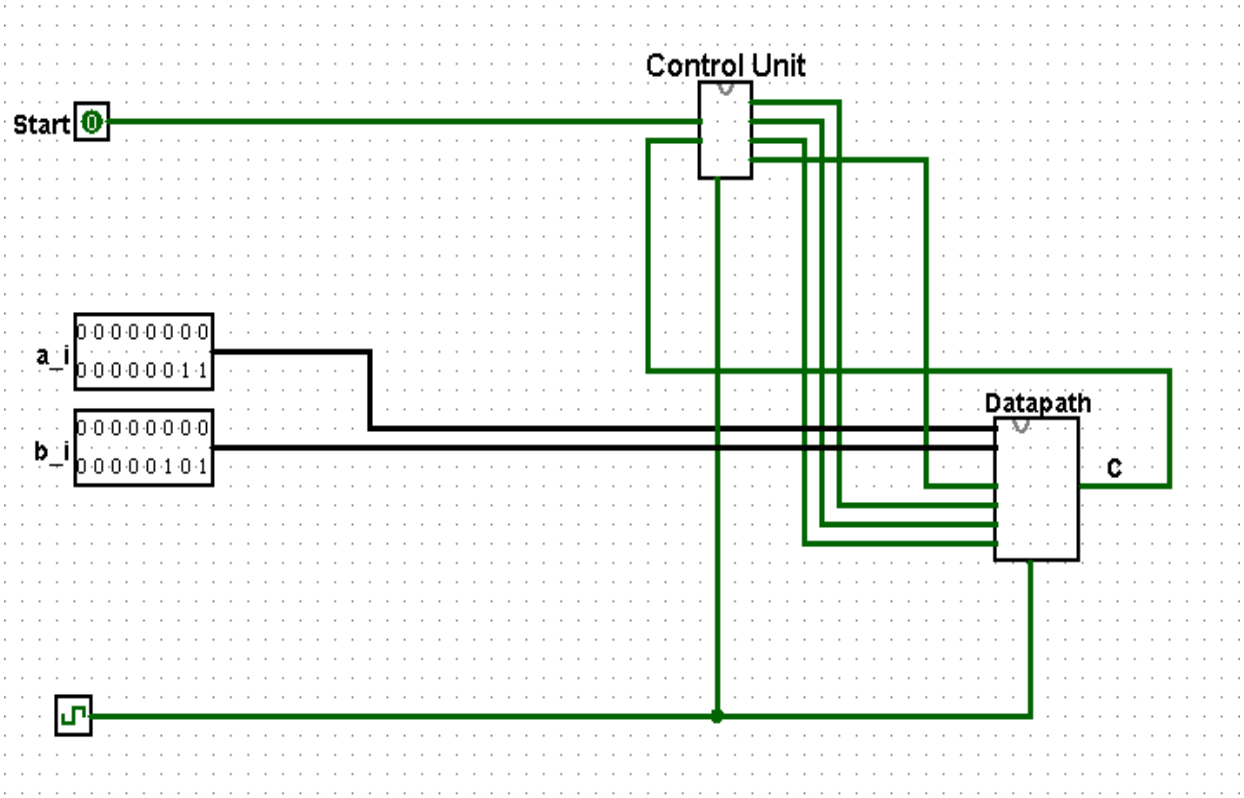
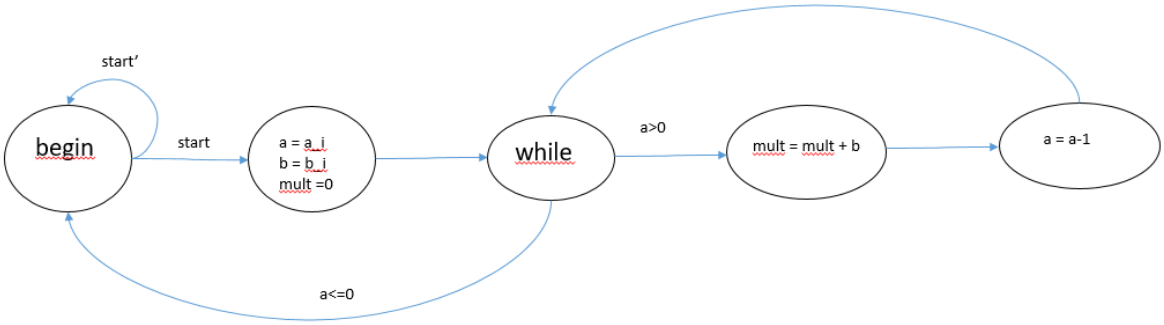
Note: Multiplication is avaliable only if given a and b inputs positive number, you must enter inputs and press start button to see result , C signal is compare a with 0 and send 1 if a>0 , it is enough to press start button 1 cycle.

