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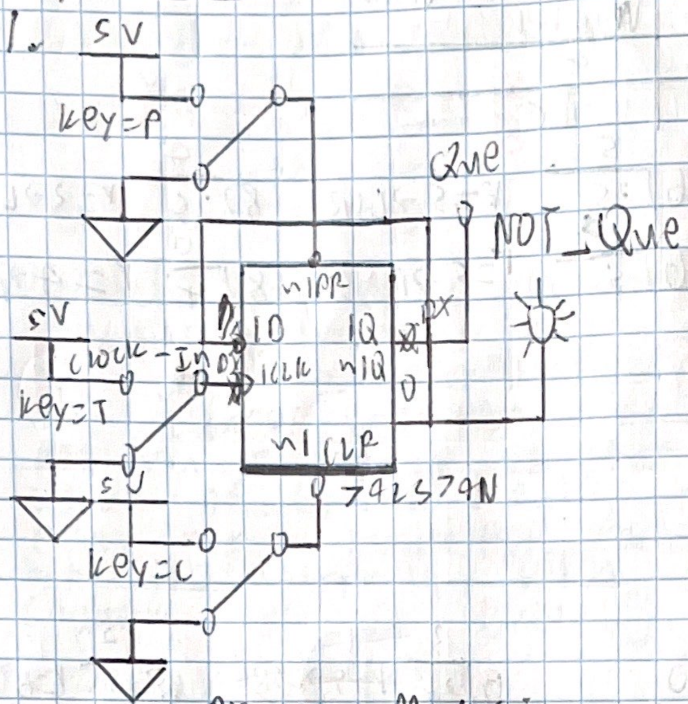
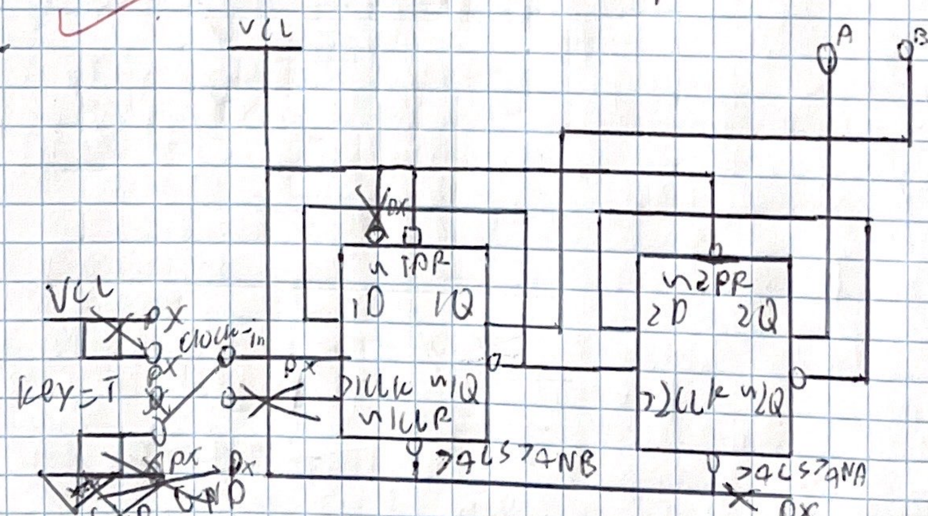
Activity 1.2.4 Introduction to Sequential Logic Design

1.



a. ~~N/A~~ DX On Multisim
b. The circuit works like the circuit in 1.1.6.
c. Que is lit up, and t DX NOT_Que is not lit.
d. The state of the outputs do not change.
e. Que is off, while NOT_Que is on.
f. The state of the outputs does not change.

2.



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a. On Multisim

b.

Clock-in	A	B
Initial values	0	0
cycle 1	0	1
cycle 2	1	0
cycle 3	1	1
cycle 4	0	0
cycle 5	0	1
cycle 6	1	0
cycle 7	1	1
cycle 8	0	0
cycle 9	0	1

c. The cycle starts with A and B both as 0. The ~~combinations~~ sequence of combinations A=0 and B=0, A=0 and B=1, A=1 and B=0, and A=1 and B=1 repeats every fourth cycle.

The O/P create a binary count from 0 to 3 (00_2 to 11_2)

3. a-d. On Multisim

e.

signal	period	frequency
clock-in	0.8 div $\cdot \frac{20ms}{div}$ = 16ms	$\frac{1}{T} = \frac{1}{16ms} = \frac{1}{16 \cdot 10^{-3} s} = \frac{10^3}{16 s} =$ ~~62.5 Hz~~ ~~15.625 Hz~~ 62.5 Hz — 60 Hz
B	1.6 div $\cdot \frac{20ms}{div}$ = 32ms	$\frac{1}{T} = \frac{1}{32ms} = \frac{1}{32 \cdot 10^{-3} s} = \frac{10^3}{32 s} =$ ~~62.5 Hz~~ 31.25 — 30 Hz
A	3.2 div $\cdot \frac{20ms}{div}$ = 64ms	$\frac{1}{T} = \frac{1}{64ms} = \frac{1}{64 \cdot 10^{-3} s} = \frac{10^3}{64 s} =$ 15.625 Hz — 15 Hz

f. The periods and frequency are inversely porportional to each other. The frequency of the clock-in is two times that of ~~the~~ signal B,

