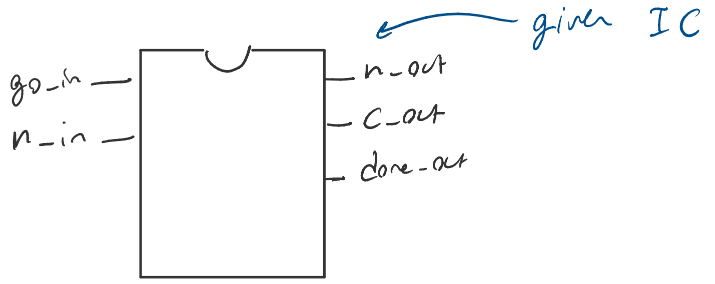
MR - SPP

April 11, 2022 5:42 PM

→ collatz algorithm

$$C_{n+1} = \begin{cases} C_n/2 & \text{if } x\%2=\emptyset \\ 3(C_n)+1 & \text{if } x\%2=1 \end{cases}$$

→ collatz conjecture; if you perform collatz algorithm on a number enough, you will reach 1



Algorithm design

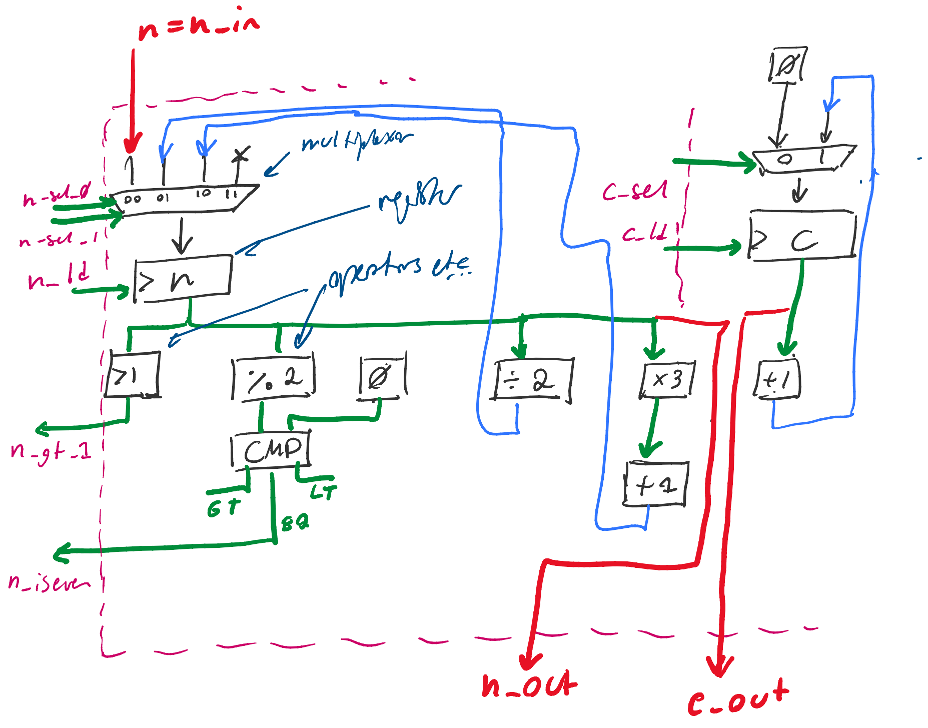
```
while (1) {
    while (!go_in);
    n = n_in;
    c = ∅;
    while (n>1) {
        if (n%2 == ∅) {
            n = n/2;
        } else {
            n = 3·n+1;
        }
        count ++;
    }
    done_out =1;
}
```

Datapath

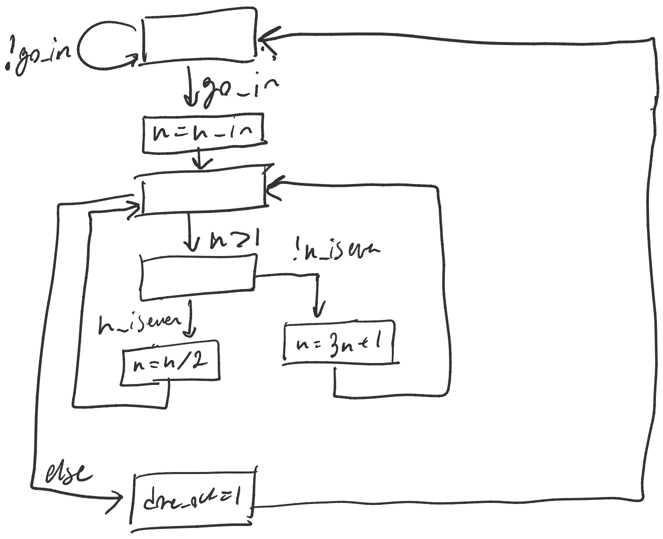
optimization

→ typically: boolean signals are control signals

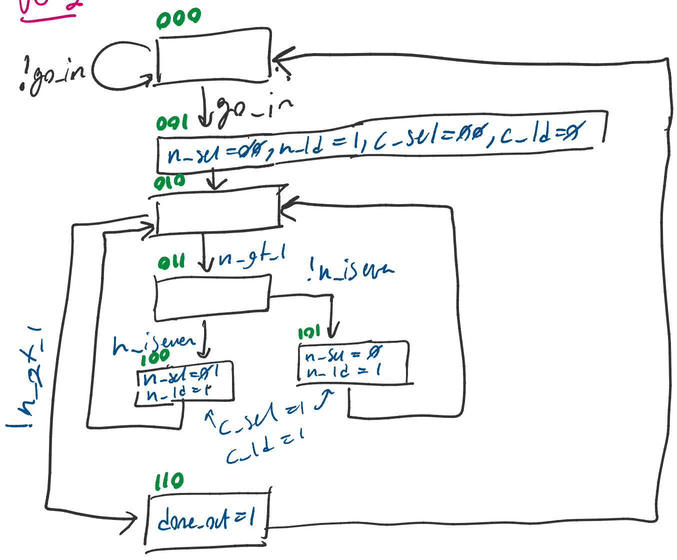
→ floats & ints are data



FSM



ver 2



label states

3-bit state register

State table

X = inputs don't care

☆ = output don't care

need eqns for those

new state register values

state register $Q_2Q_1Q_0$	go_in	n_sel	c_sel	n_ld	c_ld	done_out	n_gt_1	n_iseven	$I_2I_1I_0$
000	0	XX	X	0	0	0	☆	☆	000
000	1	XX	X	0	0	0	☆	☆	001
001	″	00	0	1	1	0	☆	☆	010
010	↓	XX	X	0	0	0	0	☆	110
010		XX	X	0	0	0	1	☆	011
011		XX	X	0	0	0	☆	0	101
011		XX	X	0	0	0	☆	1	100
100		01	1	1	1	0	☆	☆	010
101		10	1	1	1	0	☆	☆	010
110		XX	X	0	0	1	☆	☆	000

Eqns

$$\text{doneout} = Q_2 Q_1 \overline{Q_0}$$

$$\text{n\_ld} = \text{c\_ld} = (Q_2 + Q_0)\overline{Q_1}$$

$Q_2Q_1Q_0$
001
100
101

$$\text{c\_sel} = \overline{\overline{Q_2}\,\overline{Q_1}\,Q_0}$$