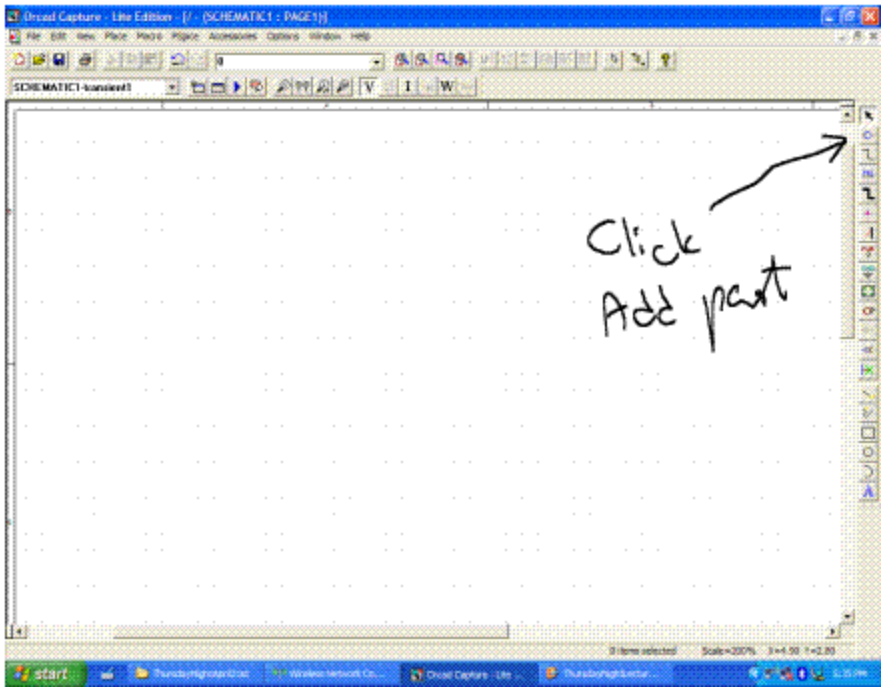
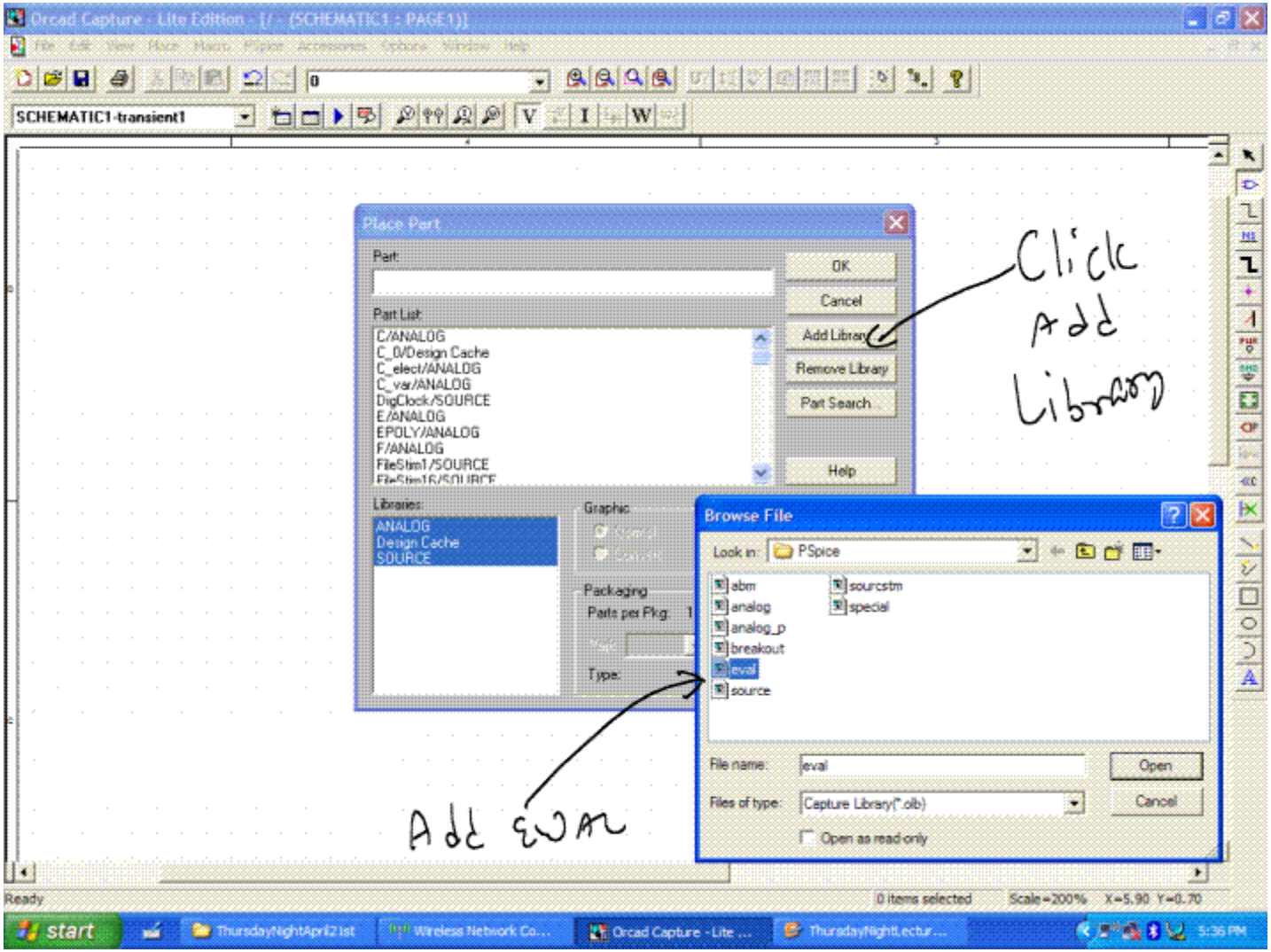