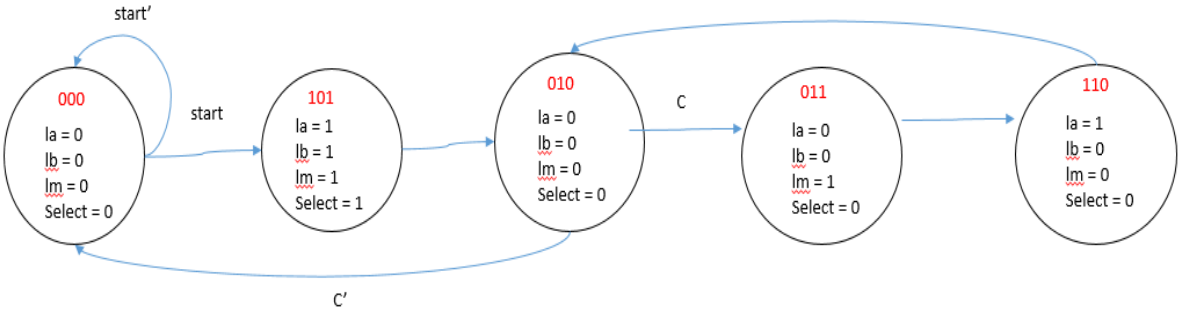
GENERAL CIRCUIT



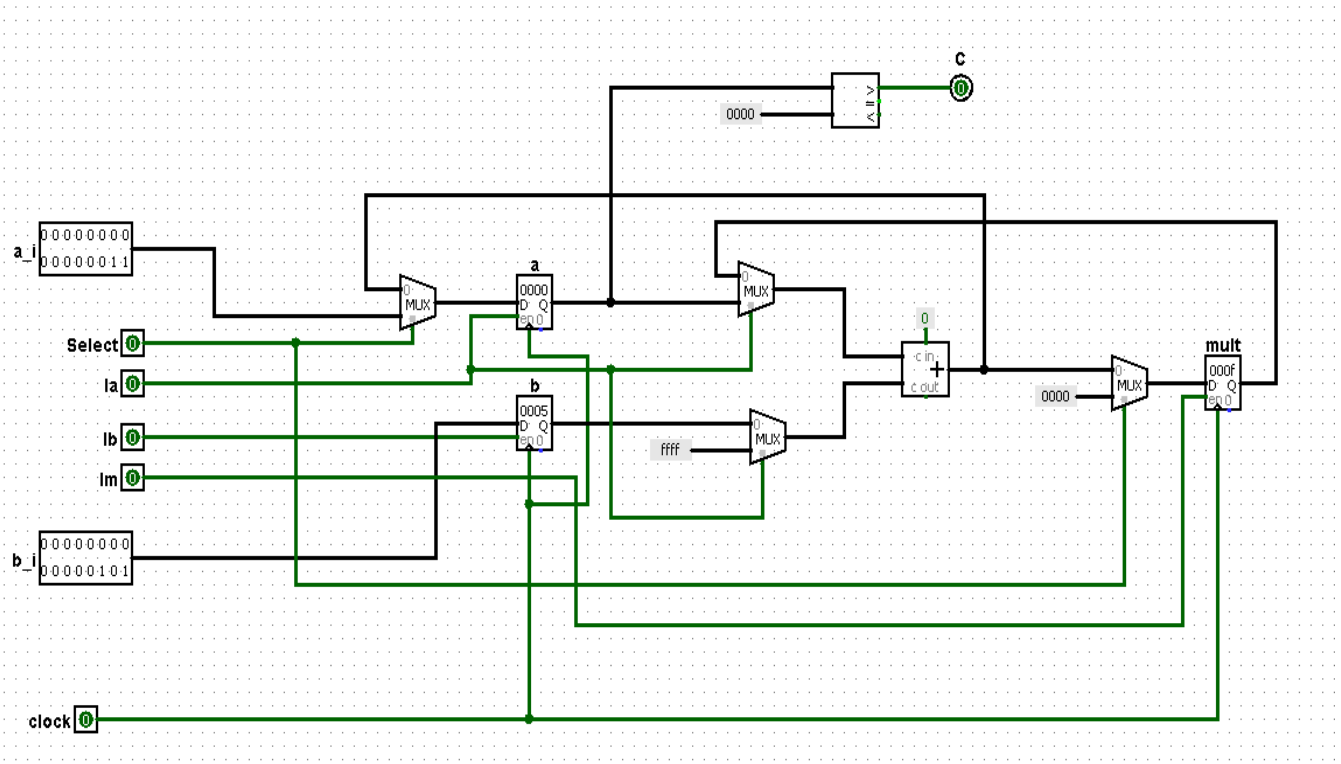
Generalization of C code as state diagram



