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

Copy everything you want counted towards your grade onto the pages that I provided. Use the extra pages I provide if necessary.

Write with a pen that cannot be erased!

No books and none of your own calculators are allowed! Use the calculators that we provide.

Write down all the steps that lead to your result. If we cannot see how you arrived at the result, no points will be awarded.

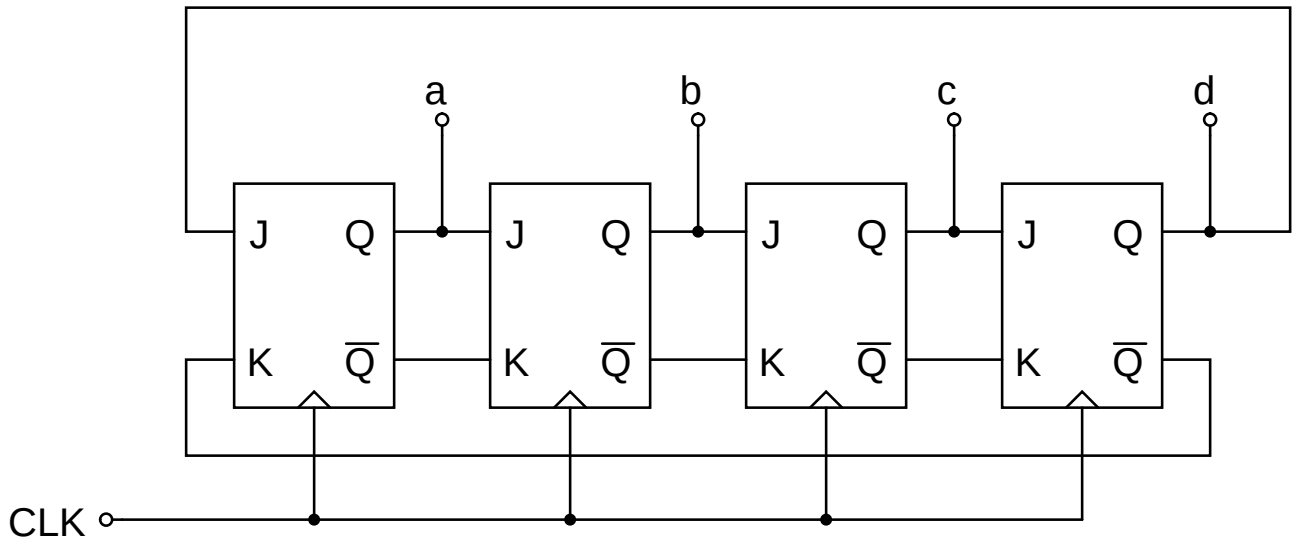
Clearly identify all variables that you may introduce in the circuit diagrams.

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

The last problem is for the 6610 students only. Should students from 3610 attempt to solve the problem, points they gain may be used to proportionally replace the lowest scoring problem in their main section. In other words: Should a 3610 student get 100% on the last problem but e.g. a lowest score of only 50% on the first problem, the complete score for that student will be calculated with 100% of the points for the first problem replacing the actually achieved 50% of points on the respecive first problem.
Students from 3610 are not required to do the last problem!

Problem 1 (6 pts):

For the circuit shown: Complete the table below of sequential states as they change from one clock edge to the next:



	a	b	c	d
first:	1	0	0	0
next:				
next:				
next:				
next:				
next:				
next:				

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	1
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

(continuation of problem 2)

Problem 3 (6 pts):

Draw a circuit diagram for a circuit that would clamp a sinusoidal input waveform so that the output never goes above -3V. Remember to make sure a current can always flow. Do not count on the load for this. Assume ideal circuit elements. What condition do even ideal circuit elements impose on the frequency of the sinosoid?

(continuation of problem 3)

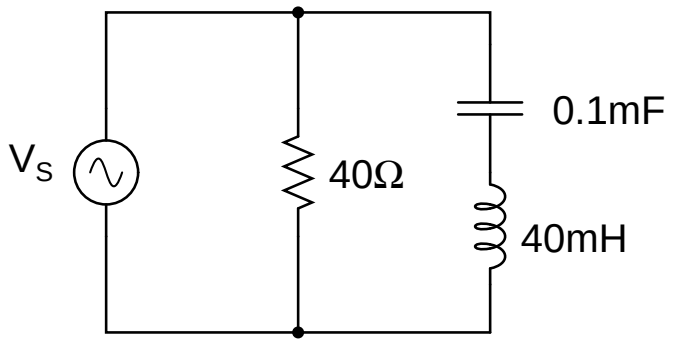
Problem 4 (8x pts):

Implement the logic function $F = (A + \overline{B} + \overline{C})(\overline{A} + C)$ solely through NOR gates, i.e. draw the schematic for your solution. Start from the uninverted inputs A,B,C, and D. Inverters are not allowed; only NOR gates.

(continuation of problem 4)

Problem 5 (8 pts):

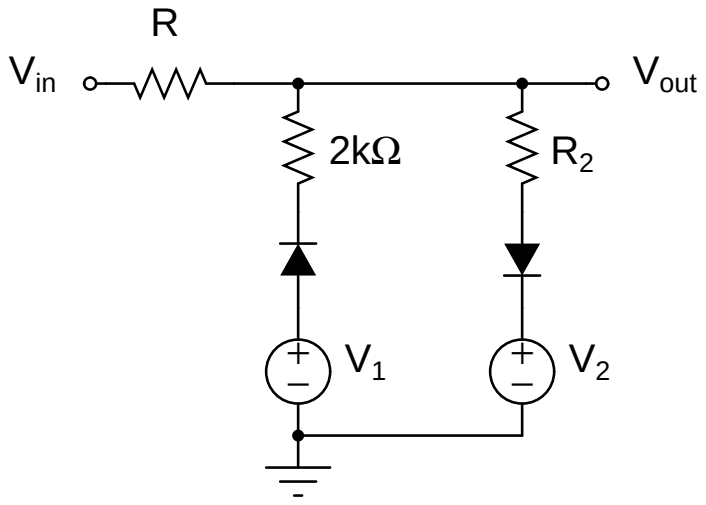
Find the phasor for the current I_{LC} that goes through the capacitance and the inductance and the phasor I_R for the current through the resistor if the input voltage $V_S = 240(\sin 1000\frac{\text{rad}}{\text{sec}}t)$ V:



(continuation of problem 5)

Problem 6 ONLY 6610 students !!! (8 pts):

Find values for the voltage sources and resistors in the circuit below so that below 3 V the output voltage V_{out} increases by 2/3 of the increase of the input voltage V_{in}, above 10 V the output voltage increases by double any increase in input voltage, and $V_{out} = V_{in}$ in between 3 V and 10 V. All circuit elements are ideal.



(continuation of problem 6)