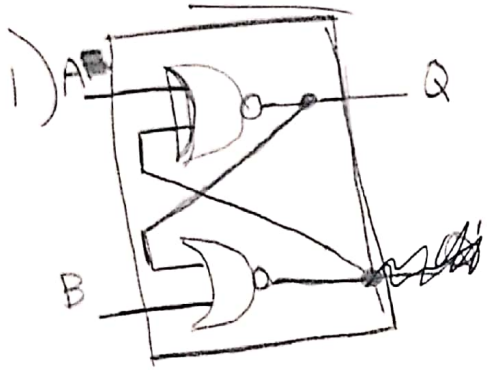
8 Adam Stammer

Quiz – Latches

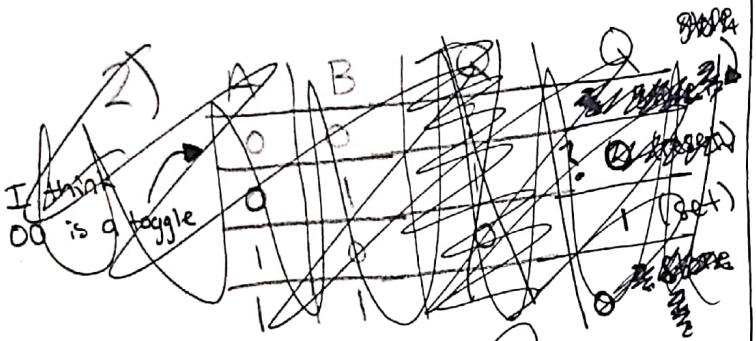
1) (2 pts) Using nor gates, please design a simple latch. Use inputs A, B, and output Q.
2) (3 pts) For the latch, indicate what states lead to set (Q=1), reset (Q=0), and store.
3) (1 pt) Also identify the state that leads to uncontrolled oscillation.
4) (4 pts) Using logic gates, create an "interface" for the raw latch that does the following:
   a. User inputs J & K, interface outputs to A & B on the raw latch
   b. When J=1, K=0, the latch is set
   c. When J=0, K=1, the latch is unset (to zero)
   d. When J=0, K=0, the latch holds (does not change value)
   e. When J=1, K=1, the latch toggles (Q becomes not-Q)

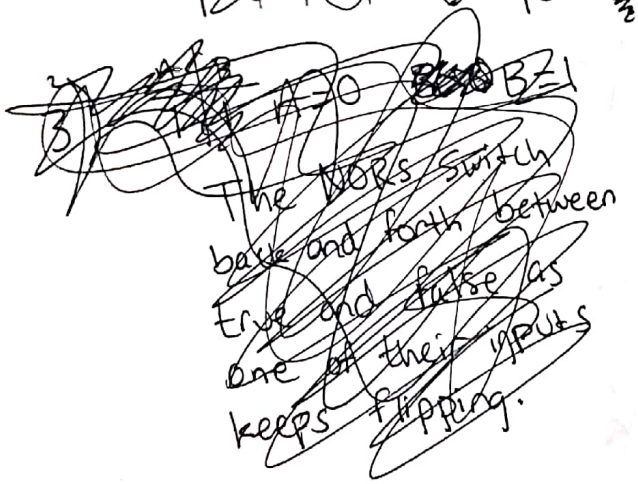
SEE BACK FOR ANSWERS

1) 

Built under the assumption that the following truth table holds

A	B	Q
0	0	Toggle ?
0	1	1 (set)
1	0	0 (reset)
1	1	

2) 

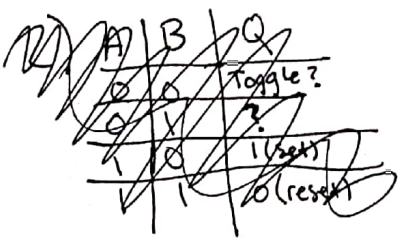
3) 

