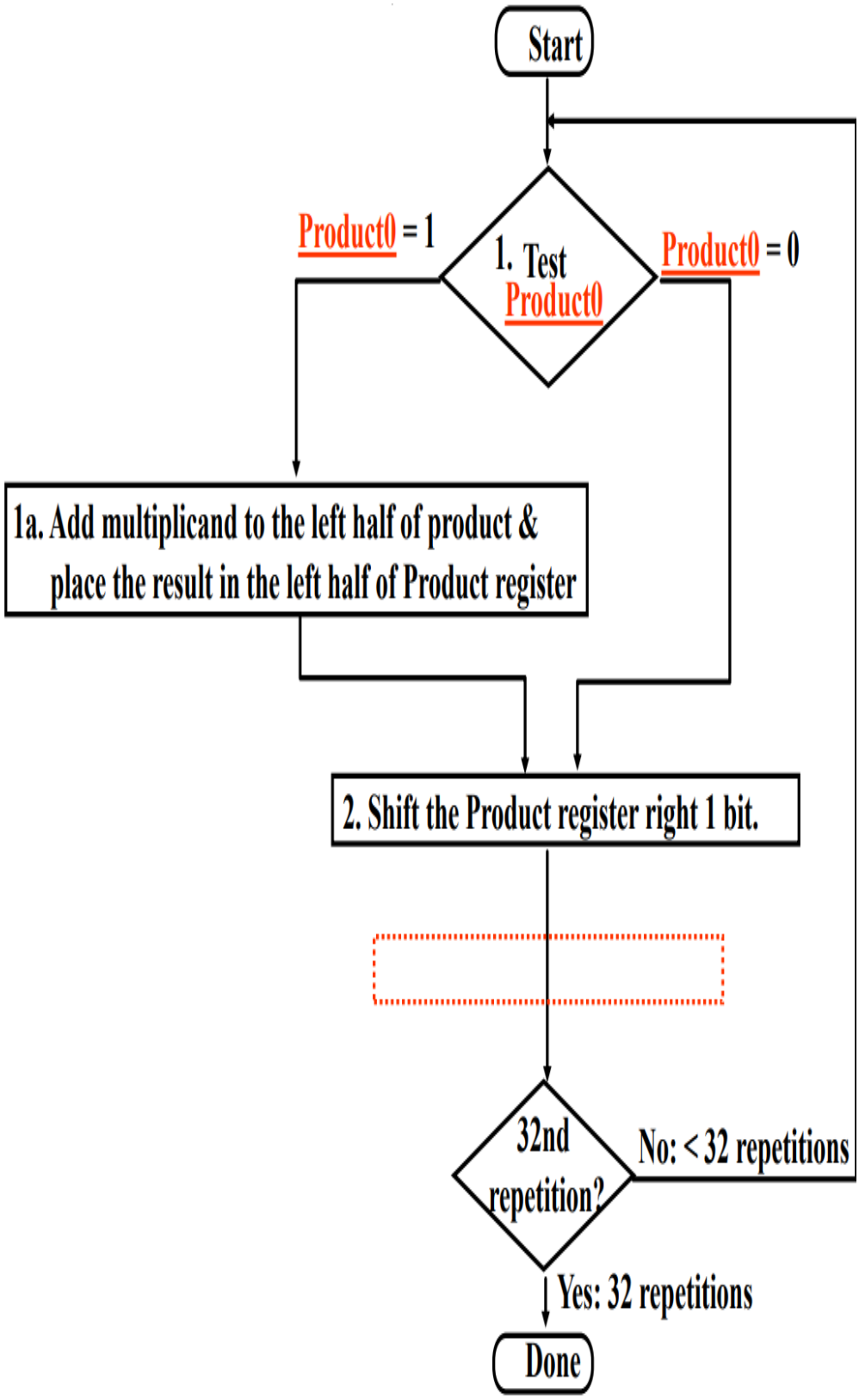
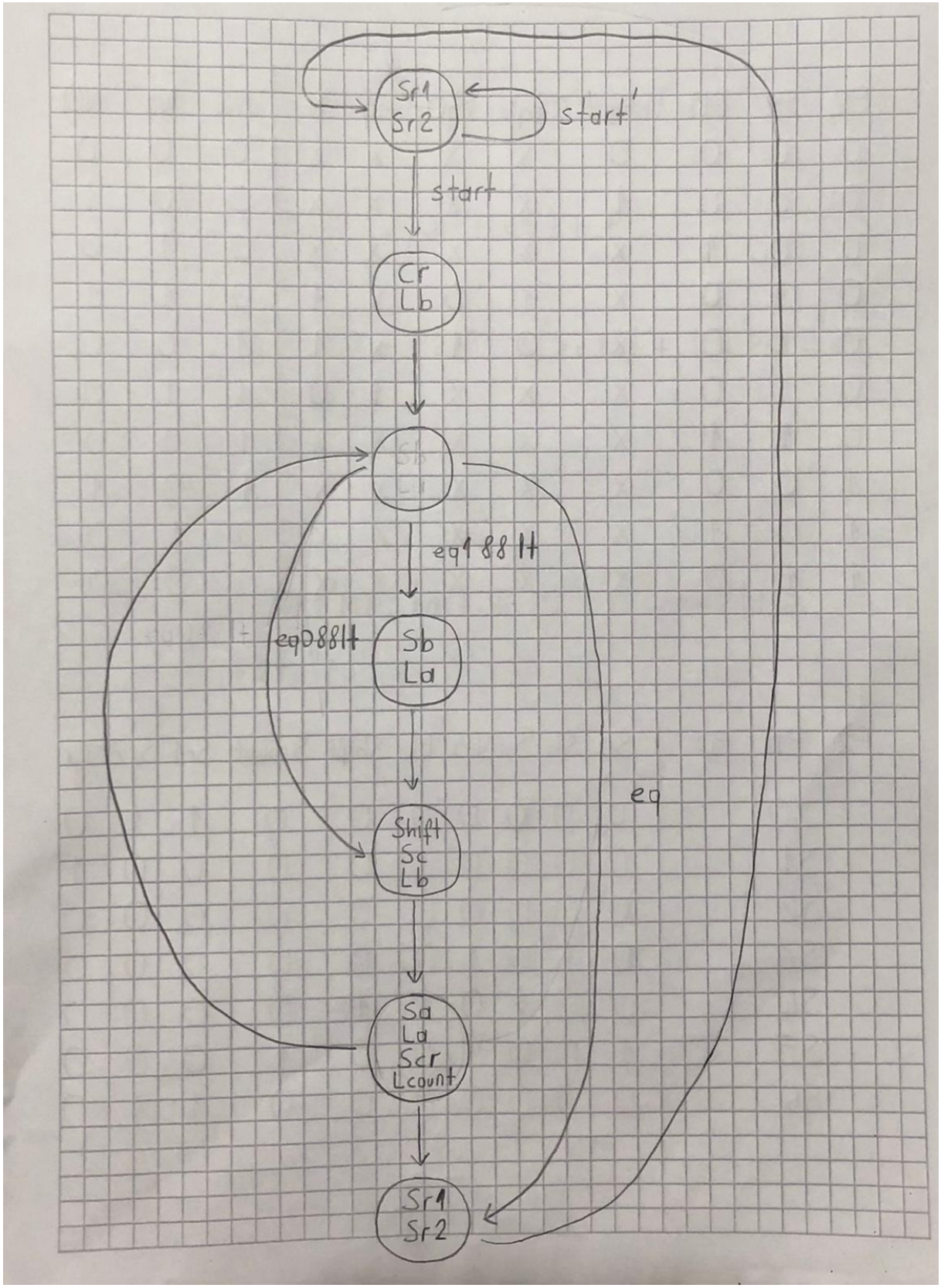
Assignment 3 Report

