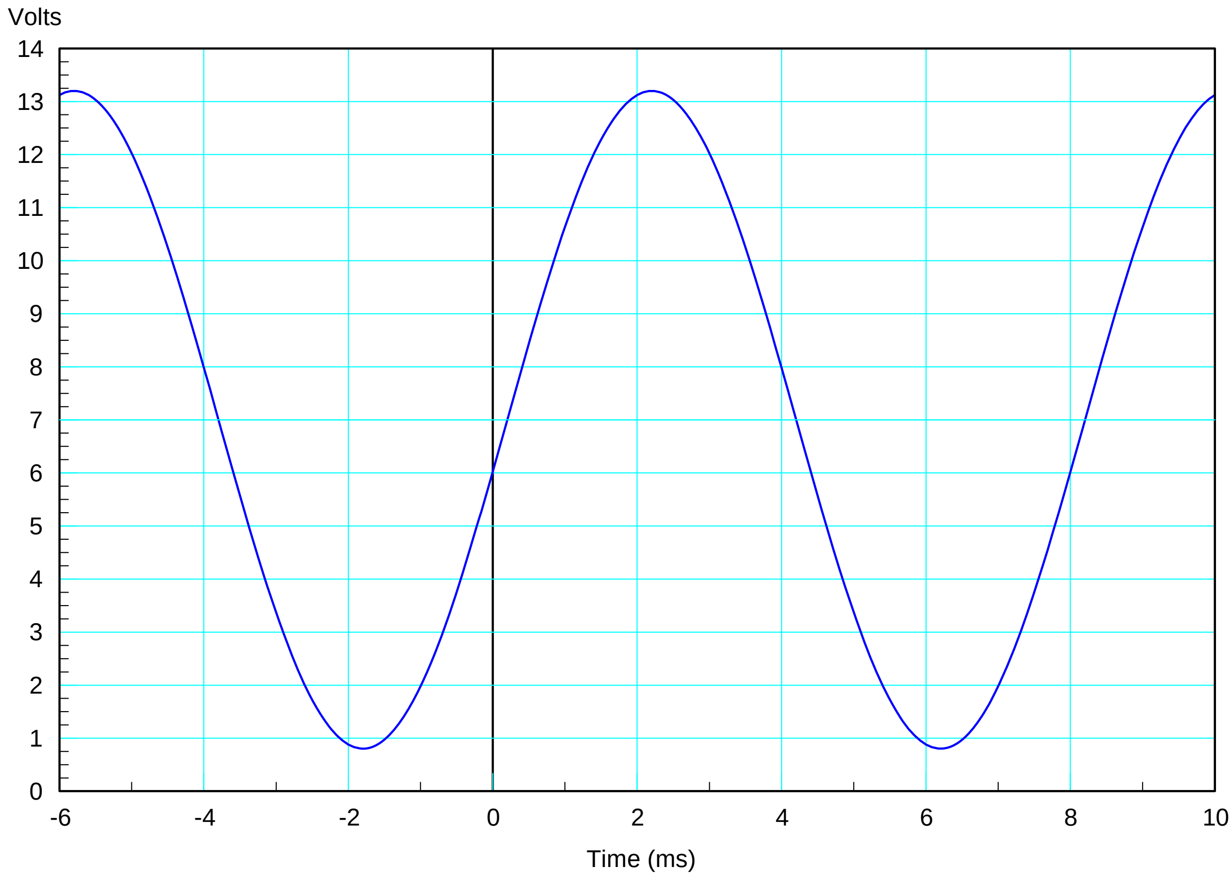
ECE 320 - Quiz #6 - Name ______________________