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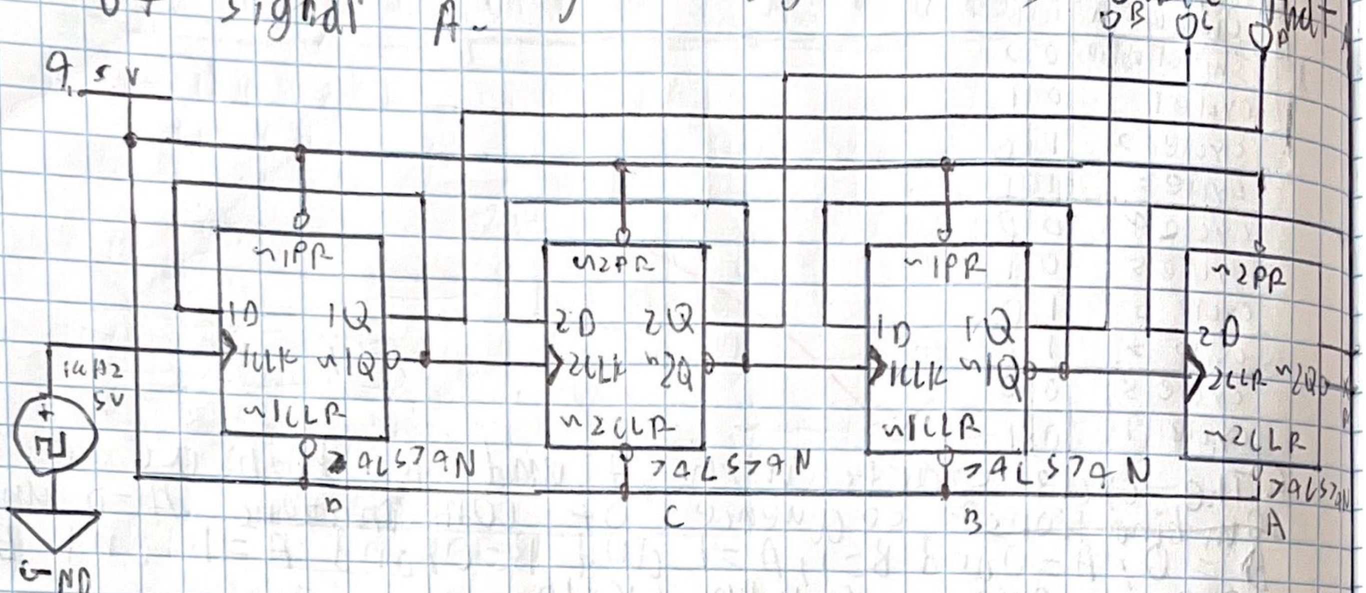

signal	period	frequency
clock-in	$T = \frac{1}{f} = \frac{1}{1000\,Hz}$, $\boxed{T = 0.001\,s}$	1000Hz
D	$0.8\,\cancel{div} \cdot \frac{20\,ms}{\cancel{div}} = \boxed{[illegible]\,ms}$	$f = \frac{1}{T} = \frac{1}{[illegible]\,ms} = \frac{1}{[illegible] \cdot 10^{-3}\,s} = \frac{1000}{[illegible]\,s} = \boxed{500\,Hz}$
C	$0.2\,\cancel{div} \cdot \frac{20\,ms}{\cancel{div}} = \boxed{[illegible]\,ms}$	$f = \frac{1}{T} = \frac{1}{4\,ms} = \frac{1}{4 \cdot 10^{-3}\,s} = \frac{10^3}{4\,s} = \boxed{250\,Hz}$
B	$0.4\,\cancel{div} \cdot \frac{20\,ms}{\cancel{div}} = \boxed{8\,ms}$	$f = \frac{1}{T} = \frac{1}{8\,ms} = \frac{1}{8 \cdot 10^{-3}\,s} = \frac{10^3}{8\,s}$

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		$=\boxed{125\ Hz}$
A	$0.8\ div \cdot \frac{20\ ms}{1\ div}$ $=\boxed{16\ ms}$	$f = \frac{1}{T} = \frac{1}{16\ ms} = \frac{1}{16 \cdot 10^{-3}\ s} = \frac{10^3}{16\ s} = \boxed{62.5\ Hz}$

5. a. 1, 10, 11, 100, 101, 110, 111, 1000, 1001, 1010, 1011, 1100, 1101, 1110, 1111
   b. A clock frequency of 1 Hz works best for me.

Conclusion:

1. Each ~~counter~~ probe to the left of another blinks twice as fast as the counter on its right. If a probe that is on is represented by a 1 and a probe that is off is represented by a 0, the counter loops through the numbers 0-15. The relative blink speeds of the probes contribute to how they produce the effect of counting in binary repeatedly.
2. The highest number I can count to is 31.
3. One product is a digital clock, which uses a counter to measure time. Another product is a fire alarm, which uses a counter to make sure the time between each time it makes a noise is constant. Another ~~object~~ product is a car, ~~as it~~ which uses a counter to make the frequency constant when it flashes its lights.

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