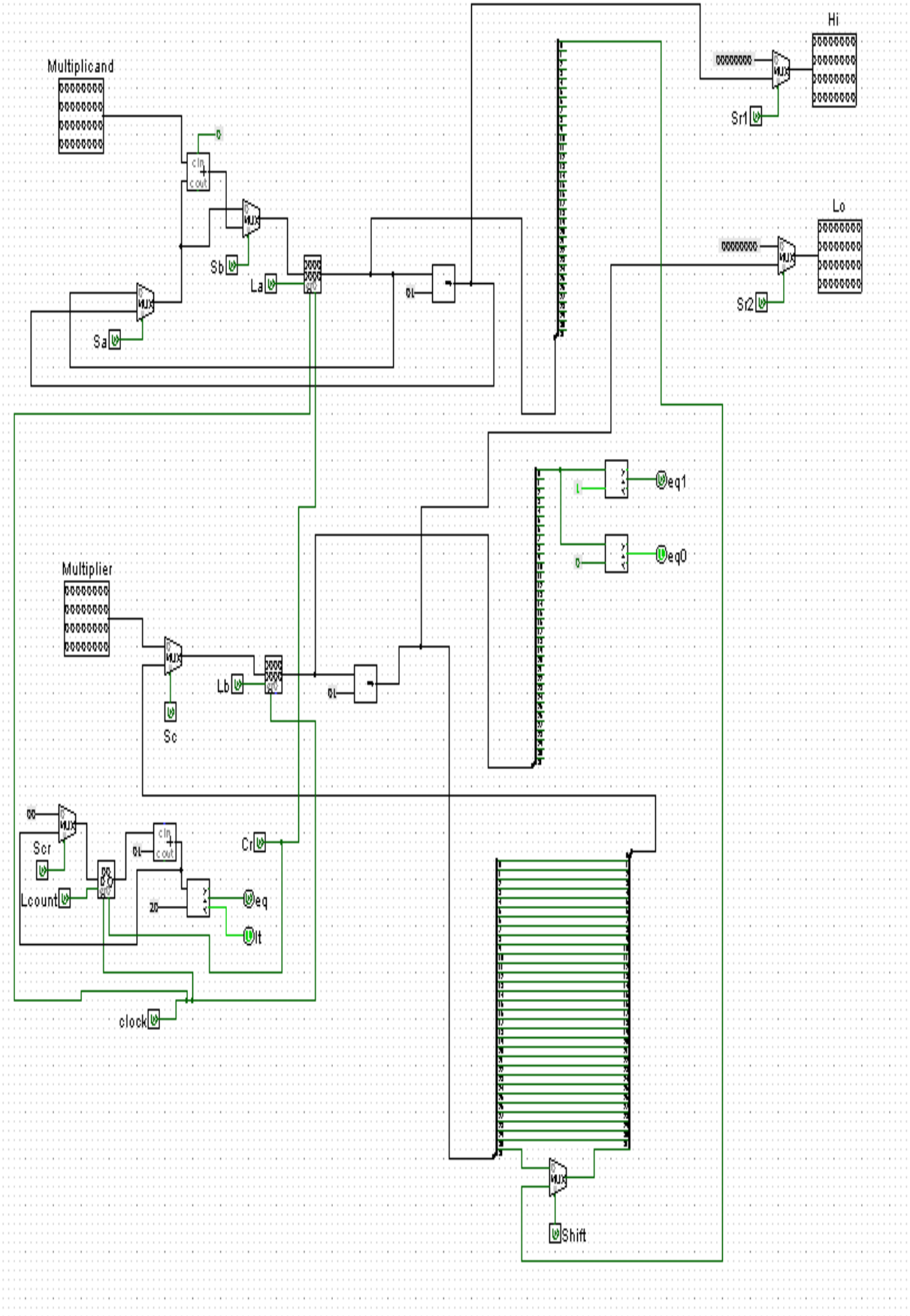
ASM



State Diagram



Datapath


Multiplicand
Hi
Lo
Sr1
Sr2
Sb
La
Sa
Multiplier
Lb
Sc
eq1
eq0
Scr
Lcount
Cr
eq
lt
clock
Shift

Datapath Input

1-Sa: This signal provides that we can take a current most significant 32 bit of product.

2-Sb: This signal provides that we can add multiplicand to most significant bit of product.

3-Sc: This signal provides that we can take a current less significant 32 bit of product.

4-La: This signal provides that we can load current most significant 32 bit of product to register.

5-Lb: This signal provides that we can load current less significant 32 bit of product to register.

6-Shift: This signal provides that we can shift 0th bit of most significant 32 bit product to 31th bit of less significant 32 bit product.

7- Scr: This signal provides that we can take a current counter register value.

8-Lcount: This signal provides that we can load current counter value to register.

9-Sr1: This signal provides that we can show the most significant 32 bit of result on Hi pin.

10-Sr2: This signal provides that we can show the less significant 32 bit of result on Lo pin.

11-Cr: This signal provides that we can clean the content of most significant 32 bit of product register and counter register.

12-Clock

Datapath Output

1-eq1: This signal decides that 0th bit of most significant 32 bit of product is equal to 1 or not.

2-eq0: This signal decides that 0th bit of most significant 32 bit of product is equal to 0 or not.

3-eq: This signal decides that counter register value is equal to 32 or not.

4-lt: This signal decides that counter register value is less than 32 or not.

Control Unit

Truth Tables

P2	P1	P0	start	eq1	eq0	eq	lt	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	-	1	0	0	1	0	1	1
0	1	0	-	0	1	0	1	1	0	0
0	1	0	-	-	-	1	0	1	1	0
0	1	1	-	-	-	-	-	1	0	0
1	0	0	-	-	-	-	-	1	0	1
1	0	1	-	-	-	-	-	0	1	0
1	1	0	-	-	-	-	-	0	0	0