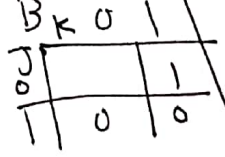
a) ~~01→01~~ J=A K=B

b) 01 → 11
J = $\bar{A}$ K = $\bar{B}$

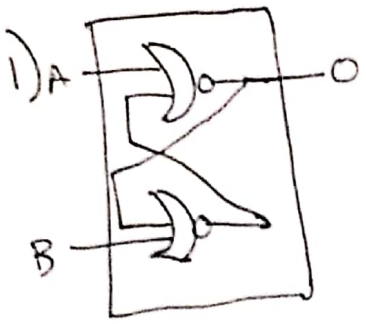
c)

e) 11 → 00
J = $\bar{A}$ k = $\bar{B}$





b) 10 → 10
c) 01 → 11
d)
e) 11 → 00

1) 

✓

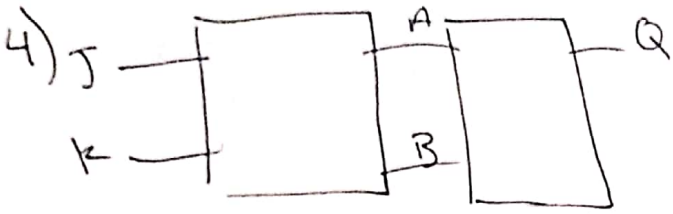
2)

A	B	Q
0	0	oscillates
0	1	1 (set)
1	0	0 (reset)
1	1	~~store~~ Nope

store

-1

3) 00 causes any existing Q to flip back and forth a lot really fast. or, it stores.

4) 

Built assuming the truth table above is true

~~a~~ b) latch set on 10

c) latch reset on 01

d) hold on 00

e) toggle on 11

+3

A

J \ K	0	1
0	1	1
1	0	?