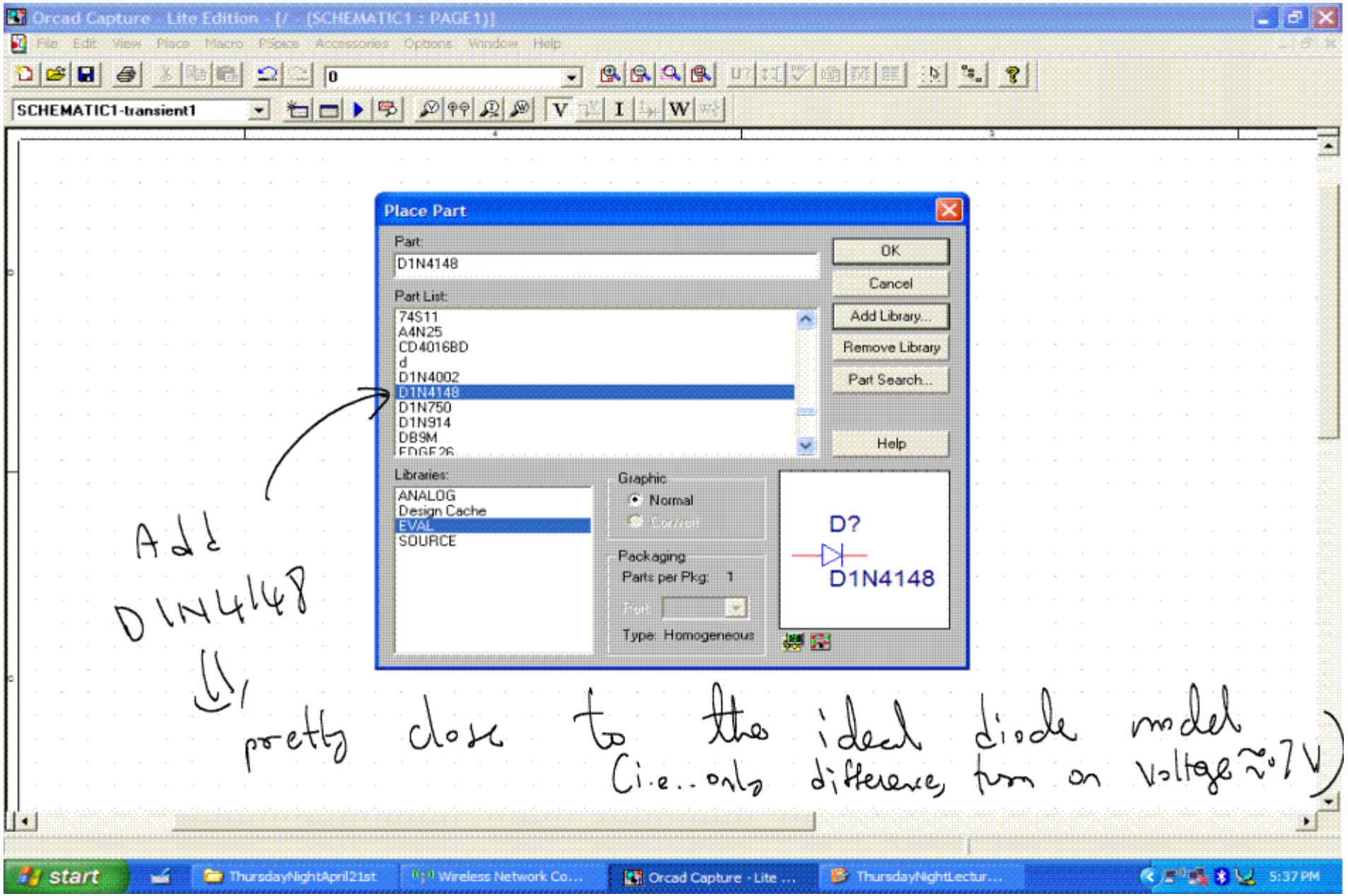
Office hours lecture