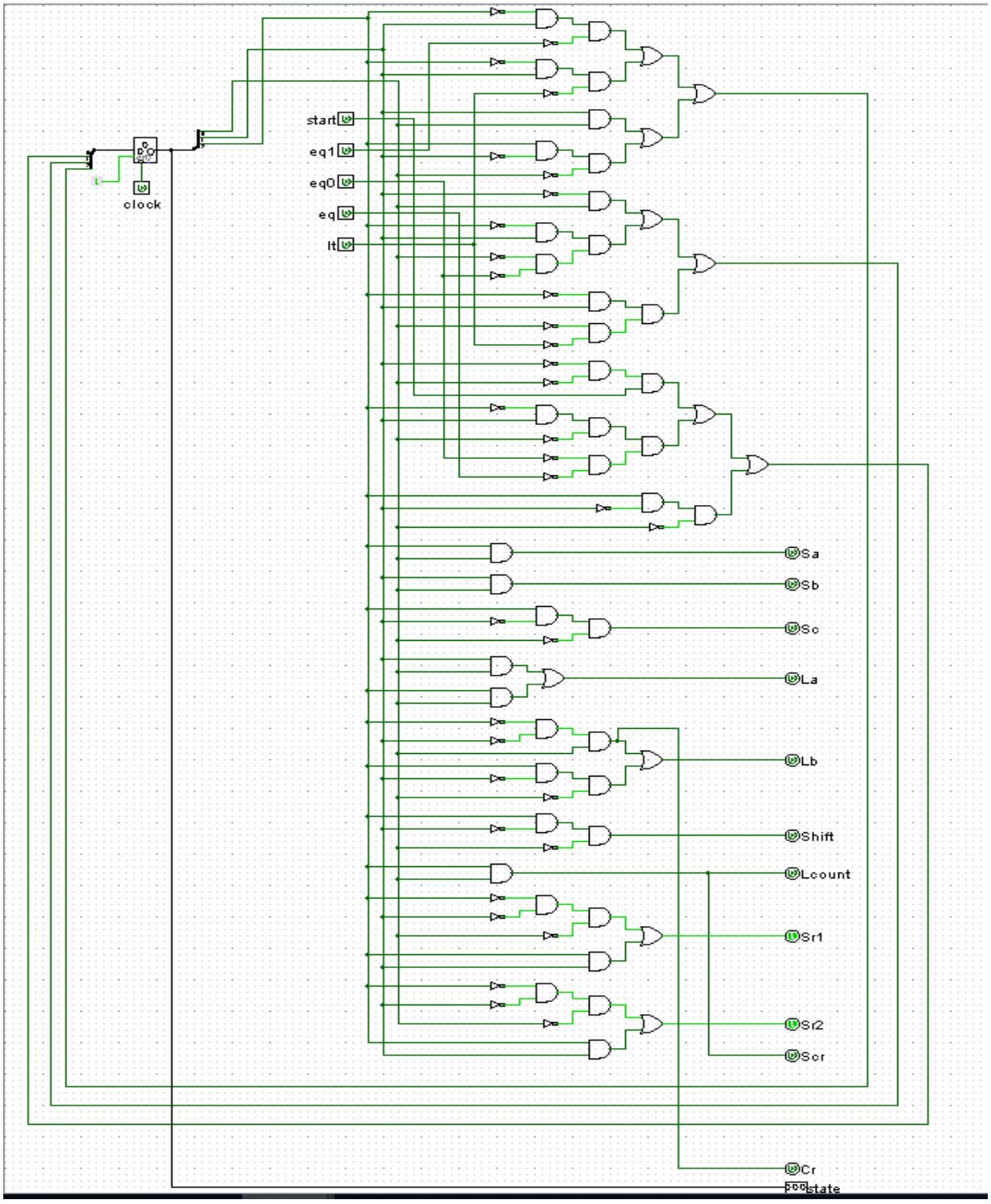
P2	P1	P0	Sa	Sb	Sc	La	Lb	Shift	Scr	Lcount	Sr1	Sr2	Cr
0	0	0	0	0	0	0	0	0	0	0	1	1	0
0	0	1	0	0	0	0	1	0	0	0	0	0	1
0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	1	1	0	1	0	1	0	0	0	0	0	0	0
1	0	0	0	0	1	0	1	1	0	0	0	0	0
1	0	1	1	0	0	1	0	0	1	1	0	0	0
1	1	0	0	0	0	0	0	0	0	0	1	1	0

Boolean Expressions

N2= P2’P1P0’eq0lt + P2’P1P0’eq + P2’P1P0 + P2P1’P0’

N1= P2’P1’P0 + P2’P1P0’eq1lt + P2’P1P0’eq + P2P1’P0

N0= P2’P1’P0’start + P2’P1P0’eq1lt + P2P1’P0’



