CSCI 226 Project 3: Stateful Circuits & FSMs Name: Aidan Fahey (amfahe25)

PRNG	**15 Points**	**Score**
Basics: Valid sequential circuit with some inputs, output, one or more registers, valid wiring, and a clock connected directly and only to the registers.	4 pts	
Behavior: Circuit implements desired behavior - upon reseed (regardless of update), sets register from input - upon update (if not reseeding), updates register using middle-square method - otherwise, does not update the register	6 pts	
Details: Three inputs (16 bit seed, 1 bit reseed, 1 bit update), one output (16 bit rand), one register (16 bits).	2 pts	
Style: Clean layout, straightforward implementation, clear design.	3 pts	
Prime-Finder	**15 Points**	**Score**
Syntax: Valid sequential circuit with proper wiring, a few registers, etc.	4 pts	
Behavior: - begins search with user chosen candidate and i=2 - increments candidate or i, or sets i=2 at appropriate times - stops when prime is found, turns output light on	6 pts	
Details: 32-bit values, user can choose new candidate at any time.	2 pts	
Style: Clean layout, straightforward implementation, clear design.	3 pts	
Hailstone Calculator (Moore-style FSM)	**15 Points**	**Score**
Syntax: Valid FSM diagram, with states and arrows, a name for each state, all input and output values shown in correct places (Moore-style), with starting state clearly indicated; diagram is clear and neat.	4 pts	
Semantics: FSM diagram implements desired behavior - Waits until user input is positive (not zero, not negative) - loops until A is 1; infinite loop at end - when even, divides by 2; when odd, multiplies by 3 and adds 1	5 pts	
Encoding: Bit patterns, truth tables, and they match diagram.	2 pts	
Implementation: Neat, working FSM + calculating machine in Logisim	4 pts	
Newton's Method Calculator (Moore-style FSM)	**15 Points**	**Score**
Syntax: Valid FSM diagram, with states and arrows, starting state, neatly, etc.	4 pts	
Semantics: FSM diagram implements desired behavior - repeats entire algorithms, forever - waits until user input is not negative (positive or zero) - B = 2 - compute improve result, repeat until user input changes	5 pts	
Encoding: Bit patterns, truth tables, and they match diagram.	2 pts	
Implementation: Neat, working FSM + calculating machine in Logisim	4 pts	
Extra Credit: Particularly efficient or clever algorithm / implementation		
Total for Assignment	**60 pts**	

*** ============================== collaboration.txt ==============================**

```
{\rtf1\ansi\ansicpg1252\cocoartf2580
\cocoatextscaling0\cocoaplatform0{\fonttbl\f0\fswiss\fcharset0 Helvetica;}
{\colortbl;\red255\green255\blue255;}
{\*\expandedcolortbl;;}
\margl1440\margr1440\vieww11520\viewh8400\viewkind0
\pard\tx720\tx1440\tx2160\tx2880\tx3600\tx4320\tx5040\tx5760\tx6480\tx7200\tx7920\tx8640\pardirnatural\partightenfact
or0

\f0\fs24 \cf0 I collaborated with Charlie Youssef}
```

*** ============================== log.txt ==============================**

```
sequential.circ submitted: 2023-11-19 09:34:52
  Testing sequential.circ ...
```

*** Testing prng circuit**

cycle	seed	reseed	update	rand	expected	ok
00	0000	0	0	0000	0000	1
01	0000	0	0	0000	0000	1
02	1234	1	0	0000	0000	1
03	0000	0	0	1234	1234	1
04	0000	0	0	1234	1234	1
05	0000	0	1	1234	1234	1
06	0000	0	0	0024	4b5a	0
07	0000	0	1	0024	4b5a	0
08	0000	0	1	0000	2ddb	0
09	0000	0	1	0000	36b9	0
0a	ffff	0	0	0000	b291	0
0b	7777	0	1	0000	b291	0
0c	0000	0	0	0000	6bf6	0
0d	0000	0	0	0000	6bf6	0
0e	abcd	1	0	0000	6bf6	0
0f	0000	0	1	abcd	abcd	1
10	0000	0	1	ff57	b182	0
11	0000	0	1	fffe	1106	0
12	0000	0	0	ffff	21cc	0
13	0000	0	0	ffff	21cc	0
14	cafe	1	1	ffff	21cc	0
15	0000	0	1	cafe	cafe	1
16	0000	0	1	ff95	f9d4	0
17	0000	0	1	ffff	2617	0
18	0000	0	0	ffff	aad6	0
19	0000	0	0	ffff	aad6	0
1a	1234	1	0	ffff	aad6	0
1b	0000	0	1	1234	1234	1
1c	0000	0	1	0024	4b5a	0
1d	0000	0	1	0000	2ddb	0
1e	0000	0	1	0000	36b9	0
1f	0000	0	0	0000	b291	0