Note: Diodes in PSpice.

Step 1: Add EVAL Library:

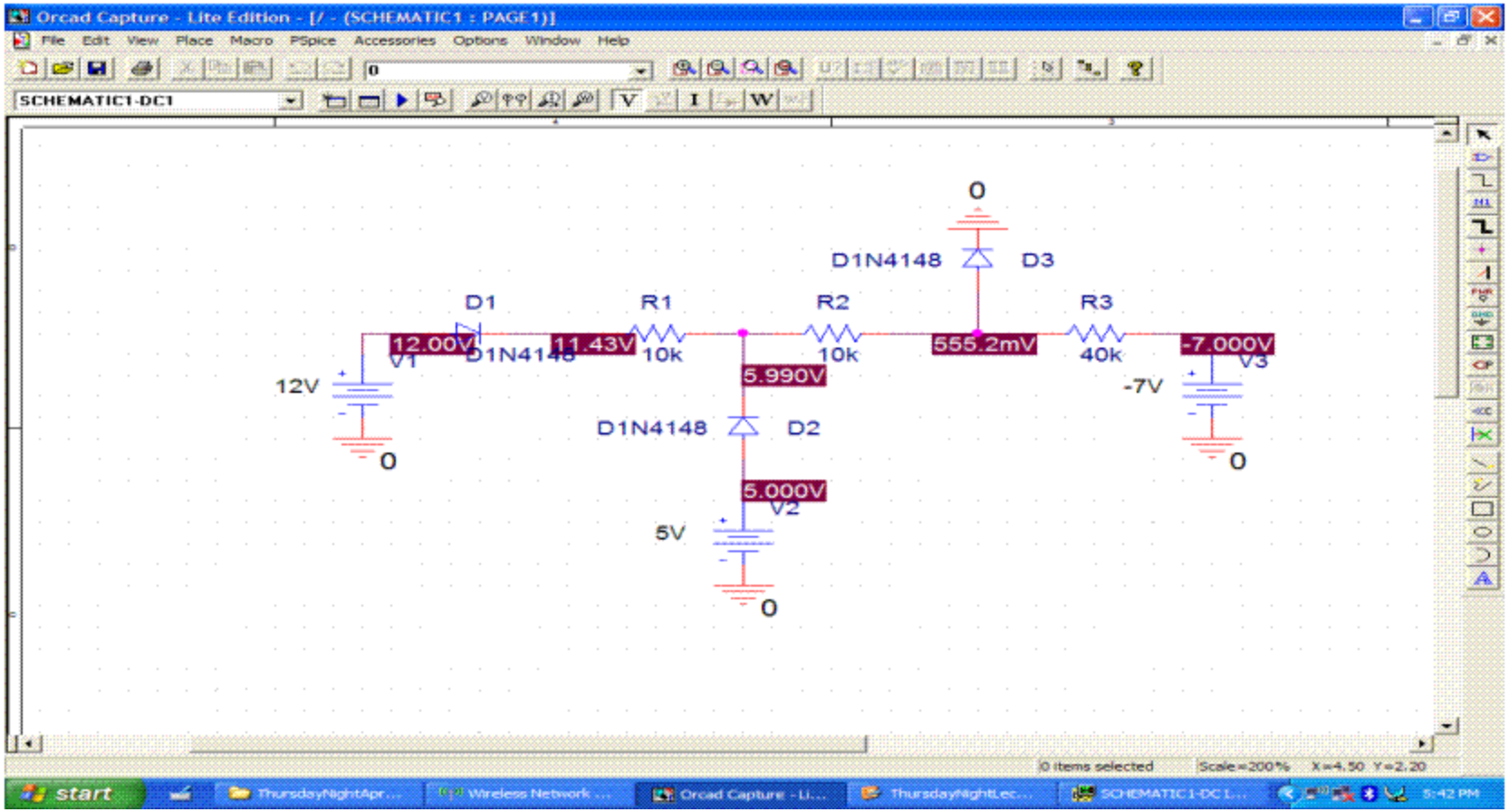



Orcad Capture - Lite Edition - [/ - (SCHEMATIC1 : PAGE1)]
SCHEMATIC1-transient1
Place Part
Part:
OK
Cancel
Part List:
C/ANALOG
C_0/Design Cache
C_elect/ANALOG
C_var/ANALOG
DigClock/SOURCE
E/ANALOG
EPOLY/ANALOG
F/ANALOG
FileStm1/SOURCE
Add Library
Remove Library
Part Search
Help
Libraries:
ANALOG
Design Cache
SOURCE
Graphic
Packaging
Parts per Pkg:
Type:
Click Add Library
Browse File
Look in:
PSpice
abm
analog
analog_p
breakout
eval
source
sourcstm
special
File name:
eval
Open
Files of type:
Capture Library(*.olb)
Cancel
Open as read-only
Add EVAL
Ready
0 items selected
Scale=200%
X=5.90 Y=0.70
start
ThursdayNightApril2 1st
Wireless Network Co...