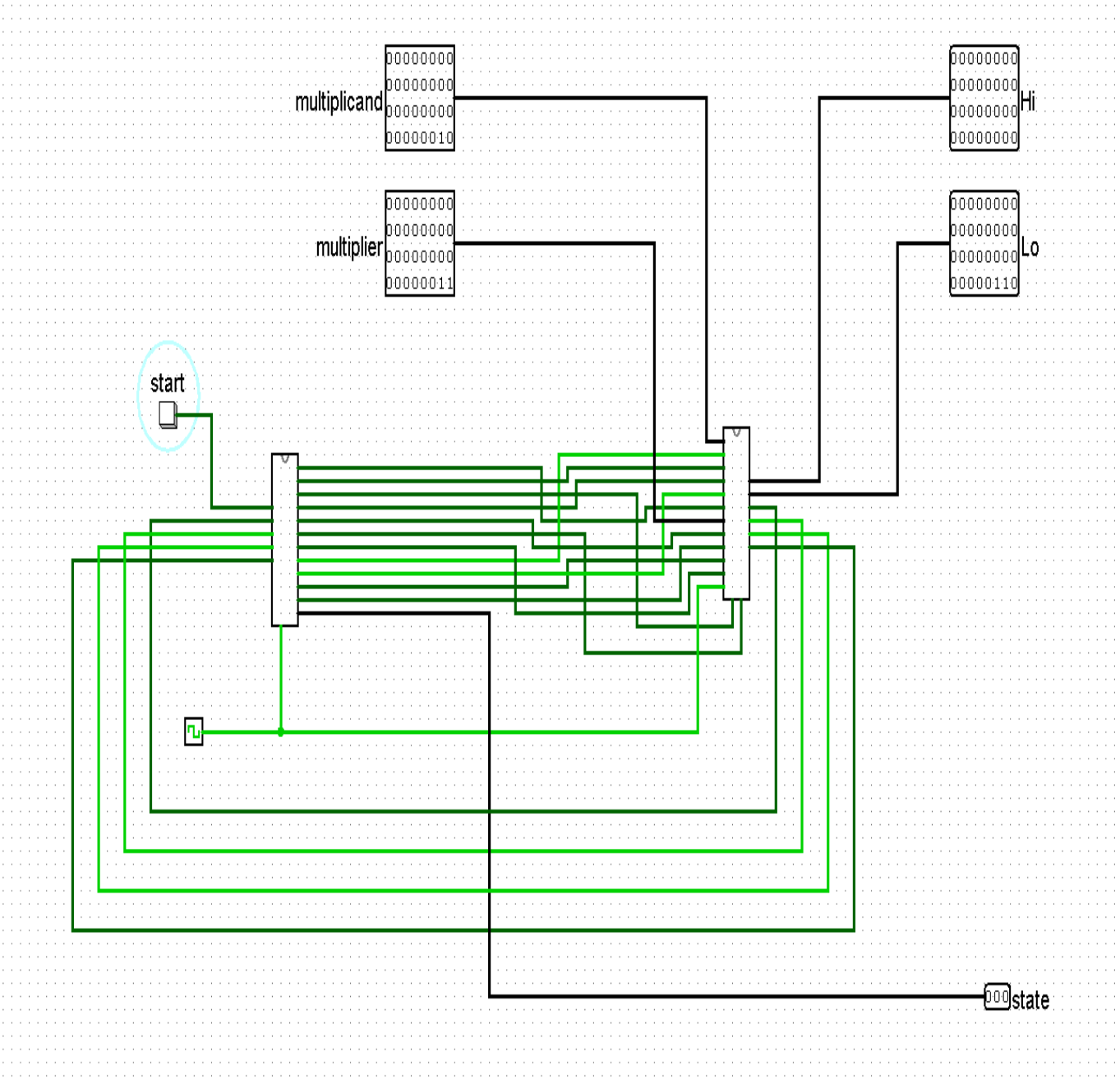
Test Cases

Hi pin holds the most significant 32 bit of result. [63:32]

Lo pin holds the less significant 32 bit of result. [31:0]