*** Testing primefinder circuit**

cycle	StartingNumber	PrimeNumber	done	Candidate	Register_i
0	0	???	1	0	0
1	24	???	0	24	0
2	24	???	0	24	1
3	24	???	0	24	2
4	24	???	0	24	3
5	24	???	0	24	4
6	24	???	0	24	5
7	24	???	0	24	6
8	24	???	0	24	7
9	24	???	0	24	8
10	24	???	0	24	9
11	24	???	0	24	10
12	24	???	0	24	11
13	24	???	0	24	12
14	24	???	0	24	13
15	24	???	0	24	14
16	24	???	0	24	15
17	24	???	0	24	16
18	24	???	0	24	17
19	24	???	0	24	18
20	24	???	0	24	19
21	24	???	0	24	20

22	4	???	0	4	21
23	4	???	0	4	22
24	4	???	0	4	23
25	4	???	0	4	24
26	4	???	0	4	25
27	4	???	0	4	26
28	4	???	0	4	27
29	4	???	0	4	28
30	4	???	0	4	29
31	4	???	0	4	30
32	32	???	0	32	31
33	32	???	1	32	32
34	32	???	1	32	32
35	32	???	1	32	32
36	32	???	1	32	32
37	32	???	1	32	32
38	32	???	1	32	32
39	32	???	1	32	32
40	32	???	1	32	32
41	32	???	1	32	32
42	32	???	1	32	32
43	32	???	1	32	32
44	32	???	1	32	32
45	32	???	1	32	32
46	32	???	1	32	32
47	32	???	1	32	32
48	32	???	1	32	32
49	32	???	1	32	32
50	32	???	1	32	32
51	32	???	1	32	32
52	32	???	1	32	32
53	32	???	1	32	32
54	32	???	1	32	32
55	32	???	1	32	32
56	32	???	1	32	32
57	32	???	1	32	32
58	32	???	1	32	32
59	32	???	1	32	32
60	32	???	1	32	32
61	32	???	1	32	32
62	32	???	1	32	32
63	32	???	1	32	32
64	32	???	1	32	32
65	32	???	1	32	32
66	32	???	1	32	32
67	32	???	1	32	32
68	32	???	1	32	32
69	32	???	1	32	32
70	32	???	1	32	32
71	32	???	1	32	32
72	32	???	1	32	32
73	32	???	1	32	32
74	32	???	1	32	32
75	32	???	1	32	32
76	32	???	1	32	32
77	32	???	1	32	32
78	32	???	1	32	32
79	32	???	1	32	32
80	8216	???	0	8216	32
81	24	???	0	24	33
82	8216	???	0	8216	34
83	24	???	0	24	35
84	8216	???	0	8216	36
85	24	???	0	24	37
86	6	???	0	6	38
87	6	???	0	6	39
88	6	???	0	6	40
89	6	???	0	6	41
90	6	???	0	6	42
91	6	???	0	6	43
92	6	???	0	6	44
93	6	???	0	6	45
94	6	???	0	6	46
95	6	???	0	6	47
96	0	???	0	0	48
97	0	???	0	0	49

```
   98              0         ???    0         0         50
   99              0         ???    0         0         51
  100              0         ???    0         0         52
  101              0         ???    0         0         53
  102              0         ???    0         0         54
  103              0         ???    0         0         55
  104              0         ???    0         0         56
  105              0         ???    0         0         57
  106              0         ???    0         0         58
  107              0         ???    0         0         59
  108              0         ???    0         0         60
  109              0         ???    0         0         61
  110              0         ???    0         0         62
  111              0         ???    0         0         63
  112              0         ???    0         0         64
  113              0         ???    0         0         65
  114              0         ???    0         0         66
  115              0         ???    0         0         67
  116              0         ???    0         0         68
  117              0         ???    0         0         69
  118              0         ???    0         0         70
  119              0         ???    0         0         71
  120              0         ???    0         0         72
  121              0         ???    0         0         73
  122              0         ???    0         0         74
  123              0         ???    0         0         75
  124              0         ???    0         0         76
  125              0         ???    0         0         77
  126              0         ???    0         0         78
  127              0         ???    0         0         79
```

*** Testing hailstone fsm**

```
Cycle CurState        A        B        C        D    input   result R P Q Op L Z G NextState
   00        0        0        0        0        0        0        0 A B B  7 0 1 0         0  A = user_input;
   01        0        0        0        0        0        0        0 A B B  7 0 1 0         0  A = user_input;
   02        0        0        0        0        0        0        0 A B B  7 0 1 0         0  A = user_input;
   03        0        0        0        0        0       12       12 A B B  7 0 0 1         1  A = user_input;
   04        1       12        0        0        0       --        1 B B B  6 0 0 1         2  B = 1;
   05        2       12        1        0        0       --        2 B B B  0 0 0 1         3  B = B + B;
   06        3       12        2        0        0       --        0 D A B  4 0 1 0         8  D = A % B;
   07        8       12        2        0        0       --        6 A A B  3 0 0 1         9  A = A / B;
   08        9        6        2        0        0       --        1 C A B  6 0 0 1         a  C = 1;
   09        a        6        2        1        0       --        5 D A C  1 0 0 1         a  D = A - C;
   0a        a        6        2        1        5       --        5 D A C  1 0 0 1         a  D = A - C;
   0b        a        6        2        1        5       --        5 D A C  1 0 0 1         a  D = A - C;
   0c        a        6        2        1        5       --        5 D A C  1 0 0 1         a  D = A - C;
   0d        a        6        2        1        5       --        5 D A C  1 0 0 1         a  D = A - C;
```