Orcad Capture - Lite ...
ThursdayNightLectur...
5:36 PM

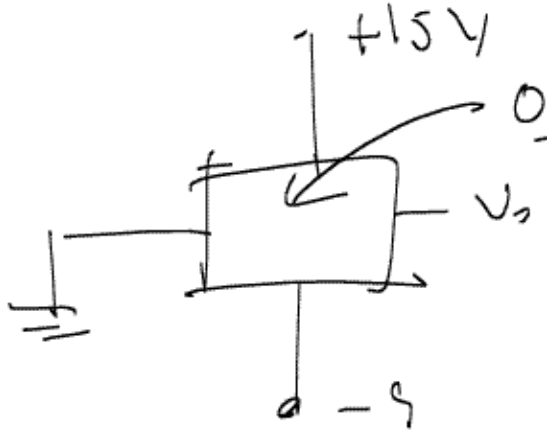

Orcad Capture - Lite Edition [/ - (SCHEMATIC1 : PAGE1)]
File Edit View Place Macro PSpice Accessories Options Window Help
SCHEMATIC1-transient1
Place Part
Part:
D1N4148
OK
Cancel
Part List:
74S11
A4N25
CD4016BD
d
D1N4002
D1N4148
D1N750
D1N914
DB9M
Add Library...
Remove Library
Part Search...
Help
Libraries:
ANALOG
Design Cache
EVAL
SOURCE
Graphic
Normal
Packaging
Parts per Pkg: 1
Type: Homogeneous
D?
D1N4148
Add D1N4148
pretty close to the ideal diode model
(i.e.. only difference from on voltage ~.7V)
start
ThursdayNightApril21st
Wireless Network Co...
Orcad Capture - Lite ...
ThursdayNightLectur...
5:37 PM

Build the circuit & run a DC bias simulation.