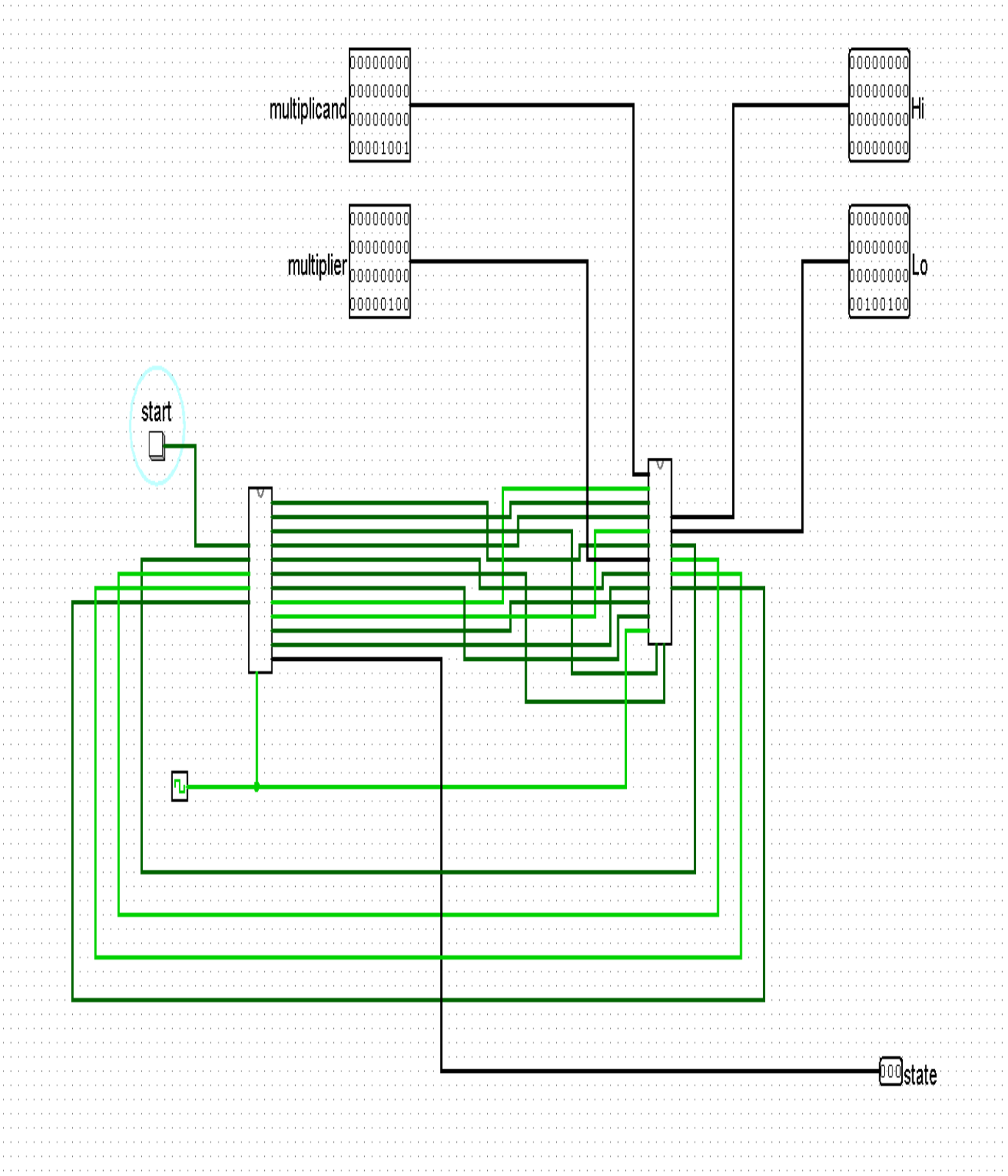
Test1

2×3=6



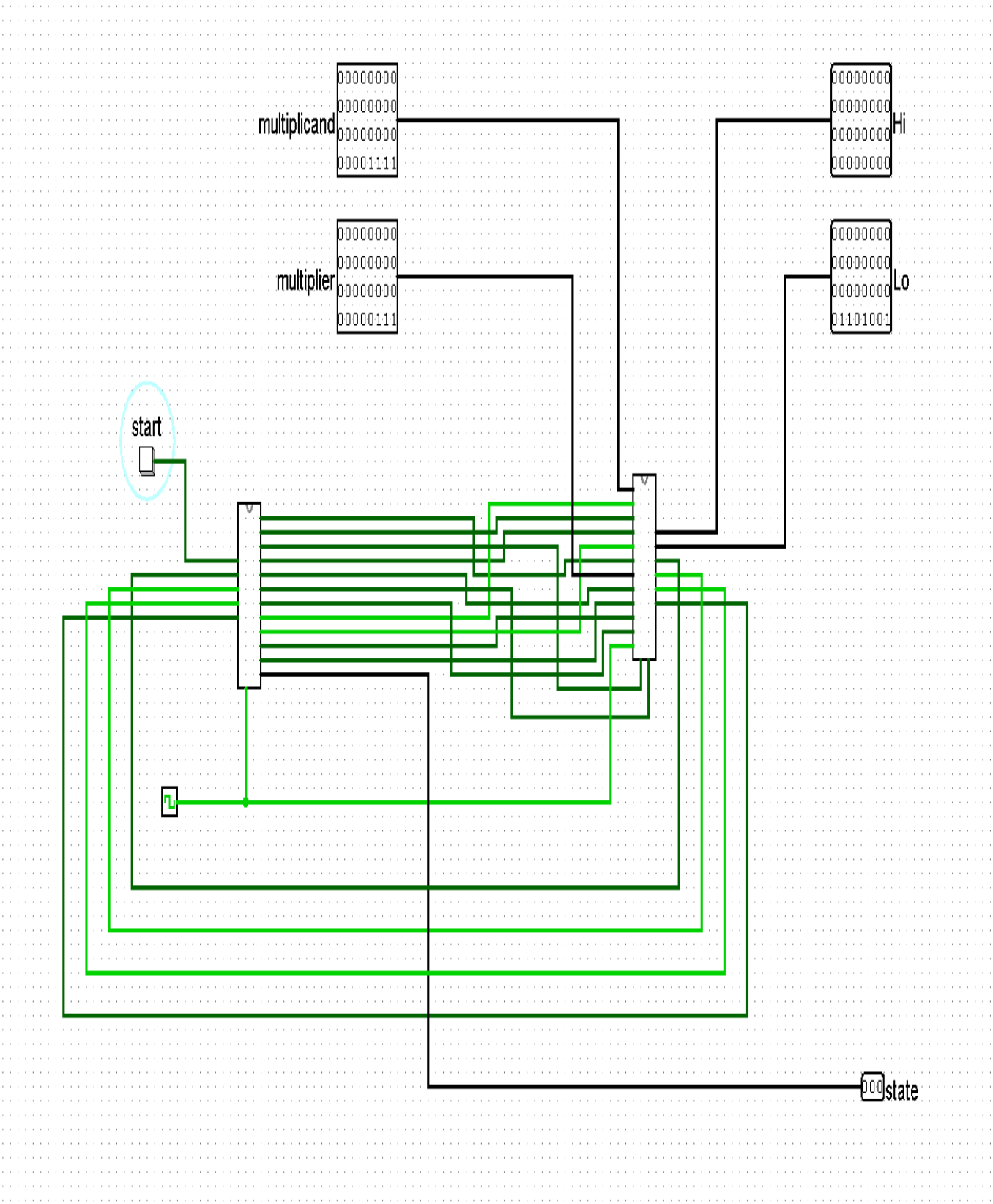
Test 2

9×4=36


multiplicand
00000000
00000000
00000000
00001001
multiplier
00000000
00000000
00000000
00000100
Hi
00000000
00000000
00000000
00000000
Lo
00000000
00000000
00000000
00100100
start
state
000