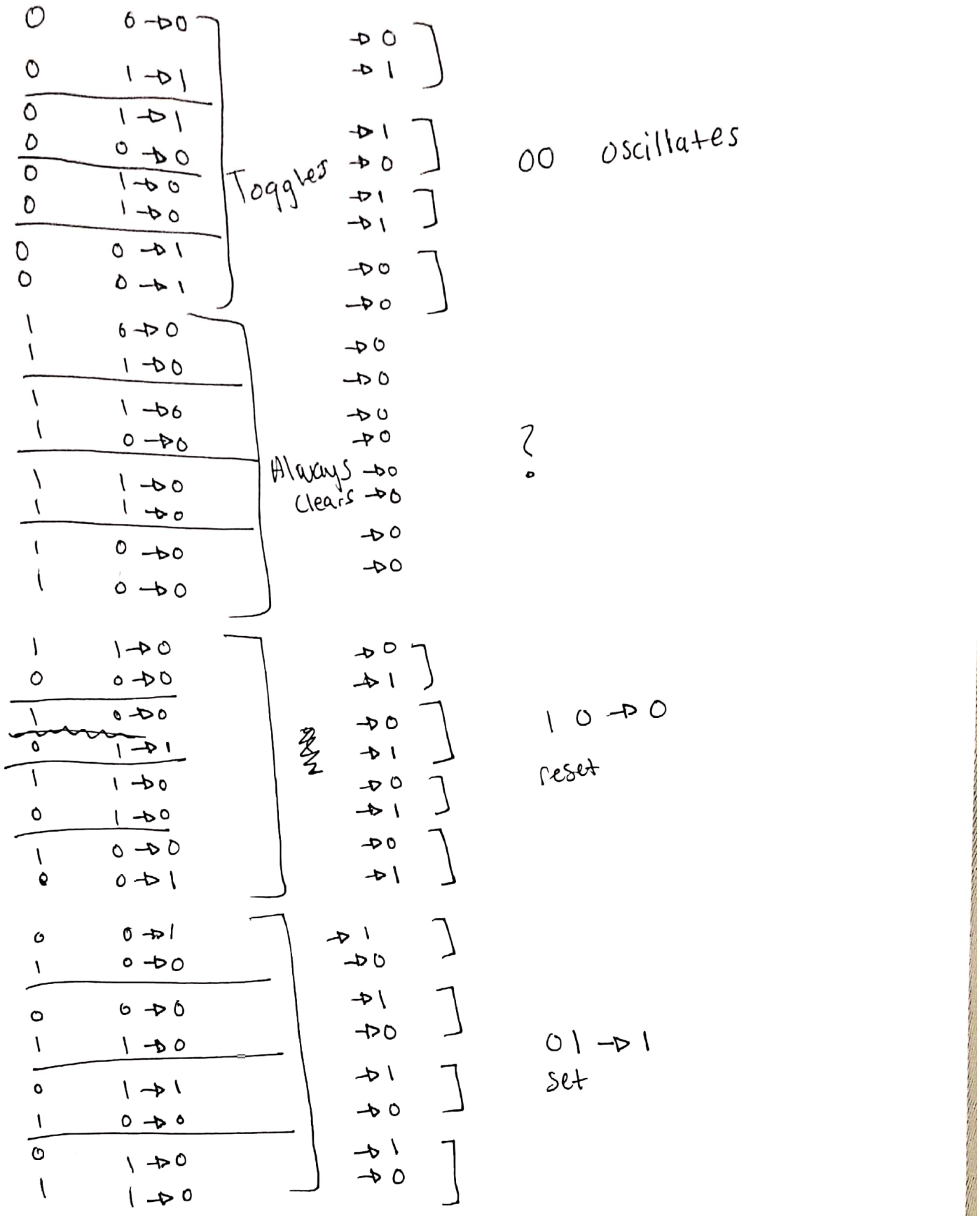
B

J \ K	0	1
0	1	0
1	1	?

I'm not sure how to toggle this without oscillation. But I do think this would avoid a 00.

$A = \overline{J}$

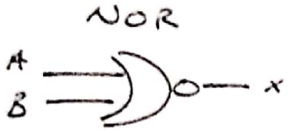
$B = K$



10 pts

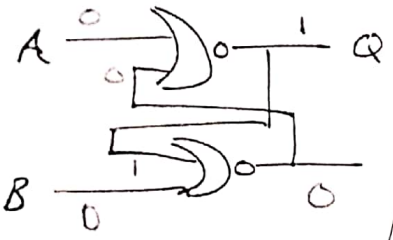
Quiz – Latches

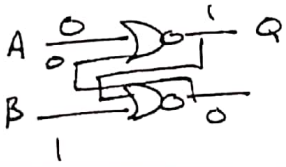
1) (2 pts) Using nor gates, please design a simple latch. Use inputs A, B, and output Q. ✓
2) (3 pts) For the latch, indicate what states lead to set (Q=1), reset (Q=0), and store. ✓
3) (1 pt) Also identify the state that leads to uncontrolled oscillation. ✓
4) (4 pts) Using logic gates, create an "interface" for the raw latch that does the following:
   a. User inputs J & K, interface outputs to A & B on the raw latch
   b. When J=1, K=0, the latch is set
   c. When J=0, K=1, the latch is unset (to zero)
   d. When J=0, K=0, the latch holds (does not change value)
   e. When J=1, K=1, the latch toggles (Q becomes not-Q)



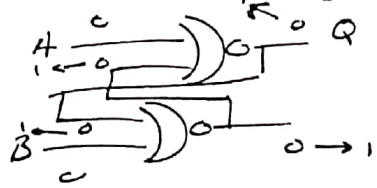
A	B	x
0	0	1
0	1	0
1	0	0
1	1	0

A	B	Q
0	0	Q_0 ← old value of Q
0	1	1 ← set
1	0	0 ← Reset
1	1	0 ← avoid, leads to oscillation if you go from 00 → 11 state





oscillation



from AB stable then $\bar{A}\bar{B}$ stable

$AB \rightarrow \bar{A}\bar{B}$ creates oscillation!

4] Interface:

User inputs J	K	Wants	so, map to latch command A	B
0	0	hold	0	0
1	0	set	0	1
0	1	unset (clear)	1	0
1	1	toggle → $Q_0\ \bar{Q}_0$ ← old Q		

if $Q_0 = 1$ want $Q_1 = 0$ so clear command!

~~so, could you say $A = \bar{J}K + Q_0$ And could you say $B = \bar{J}K + \bar{Q}_0$~~

So

$A = \bar{J}K + Q_0$

$B = J\bar{K} + \bar{Q}_0$