*** Testing newton fsm**

```
Cycle CurState        A        B        C        D    input   result R P Q Op L Z G NextState
   00        0        0        0        0        0       -1       -1 A B B  7 1 0 0         1  A = user_input;
   01        1       -1        0        0        0       --        1 B D D  6 0 0 1         2  B = 1;
   02        2       -1        1        0        0       --        2 B B B  0 0 0 1         3  B = B + B;
   03        3       -1        2        0        0       --        2 C B C  0 0 0 1         4  C = B + C;
   04        4       -1        2        2        0       --       -2 D B A  3 1 0 0         5  D = B / A;
   05        5       -1        2        2       -2       --        0 D D B  0 0 1 0         6  D = D + B;
   06        6       -1        2        2        0       --        0 B D C  3 0 1 0         7  B = D / C;
   07        7       -1        0        2        0       16       16 D D C  7 0 0 1         8  D = user_input;
   08        8       -1        0        2       16       --      -17 D A D  1 1 0 0         4  D = A - D;
   09        4       -1        0        2      -17       --        0 D B A  3 0 1 0         5  D = B / A;
   0a        5       -1        0        2        0       --        0 D D B  0 0 1 0         6  D = D + B;
   0b        6       -1        0        2        0       --        0 B D C  3 0 1 0         7  B = D / C;
   0c        7       -1        0        2        0       16       16 D D C  7 0 0 1         8  D = user_input;
   0d        8       -1        0        2       16       --      -17 D A D  1 1 0 0         4  D = A - D;
   0e        4       -1        0        2      -17       --        0 D B A  3 0 1 0         5  D = B / A;
   0f        5       -1        0        2        0       --        0 D D B  0 0 1 0         6  D = D + B;
   10        6       -1        0        2        0       --        0 B D C  3 0 1 0         7  B = D / C;
   11        7       -1        0        2        0       16       16 D D C  7 0 0 1         8  D = user_input;
   12        8       -1        0        2       16       --      -17 D A D  1 1 0 0         4  D = A - D;
   13        4       -1        0        2      -17       --        0 D B A  3 0 1 0         5  D = B / A;
   14        5       -1        0        2        0       --        0 D D B  0 0 1 0         6  D = D + B;
   15        6       -1        0        2        0       --        0 B D C  3 0 1 0         7  B = D / C;
   16        7       -1        0        2        0       16       16 D D C  7 0 0 1         8  D = user_input;
   17        8       -1        0        2       16       --      -17 D A D  1 1 0 0         4  D = A - D;
   18        4       -1        0        2      -17       --        0 D B A  3 0 1 0         5  D = B / A;
   19        5       -1        0        2        0       --        0 D D B  0 0 1 0         6  D = D + B;
```