FSM state diagram



Datapath



Truth Table

For states

s2	s1	s0	S	C	n2	n1	n0
0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0
0	0	0	1	0	1	0	1
0	0	0	1	1	1	0	1
0	0	1	0	0	0	0	0
0	0	1	0	1	0	0	0
0	0	1	1	0	0	0	0
0	0	1	1	1	0	0	0
0	1	0	0	0	0	0	0
0	1	0	0	1	0	1	1
0	1	0	1	0	0	0	0
0	1	0	1	1	0	1	1
0	1	1	0	0	1	1	0
0	1	1	0	1	1	1	0
0	1	1	1	0	1	1	0
0	1	1	1	1	1	1	0
1	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0
1	0	0	1	0	0	0	0
1	0	0	1	1	0	0	0
1	0	1	0	0	0	1	0
1	0	1	0	1	0	1	0
1	0	1	1	0	0	1	0
1	0	1	1	1	0	1	0
1	1	0	0	0	0	1	0
1	1	0	0	1	0	1	0
1	1	0	1	0	0	1	0
1	1	0	1	1	0	1	0
1	1	1	0	0	0	0	0
1	1	1	0	1	0	0	0
1	1	1	1	0	0	0	0
1	1	1	1	1	0	0	0

For outputs

s2	s1	s0	la	lb	lm	Select
0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	1	0	0	0	0	0
0	1	1	0	0	1	0
1	0	0	0	0	0	0
1	0	1	1	1	1	1
1	1	0	1	0	0	0
1	1	1	0	0	0	0

Boolean Expression

For states

n2 = s2' s1' s0' S C' + s2' s1' s0' S C + s2' s1 s0 S' C' + s2' s1 s0 S' C + s2' s1 s0 S C' + s2' s1 s0 S C

(1) (2) (3) (4) (5) (6)

= (1-2) **s2' s1' s0' S (C' + C) = s2' s1' s0' S 1**

= (3-4-5-6) **s2' s1 s0 (S' C' + S' C + S C' + S C) = (S' (C' + C) + S(C' + C)) = (S' + S) = s2' s1 s0 1**

n2 = s2' s1' s0' S + s2' s1 s0

n1 = s2' s1 s0 S' C' + s2' s1 s0 S' C + s2' s1 s0 S C' + s2' s1 s0 S C + s2' s1 s0' S' C + s2' s1 s0' S C

(1) (2) (3) (4) (5) (6)

+ s2 s1' s0 S' C' + s2 s1' s0 S' C + s2 s1' s0 S C' + s2 s1' s0 S C + s2 s1 s0' S' C' + s2 s1 s0' S' C +

(7) (8) (9) (10) (11) (12)

s2 s1 s0' S C' + s2 s1 s0' S C

(13) (14)

= (1-2-3-4) **s2' s1 s0 (S' C' + S' C + S C' + S C) = (S' (C' + C) + S(C' + C)) = (S' + S) = s2' s1 s0 1**

= (5-6) **s2' s1 s0' C (S' + S) = s2' s1 s0' C 1**

= (11-12) **s2 s1 s0' C (S' + S) = s2 s1 s0' C 1**

= (result of (5-6) - result of (11-12)) **s1 s0' C (s2' + s2) = s1 s0' C 1**

= (7-8-9-10) **s2 s1' s0 (S' C' + S' C + S C' + S C) = (S' (C' + C) + S(C' + C)) = (S' + S) = s2 s1' s0 1**

= (11-12-13-14) s2 s1 s0' (S' C' + S' C + S C' + S C) = (S' (C' + C) + S(C' + C)) = (S' + S) = s2 s1 s0' 1

n1 = s1 s0' C + s2' s1 s0 + s2 s1' s0 + s2 s1 s0'

n0 = s2' s1' s0' S C' + s2' s1' s0' S C + s2' s1 s0' S' C + s2' s1 s0' S C

(1) (2) (3) (4)