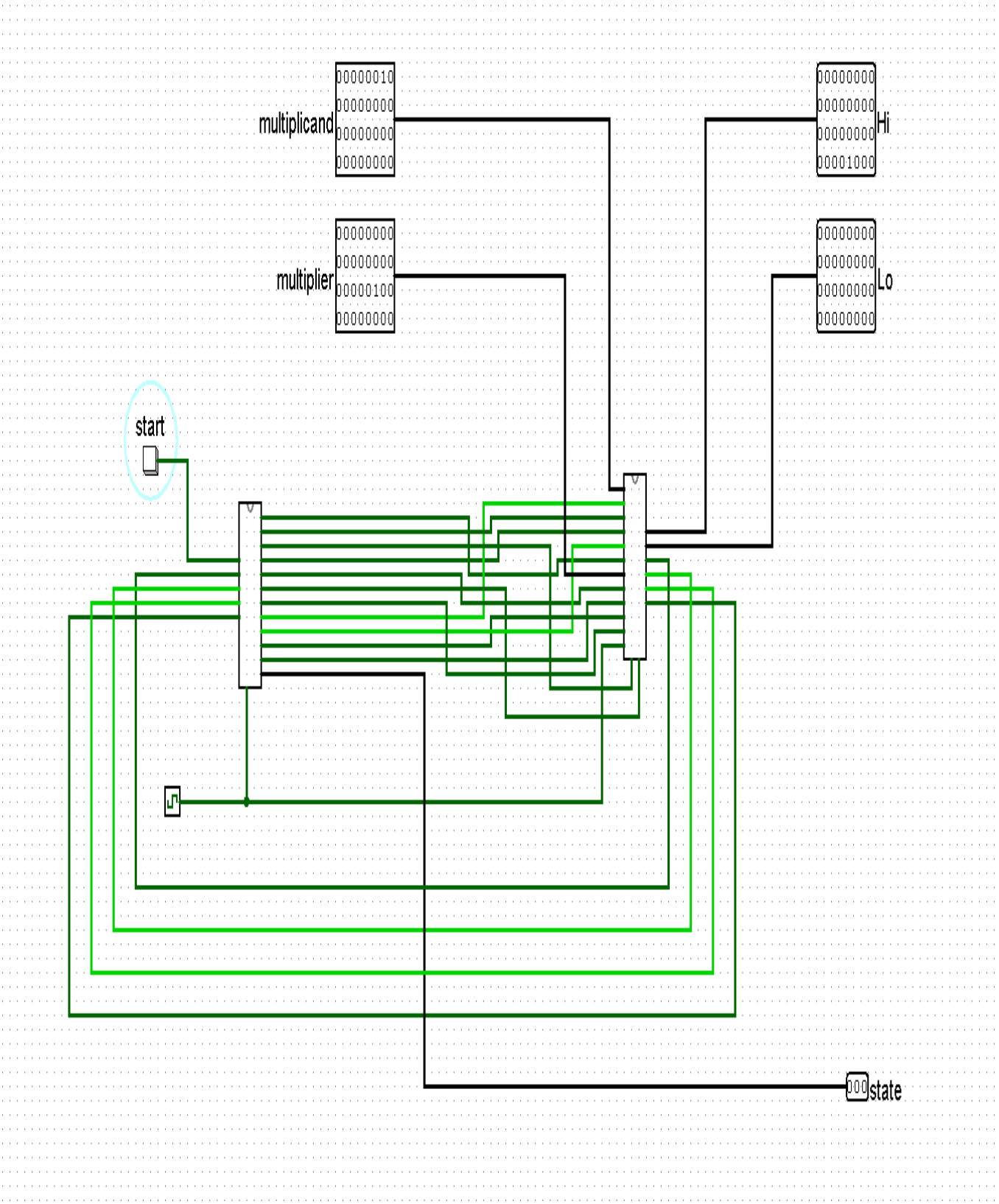
Test 3

15×7=105



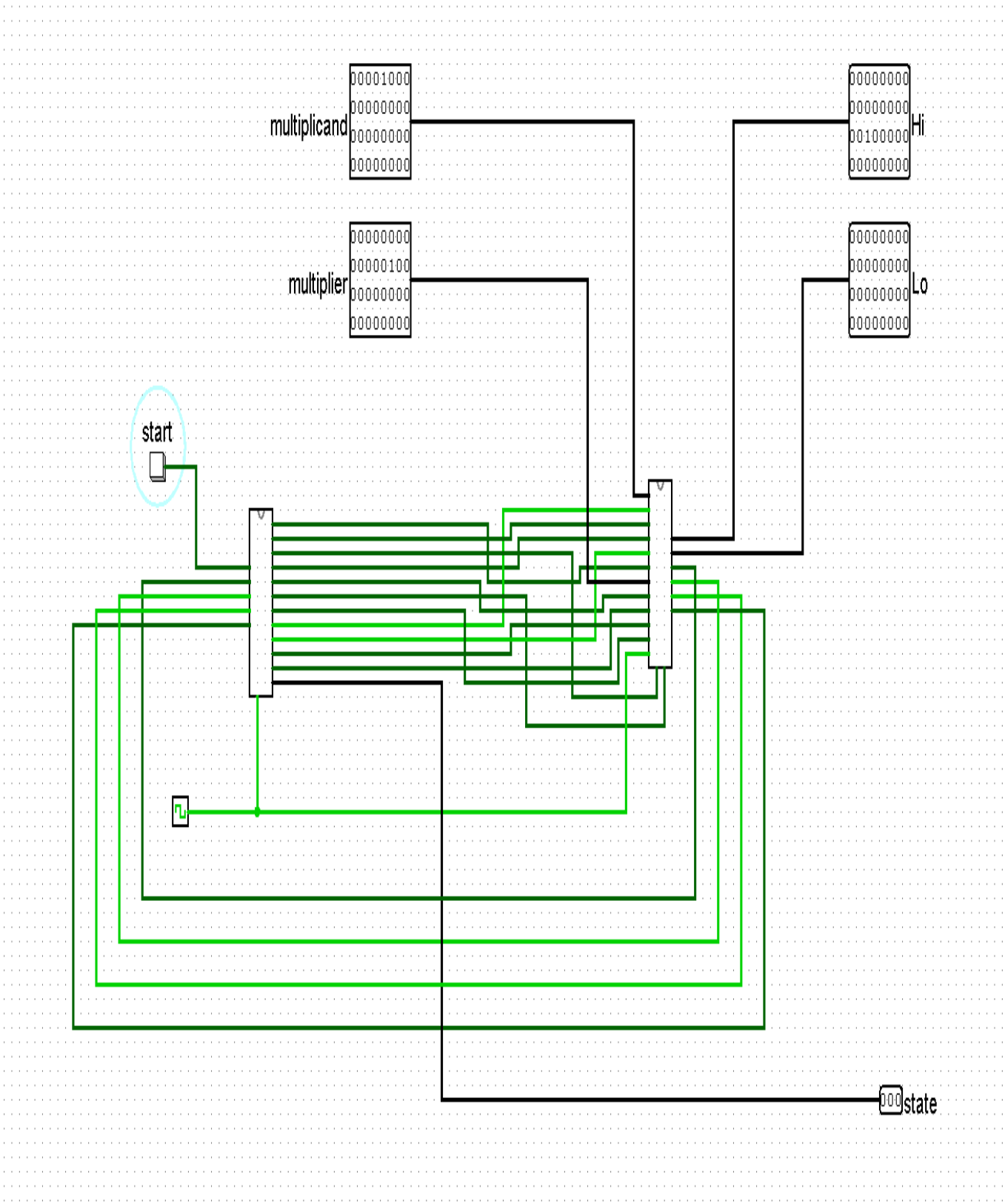
Test 4

$2^{25} \times 2^{10} = 2^{35}$