1a	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
1b	7	−1	0	2	0	16	16	D D C	7 0 0 1	8	D = user_input;
1c	8	−1	0	2	16	--	−17	D A D	1 1 0 0	4	D = A − D;
1d	4	−1	0	2	−17	--	0	D B A	3 0 1 0	5	D = B / A;
1e	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
1f	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
20	7	−1	0	2	0	16	16	D D C	7 0 0 1	8	D = user_input;
21	8	−1	0	2	16	--	−17	D A D	1 1 0 0	4	D = A − D;
22	4	−1	0	2	−17	--	0	D B A	3 0 1 0	5	D = B / A;
23	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
24	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
25	7	−1	0	2	0	16	16	D D C	7 0 0 1	8	D = user_input;
26	8	−1	0	2	16	--	−17	D A D	1 1 0 0	4	D = A − D;
27	4	−1	0	2	−17	--	0	D B A	3 0 1 0	5	D = B / A;
28	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
29	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
2a	7	−1	0	2	0	16	16	D D C	7 0 0 1	8	D = user_input;
2b	8	−1	0	2	16	--	−17	D A D	1 1 0 0	4	D = A − D;
2c	4	−1	0	2	−17	--	0	D B A	3 0 1 0	5	D = B / A;
2d	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
2e	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
2f	7	−1	0	2	0	16	16	D D C	7 0 0 1	8	D = user_input;
30	8	−1	0	2	16	--	−17	D A D	1 1 0 0	4	D = A − D;
31	4	−1	0	2	−17	--	0	D B A	3 0 1 0	5	D = B / A;
32	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
33	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
34	7	−1	0	2	0	16	16	D D C	7 0 0 1	8	D = user_input;
35	8	−1	0	2	16	--	−17	D A D	1 1 0 0	4	D = A − D;
36	4	−1	0	2	−17	--	0	D B A	3 0 1 0	5	D = B / A;
37	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
38	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
39	7	−1	0	2	0	16	16	D D C	7 0 0 1	8	D = user_input;
3a	8	−1	0	2	16	--	−17	D A D	1 1 0 0	4	D = A − D;
3b	4	−1	0	2	−17	--	0	D B A	3 0 1 0	5	D = B / A;
3c	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
3d	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
3e	7	−1	0	2	0	16	16	D D C	7 0 0 1	8	D = user_input;
3f	8	−1	0	2	16	--	−17	D A D	1 1 0 0	4	D = A − D;
40	4	−1	0	2	−17	--	0	D B A	3 0 1 0	5	D = B / A;
41	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
42	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
43	7	−1	0	2	0	169	169	D D C	7 0 0 1	8	D = user_input;
44	8	−1	0	2	169	--	−170	D A D	1 1 0 0	4	D = A − D;
45	4	−1	0	2	−170	--	0	D B A	3 0 1 0	5	D = B / A;
46	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
47	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
48	7	−1	0	2	0	169	169	D D C	7 0 0 1	8	D = user_input;
49	8	−1	0	2	169	--	−170	D A D	1 1 0 0	4	D = A − D;
4a	4	−1	0	2	−170	--	0	D B A	3 0 1 0	5	D = B / A;
4b	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
4c	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
4d	7	−1	0	2	0	169	169	D D C	7 0 0 1	8	D = user_input;
4e	8	−1	0	2	169	--	−170	D A D	1 1 0 0	4	D = A − D;
4f	4	−1	0	2	−170	--	0	D B A	3 0 1 0	5	D = B / A;
50	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
51	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
52	7	−1	0	2	0	169	169	D D C	7 0 0 1	8	D = user_input;
53	8	−1	0	2	169	--	−170	D A D	1 1 0 0	4	D = A − D;
54	4	−1	0	2	−170	--	0	D B A	3 0 1 0	5	D = B / A;
55	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
56	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
57	7	−1	0	2	0	169	169	D D C	7 0 0 1	8	D = user_input;
58	8	−1	0	2	169	--	−170	D A D	1 1 0 0	4	D = A − D;
59	4	−1	0	2	−170	--	0	D B A	3 0 1 0	5	D = B / A;
5a	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
5b	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
5c	7	−1	0	2	0	169	169	D D C	7 0 0 1	8	D = user_input;
5d	8	−1	0	2	169	--	−170	D A D	1 1 0 0	4	D = A − D;
5e	4	−1	0	2	−170	--	0	D B A	3 0 1 0	5	D = B / A;
5f	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
60	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;
61	7	−1	0	2	0	169	169	D D C	7 0 0 1	8	D = user_input;
62	8	−1	0	2	169	--	−170	D A D	1 1 0 0	4	D = A − D;
63	4	−1	0	2	−170	--	0	D B A	3 0 1 0	5	D = B / A;
64	5	−1	0	2	0	--	0	D D B	0 0 1 0	6	D = D + B;
65	6	−1	0	2	0	--	0	B D C	3 0 1 0	7	B = D / C;