= (1-2) s2' s1' s0' S (C' + C) = s2' s1' s0' S 1

= (3-4) s2' s1 s0' C (S' + S) = s2' s1 s0' C 1

n0 = s2' s1' s0' S + s2' s1 s0' C

For outputs

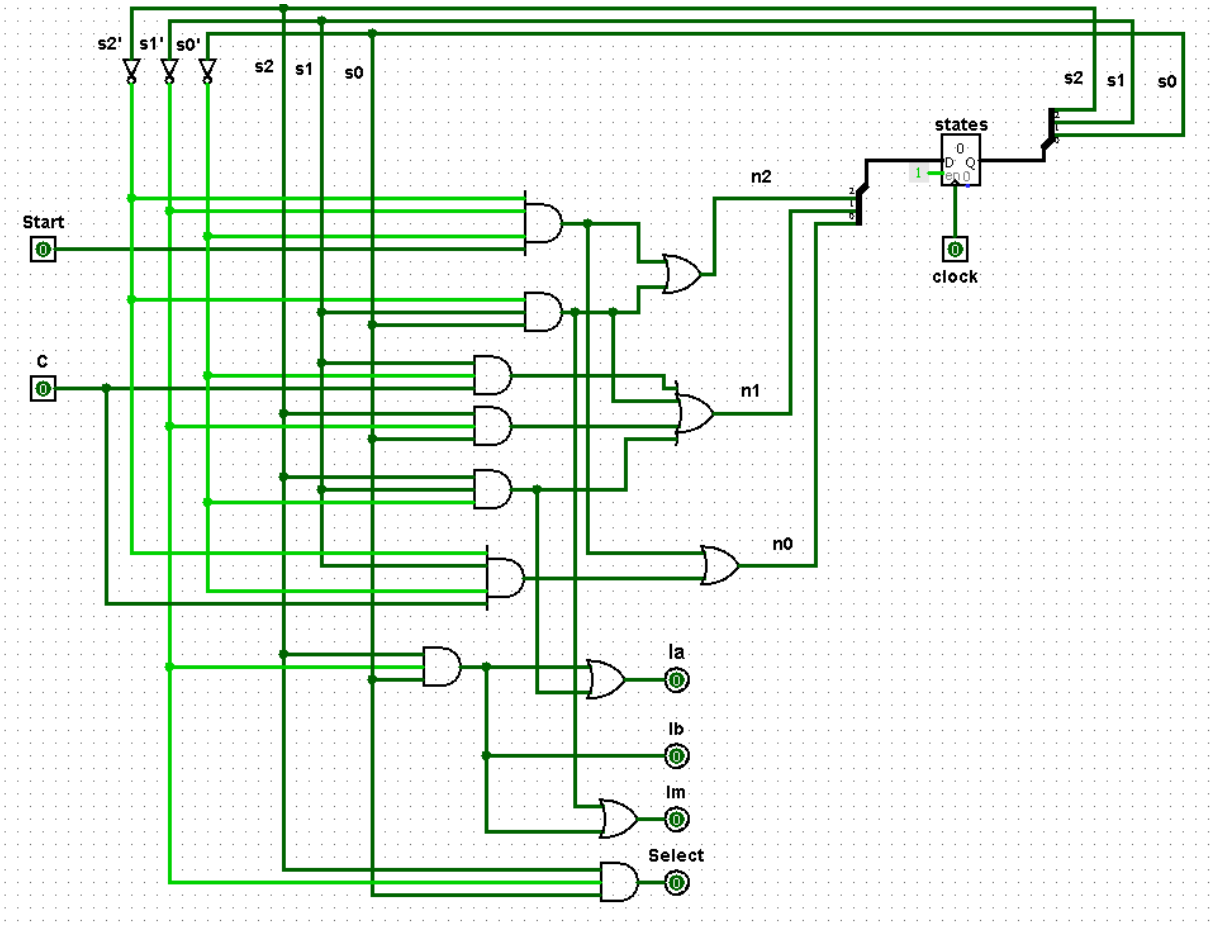
la = s2 s1' s0 + s2 s1 s0'

lb = s2 s1' s0

lm = s2' s1 s0 + s2 s1' s0

Select = s2 s1' s0

Circuit


s2'
s1'
s0'
s2
s1
s0
s2
s1
s0
states
n2
Start
C
n1
n0
clock
Ia
Ib
Im
Select