

EE 40

Homework #2

Solutions & Grading

Problem 1: 25 Total Points

(Simple) Answer:

Before the final AND gate involving the clock signal K , there is a maximum of 6 gate delays. The final AND is not included because the clock is waiting for F to be correct. The final AND would form part of the delay for the next circuit, one attached at the output.

Clock frequency = $\frac{1}{\text{period}}$

Period = total delay = 6 gates $\times \frac{20 \text{ ns}}{\text{gate}} = 120 \text{ ns}$

Clock frequency = $\frac{1}{120 \text{ ns}} = 8.33 \text{ MHz}$

25 points for answer above

? points for more complicated analysis involving clock duty cycle, etc. (The issue of clocking using "level triggering", that is, allowing signals thru when the clock signal is 1 is actually complicated)

20 points if off by powers of 10 or other calculator error

15 points if wrong because final AND gate included

10 points if counted gates wrong or freq equation wrong

Save paper,
give to
Sheila in
this case!

Problem 2: 25 Total Points

2

(Intended) Answer: A reference to a prefabricated magnitude comparator with propagation delay less than that obtained in Problem 1. Corresponding frequency = $\frac{1}{\text{propagation delay}}$.

25 points for any magnitude comparator chip reference and correct frequency

15 points for faster circuit due to simplification
MUST BE CORRECT SIMPLIFICATION

(Reason for deduction: Chip is much faster)

20 points for chip with incorrect frequency

5 pity points for incorrect simplification

Problem 3: 25 Total Points

V_{ad} Answer: Point a is 5 V lower, or -5 V higher than b. b is 3 V lower, or -3 V higher than c. c is 1 V higher than d.

Thus a is $-5 + -3 + 1 = \textcircled{-7\text{V}}$ higher than d.

V_{cb} Answer: c is $\textcircled{3\text{V}}$ higher than b.

V_x Answer: Start at + on V_x, trace path and add according to first sign on each element:

$$V_A = -5 + -3 = -8V$$

25 points for all 3 correct answers

Deduct 5 points for each incorrect sign

includes wrong sign

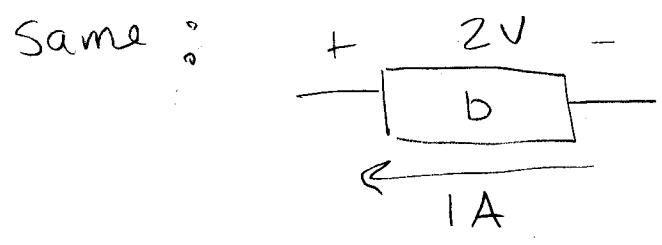
Deduct 10 points for ^{each} incorrect magnitude (to a minimum of 0 score for problem)

Problem 4:

a Answer: Current is already "associated" with voltage (goes from + to -) so

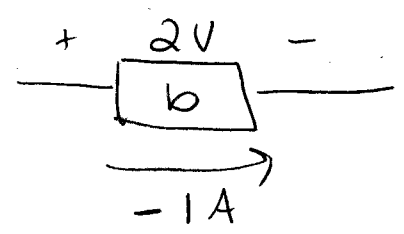
$$P_a = 12V \cdot 1A = 12W$$

b Answer: The element b is in the same branch as element a, so the current is the same:



But this is un-associated current direction! (- to +)

So flip current like this and change current sign:



Now we have associated current.

$$P_b = 2V \cdot (-1A) = -2W$$

c Answer: Current is again un-associated, so

flip direction and change sign: $P_c = 2V \cdot (-3A) = -6W$

4
d Answer: Current is in "associated" direction.

$$P_d = 1V \cdot (-4A) = (-4W)$$

25 points for all correct

Deduct 5 points for each incorrect sign

includes
wrong sign → Deduct 10 points for each incorrect magnitude
to a minimum of 0 points