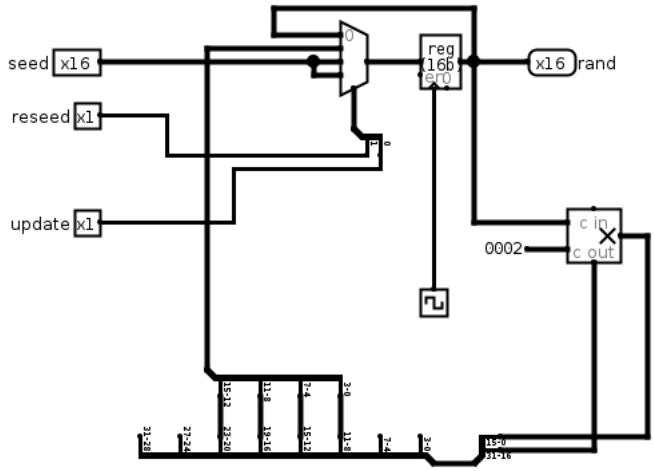
```
66  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
67  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
68  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
69  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
6a  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
6b  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
6c  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
6d  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
6e  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
6f  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
70  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
71  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
72  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
73  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
74  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
75  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
76  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
77  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
78  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
79  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
7a  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
7b  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
7c  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
7d  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
7e  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
7f  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
80  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
81  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
82  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
83  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
84  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
85  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
86  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
87  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
88  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
89  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
8a  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
8b  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
8c  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
8d  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
8e  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
8f  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
90  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
91  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
92  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
93  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
94  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
95  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
96  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
97  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
98  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
99  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
9a  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
9b  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
9c  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
9d  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
9e  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
9f  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
a0  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
a1  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
a2  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
a3  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
a4  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
a5  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
a6  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
a7  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
a8  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
a9  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
aa  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
ab  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
ac  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
ad  8  -1  0  2  169   --  -170 D A D  1 1 0 0  4  D = A - D;
ae  4  -1  0  2 -170   --     0 D B A  3 0 1 0  5  D = B / A;
af  5  -1  0  2    0   --     0 D D B  0 0 1 0  6  D = D + B;
b0  6  -1  0  2    0   --     0 B D C  3 0 1 0  7  B = D / C;
b1  7  -1  0  2    0  169   169 D D C  7 0 0 1  8  D = user_input;
```

```
b2  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
b3  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
b4  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
b5  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
b6  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
b7  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
b8  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
b9  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
ba  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
bb  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
bc  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
bd  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
be  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
bf  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
c0  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
c1  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
c2  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
c3  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
c4  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
c5  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
c6  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
c7  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
c8  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
c9  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
ca  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
cb  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
cc  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
cd  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
ce  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
cf  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
d0  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
d1  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
d2  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
d3  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
d4  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
d5  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
d6  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
d7  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
d8  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
d9  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
da  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
db  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
dc  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
dd  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
de  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
df  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
e0  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
e1  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
e2  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
e3  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
e4  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
e5  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
e6  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
e7  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
e8  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
e9  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
ea  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
eb  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
ec  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
ed  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
ee  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
ef  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
f0  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
f1  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
f2  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
f3  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
f4  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
f5  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
f6  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
f7  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
f8  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
f9  4  -1  0  2  -170  --     0 D B A  3 0 1 0  5  D = B / A;
fa  5  -1  0  2     0  --     0 D D B  0 0 1 0  6  D = D + B;
fb  6  -1  0  2     0  --     0 B D C  3 0 1 0  7  B = D / C;
fc  7  -1  0  2     0 169   169 D D C  7 0 0 1  8  D = user_input;
fd  8  -1  0  2   169  --  -170 D A D  1 1 0 0  4  D = A - D;
```

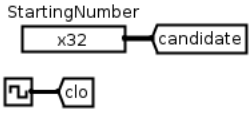
```
   fe        4       -1        0        2     -170       --        0 D B A  3 0 1 0        5  D = B / A;
   ff        5       -1        0        2        0       --        0 D D B  0 0 1 0        6  D = D + B;
```

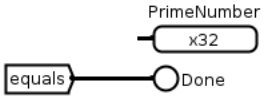
*** 1 of 1 programs compiled and tested**