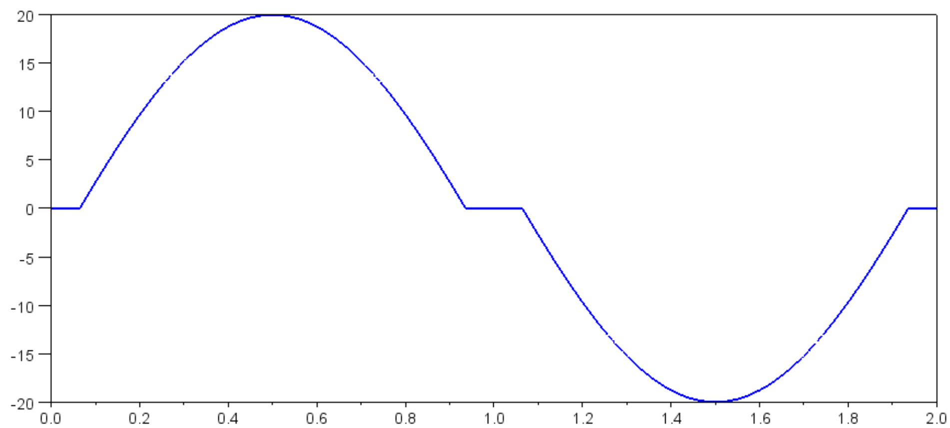
DC to AC, SCT, Boolean Logic. March 5, 2020

1) Determine the Fourier transform for the following waveform (i.e. express the signal in terms of constants and sinusoids):

x(t) =



2) A DC to AC converter outputs the following waveform:



Determine the efficiency of this DC to AC converter (i.e. the percentage of the energy in the first harmonic)

efficiency =

The Fourier coefficients are as follows:

```
a1 = 2*mean(x .* exp(-j*pi*t))
 a1  =    -18.657842i

a2 = 2*mean(x .* exp(-j*2*pi*t))
 a2  =    0

a3 = 2*mean(x .* exp(-j*3*pi*t))
 a3  =    + 1.9940369i

a4 = 2*mean(x .* exp(-j*4*pi*t))
 a4  =    0

a5 = 2*mean(x .* exp(-j*5*pi*t))
 a5  =  + 1.0688105i

a6 = 2*mean(x .* exp(-j*6*pi*t))
 a6  =  0

a7 = 2*mean(x .* exp(-j*7*pi*t))
 a7  =   + 0.6376461i
```

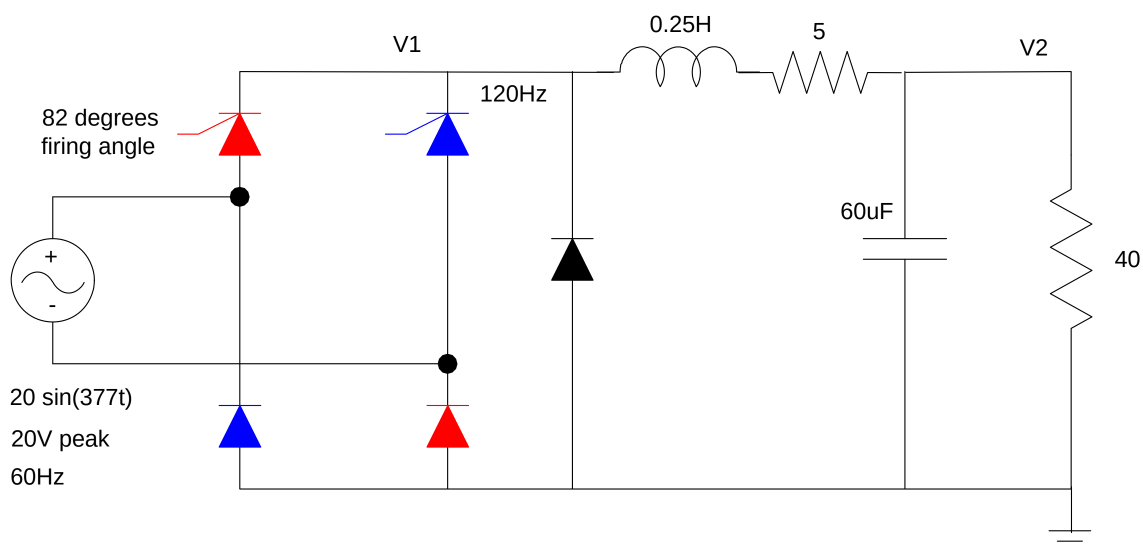
SCR: Analysis

3) Determine the voltages at V1 and V2 for the following AC to DC converter. Assume a firing angle of 82 degrees

