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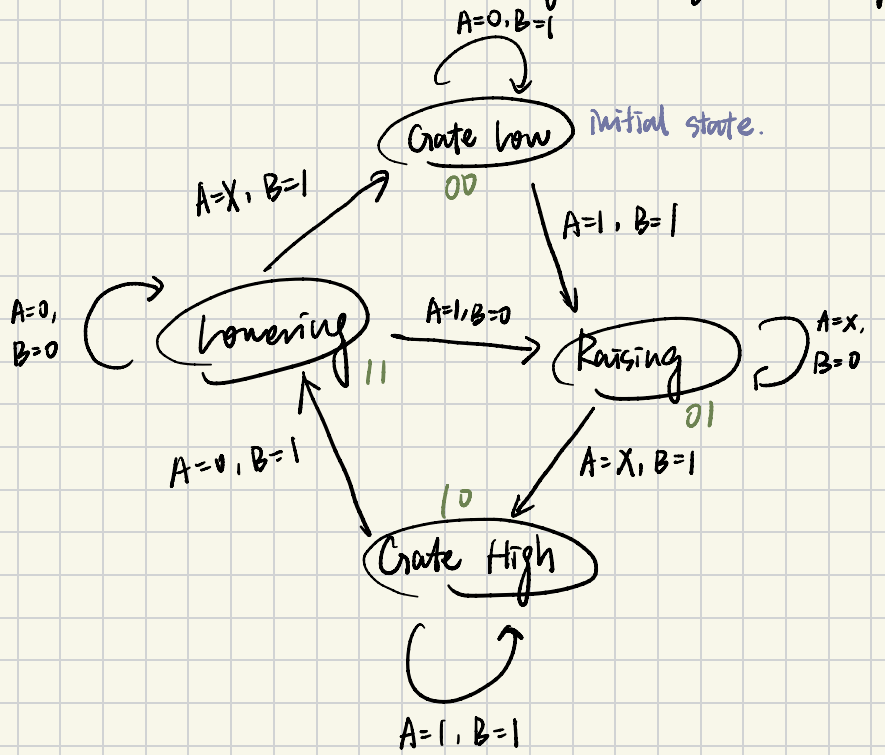
Part: A

Input: A, B

Transition: Gate low, Raising, Gate High, Lowering.



Current State	Input A	Input B	Next State
Gate low 00	0	1	Gate low 00
Gate low 00	1	1	Raising 01
Raising 01	X	0	Raising 01
Raising 01	X	1	Gate High 10
Gate High 10	1	1	Gate High 10
Gate High 10	0	1	Lowering 11
Lowering 11	0	0	Lowering 11
Lowering 11	1	0	Raising 01
Lowering 11	X	1	Gate low 00

3. 4 states ⇒ we need minimum $\log_2(4) = 2$ flip-flops for state machine.

4. Gate low = 00
Raising = 01
Gate High = 10
Lowering = 11

5. Truth Table.

F_1	F_0	Input A	Input B	new F_1	new F_0
0	0	0	1	0	0
0	0	1	1	0	1
0	1	X	0	0	1
0	1	X	1	1	0
1	0	1	1	1	0
1	0	0	1	1	1
1	1	0	0	1	1
1	1	1	0	0	1
1	1	X	1	0	0

K-map.

new $\bar{F}_1$

	$\bar{A}\cdot\bar{B}$	$\bar{A}\cdot B$	$A\cdot B$	$A\cdot\bar{B}$
$\bar{F}_1\cdot\bar{F}_0$	X	0	0	X
$\bar{F}_1\cdot F_0$	0	1	1	0
$F_1\cdot\bar{F}_0$	1	0	0	0
$F_1\cdot\bar{F}_0$	X	1	1	X

$$\text{new}\,\bar{F}_1 = F_1\cdot\bar{F}_0 + \bar{A}\cdot\bar{B}\cdot F_1 + B\cdot\bar{F}_1\cdot F_0$$

new $\bar{F}_2$

	$\bar{A}\cdot\bar{B}$	$\bar{A}\cdot B$	$A\cdot B$	$A\cdot\bar{B}$
$\bar{F}_1\cdot\bar{F}_0$	X	0	1	X
$\bar{F}_1\cdot F_0$	1	0	0	1
$F_1\cdot\bar{F}_0$	1	0	0	1
$F_1\cdot\bar{F}_0$	X	1	0	X

$$\text{new}\,\bar{F}_2 = \bar{A}\cdot\bar{B} + A\cdot\bar{B} + \bar{A}\cdot F_1\cdot\bar{F}_0 + A\cdot\bar{F}_1\cdot\bar{F}_0$$

Part II: Output.

1. Moore Machine

2. Output

	F_1F_0	Output R	Output L
Gate low	00	0	0
Raising	01	1	0
Gate high	10	0	0
Lowering	11	0	1

$R = \overline{F_1} \cdot F_0$

$L = F_1 \cdot F_0$