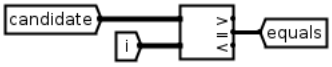
prng

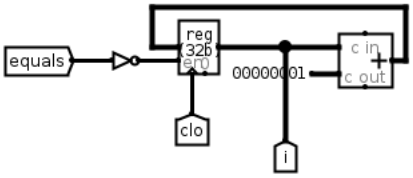


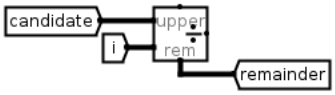
primefinder

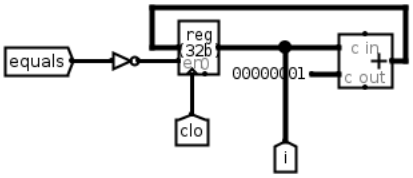




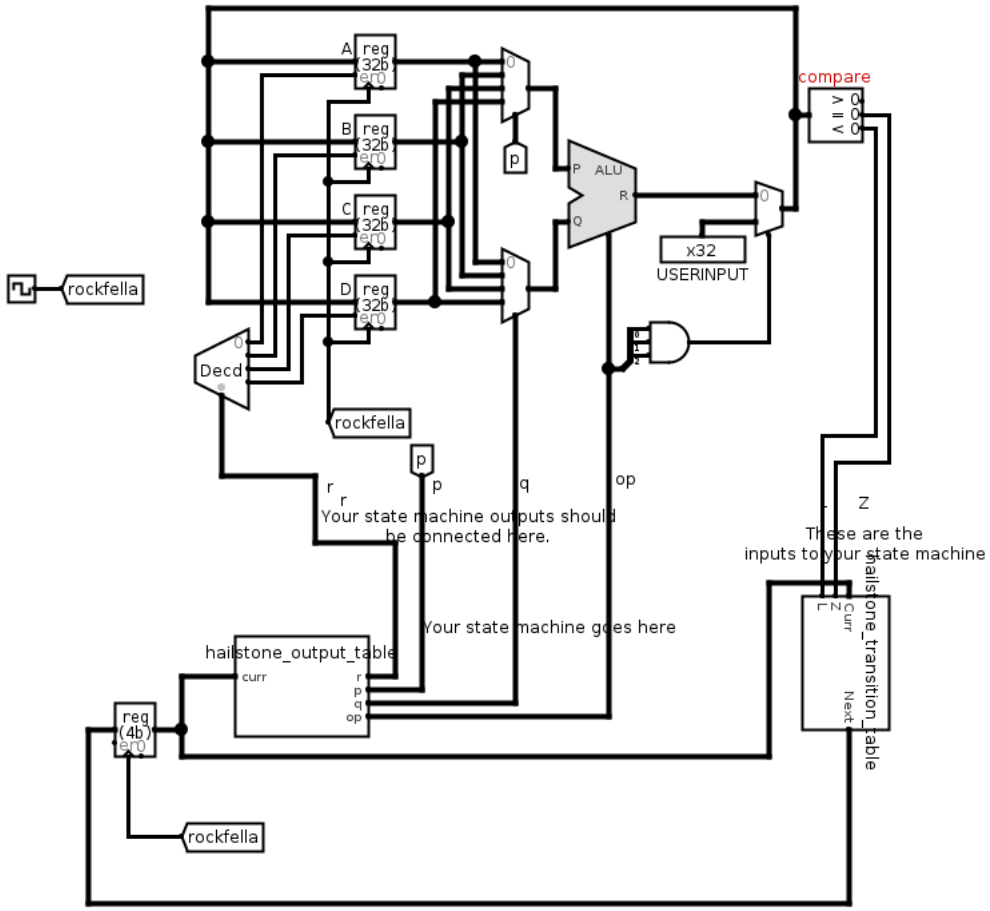




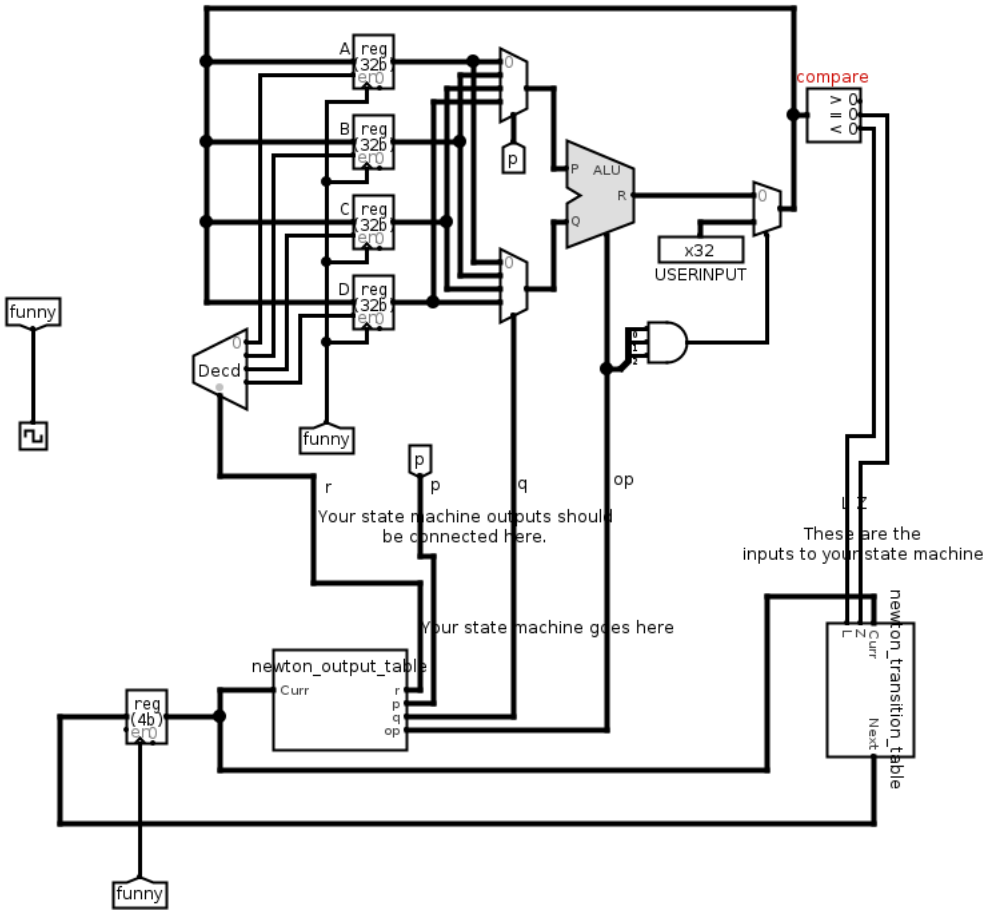




hailstone

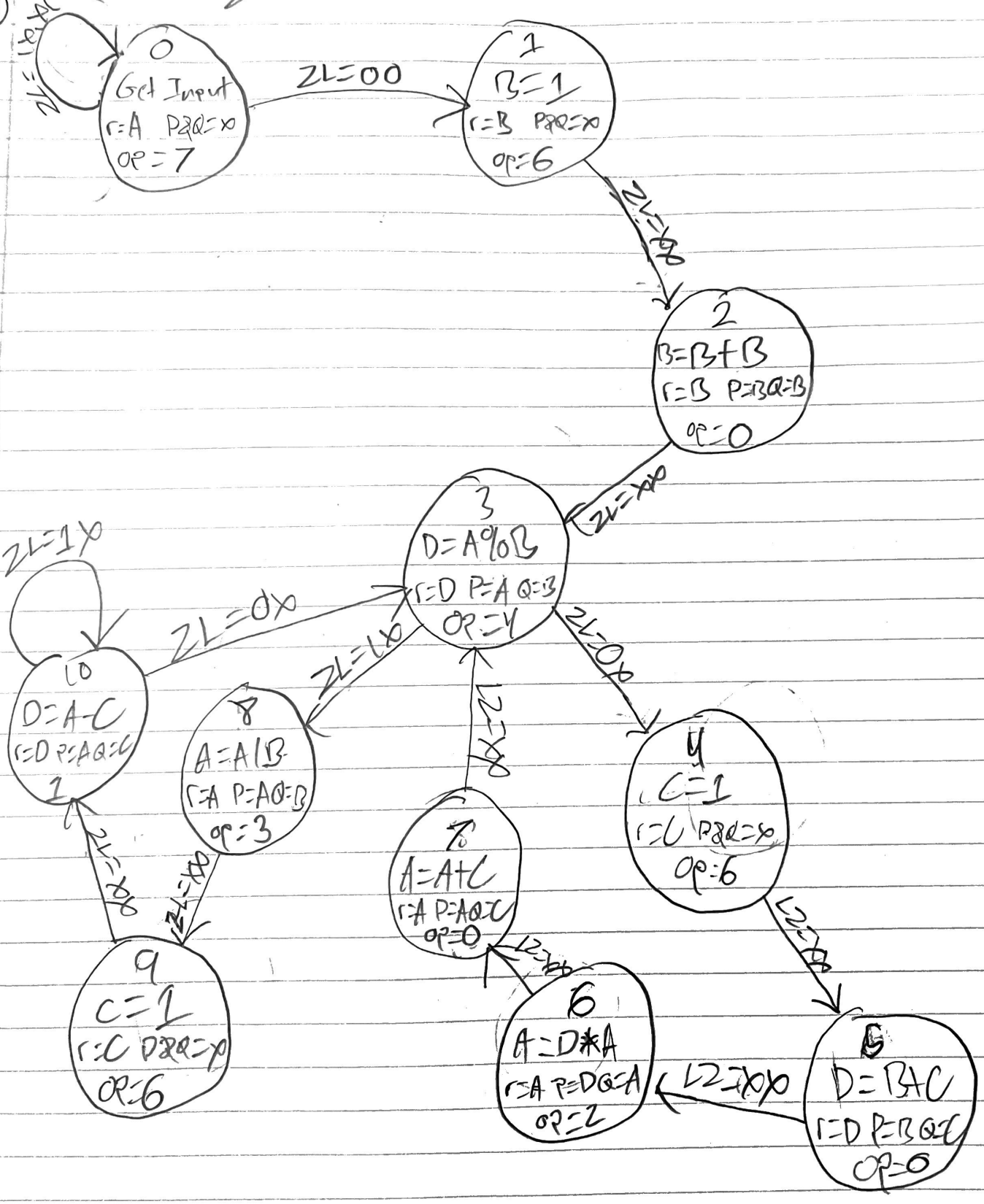

A
reg
32b
zero
B
reg
32b
zero
C
reg
32b
zero
D
reg
32b
zero
p
P
ALU
R
Q
compare
x32
USERINPUT
rockfella
Decd
rockfella
p
r
r
p
q
op
Your state machine outputs should be connected here.
Z
These are the inputs to your state machine
Your state machine goes here
hailstone_output_table
curr
r
p
q
op
reg
(4b)
zero
rockfella
hailstone_transition_table
Curr
Next

newton


A
reg
(32b)
B
C
D
p
P
ALU
R
Q
compare
x32
USERINPUT
funny
Decd
r
p
q
op
Your state machine outputs should be connected here.
These are the inputs to your state machine
Your state machine goes here
newton_output_table
Curr
reg
(4b)
newton_transition_table
Next

Aidan Fahey Project 3 I collab with Charlie

(3)



