

Write your name at the top right corner of every page (including this cover page).

Copy everything you want counted towards your grade onto the pages that I provided.

Write with a pen that cannot be erased!

No books or calculators are allowed!

Write down all the steps that lead to your result.

Identify new variables that you may introduce in the circuit diagrams that I provided.

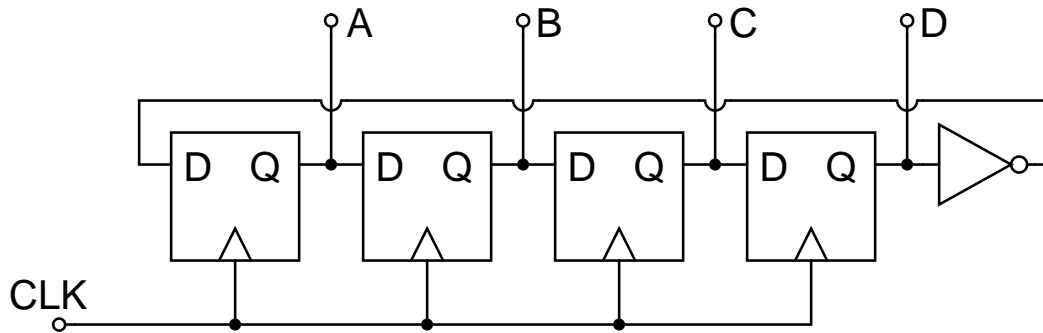
Read all the problems before you start so that you can begin with those that seem easiest to you.

Problem 1 (9 pts):

a.) In the diagram below: Are we looking at D-latches or at D-flip-flops?

D-flip-flop; the triangle at the clock input indicates edge triggering.

b.) What are the possible output states and their proper order of appearance in the sequential logic circuit below if the initial state is 1111 (i.e. A=1,B=1,C=1,D=1)?



Solution: See page 21 of lecture 7

Problem 2 (8 pts):

Write the Karnaugh map and analyze it to find an efficient(!) implementation for the following truth table:

A	B	C	D	F
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Solution:

	00	01	11	10
00	1	1	0	1
01	1	1	1	1
11	1	1	0	0
10	1	1	0	0

Be sure to get the order right: Only one bit changing between rows or columns!

$$F = \overline{C} + \overline{A}B + \overline{A}\overline{D} \text{ or: } F = \overline{AC} + \overline{BCD}$$

Problem 3 (6 pts):

Implement the logic function $F = \overline{AC} + \overline{BC} + AC$ purely through NAND gates.

Solution: See Bobrow, Example 11.11 on page 784

Problem 4 (2 pts):

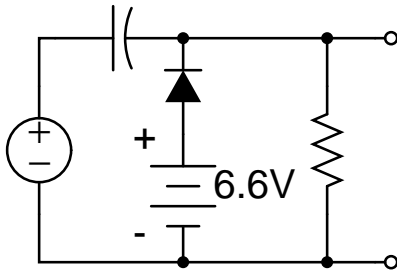
Draw the current as a function of voltage for a Zener diode with a Zener voltage of 5.7 V. Mark the Zener Voltage in your graph.

Solution: See Lecture 9 page 7. Zener voltage is the breakdown voltage.

Problem 5 (4 pts):

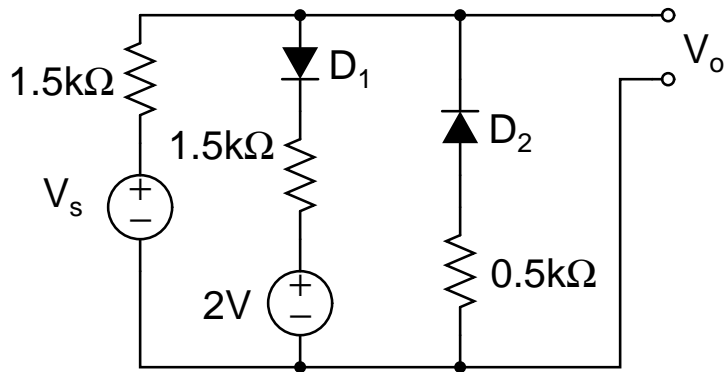
Design a circuit that clamps the negative peaks of an ac signal to +6 V. Allow for 0.6 V forward voltage drop across your diode.

Solution:



Problem 6 ONLY 6610 students !!! (6 pts):

- a.) What is the transfer function for the following diode circuit? Draw V_o as a function of V_s as your answer to this question.
- b.) What passive element can the battery in this circuit be replaced with?



Solution: a.) see slide 4 of lecture 9. b.) Zener diode.