V1		V2	
DC mean(V1)	AC (V1pp)	DC mean(V2)	AC (V2pp)

Note: the relationship between firing angle and the DC voltage is

$$V_{avg} = \left(\frac{19.3}{\pi}\right)(1 + \cos\theta) - 0.7$$



SCR Design

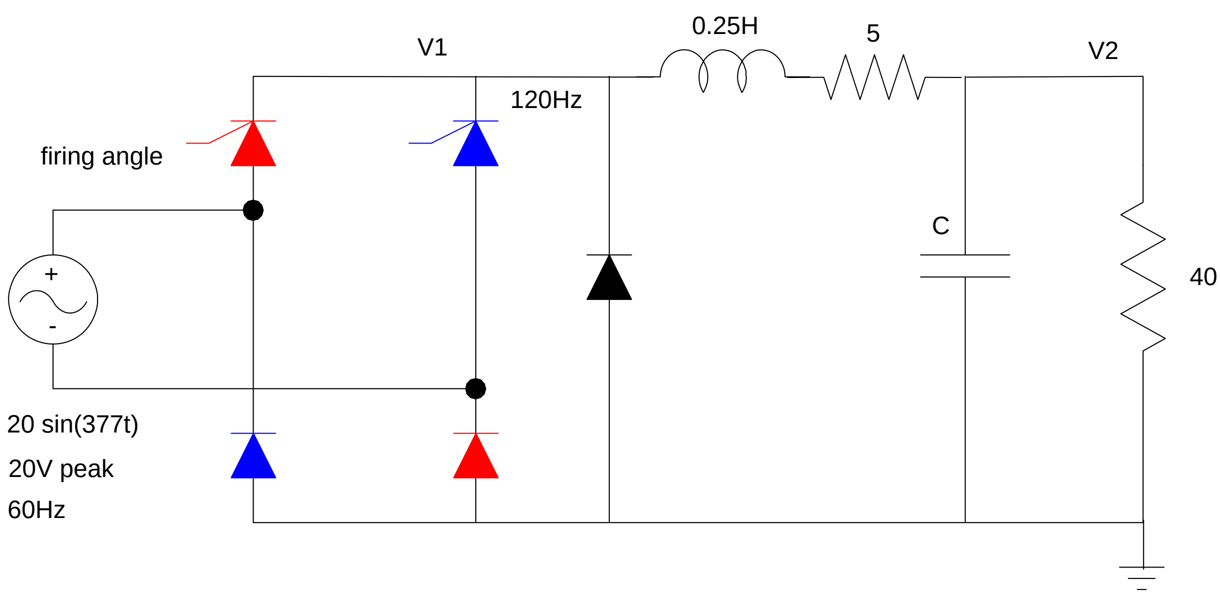
4) Design an AC to DC converter so that

- The output (V2) is 5.00V (DC)
- With a ripple of 1Vpp (AC)

V1 (DC)	Firing Angle	C	V2 (DC)
			5.00 V

Note: the relationship between firing angle and the DC voltage is

$$V_{avg} = \left(\frac{19.3}{\pi}\right)(1 + \cos\theta) - 0.7$$



5) Design a circuit to implement the following logic using NAND gates (i.e. circle the ones)

e(A,B,C,D)		CD			
		00	01	11	10
AB	00	1	0	0	1
	01	0	0	0	1
	11	x	x	x	x
	10	1	0	x	x

6) Design a circuit to implement the following logic using NOR gates (i.e. circle the zeroes)

e(A,B,C,D)		CD			
		00	01	11	10
AB	00	1	0	0	1
	01	0	0	0	1
	11	x	x	x	x
	10	1	0	x	x

Bernie Sanders Bonus!!! Did the following events come before or after Bernie Sanders was born? (Sept 1941):

- The invention of the transistor before after
- The first wind energy plant before after
- The first programmable computer before after