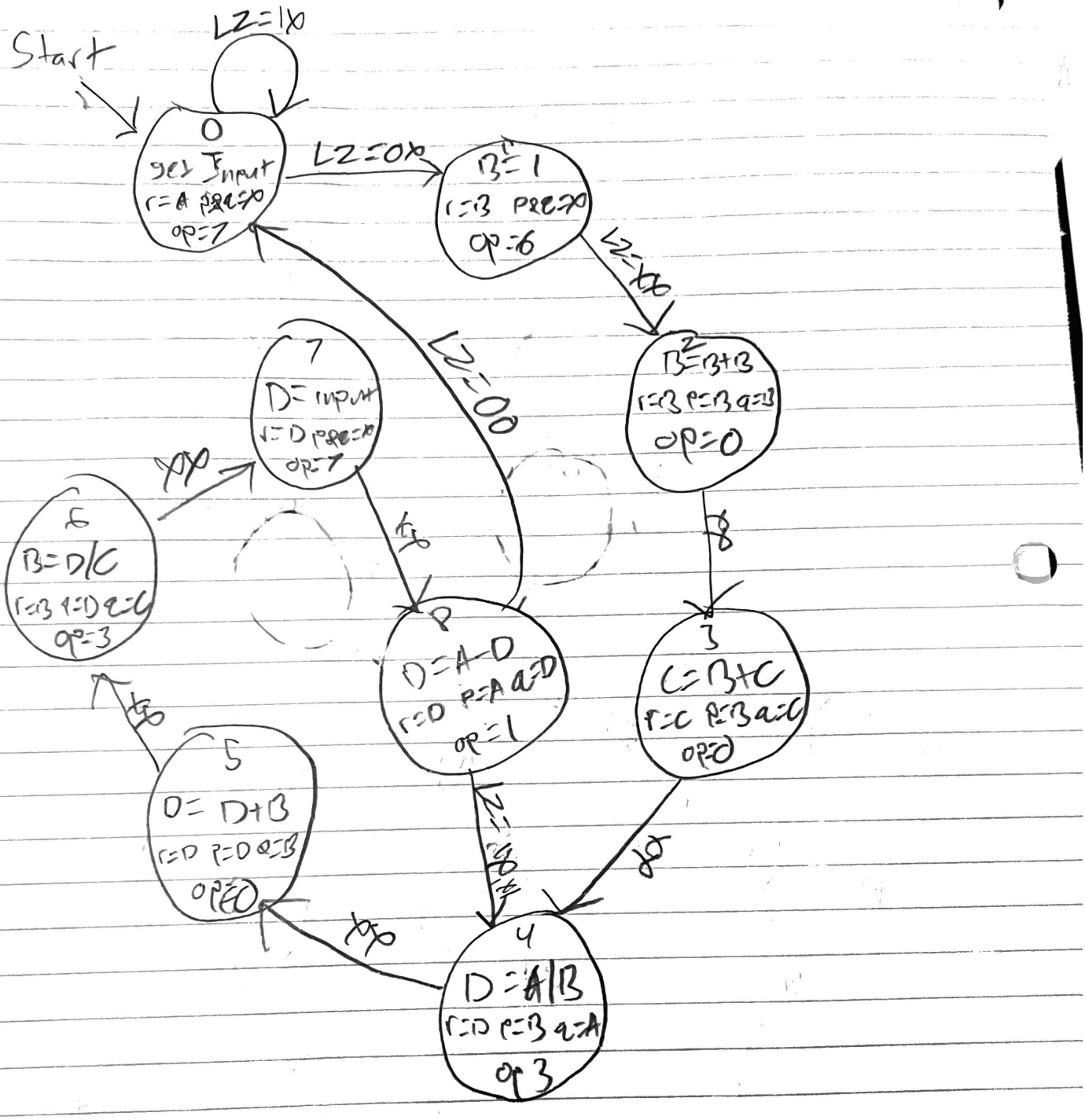
7.

Out Put Table

Curr	R	P	Q	OP
0000	00	xx	xx	111
0001	01	xx	xx	110
0010	01	01	01	000
0011	11	00	01	100
0100	10	xx	xx	110
0101	11	01	10	000
0110	00	11	00	010
0111	00	00	10	000
1000	00	00	01	011
1001	10	xx	xx	110
1010	11	00	10	001

Transition Table

Curr	Z	L	Next
0000	0	0	0001
0000	1	x	0000
0000	x	1	0000
0001	x	x	0010
0010	x	x	0011
0011	0	x	0100
0011	1	x	1000
0100	x	x	0101
0101	x	x	0110
0110	x	x	0111
0111	x	x	0011
1000	x	x	1001
1001	x	x	1010
1010	x	x	1010


Start
LZ=1
0
Get Input
r=A pre=0
op=7
LZ=0
1
B=1
r=B pre=0
op=6
LZ=1
2
B=B+B
r=B p=B q=B
op=0
LZ=0
7
D= input
r=D pre=0
op=7
6
B=D/C
r=B p=D q=C
op=3
8
D=A-D
r=D p=A q=D
op=1
3
C=B+C
r=C p=B q=C
op=0
5
D= D+B
r=D p=D q=B
op=0
LZ=1
4
D=A|B
r=D p=B q=A
op 3

(a)

Output Table

Curr	B	P	Q	OD
0000	00	xx	xx	111
0001	01	xx	xx	110
0010	01	01	01	010
0011	10	01	10	000
0100	11	01	00	011
0101	11	11	01	000
0110	01	11	10	011
0111	11	xx	xx	111
1000	11	00	11	001

Transition Table

Curr	Z	L	Next
0000	0	x	0001
0000	1	x	0000
0001	x	x	0010
0010	x	x	0011
0011	x	x	0100
0100	x	x	0101
0101	x	x	0110
0110	x	x	0111
0111	x	x	1000
1000	0	0	0000
1000	x	1	0100
1000	1	x	0100