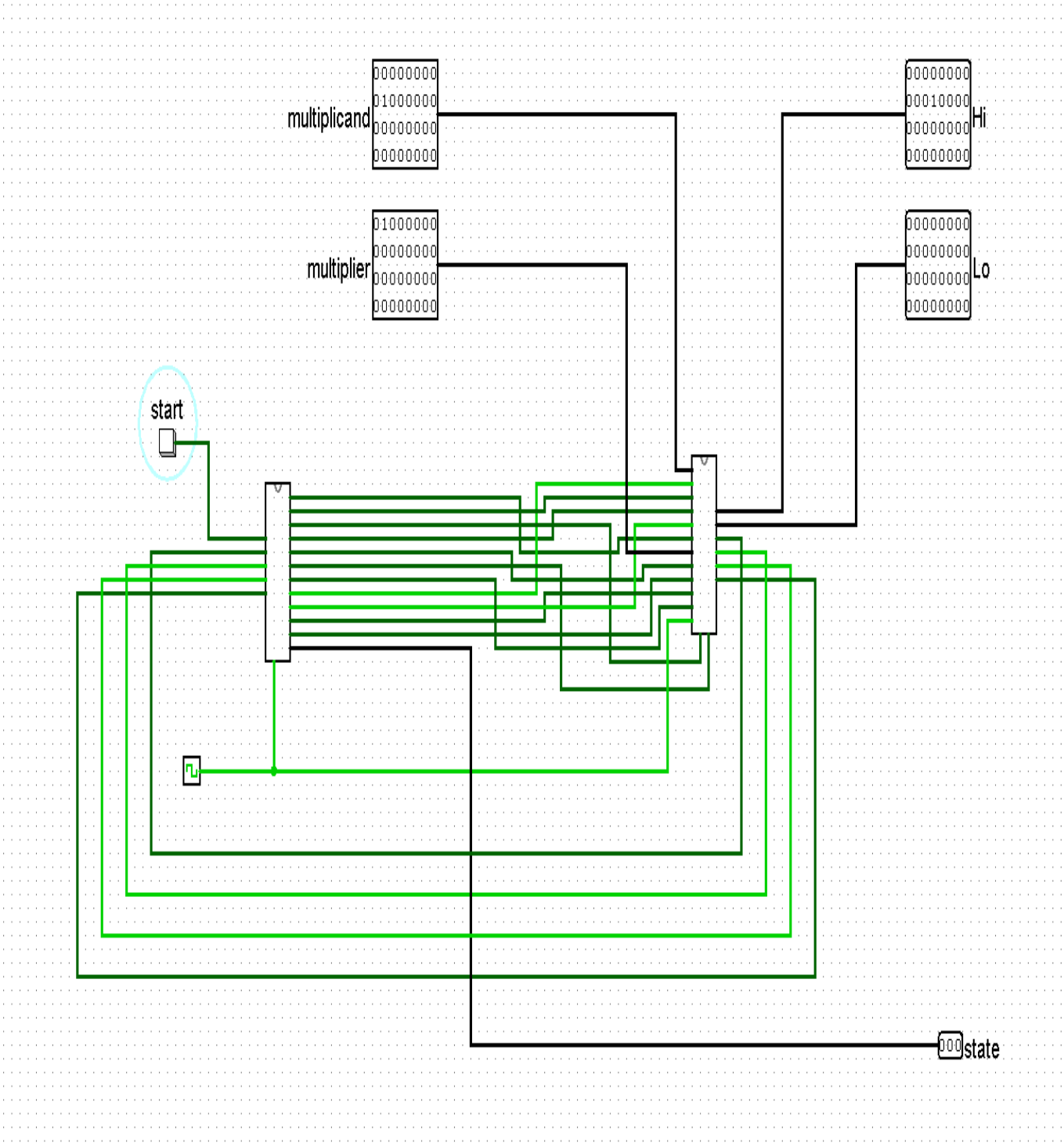
Test 5

$2^{27} \times 2^{18} = 2^{45}$



Test 6

$2^{22} \times 2^{30} = 2^{52}$



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