Viola, you should get the answer!

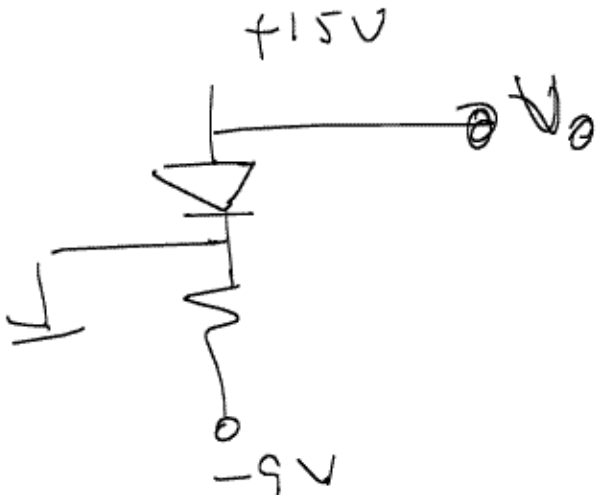


(5)



Only ideal diodes & resistors
(minimum one diode & one resistor)

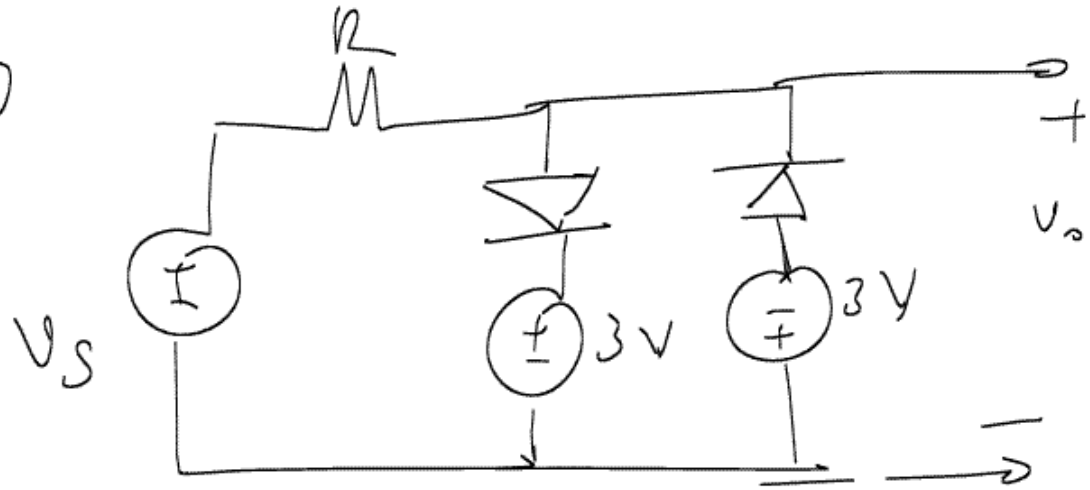
Note: Don't do this:



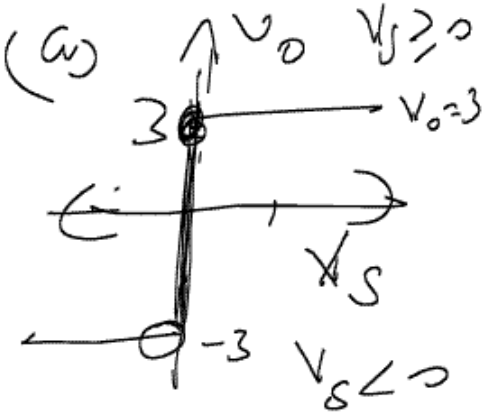
Trivial

Many possibilities. HINT: USE PSPICE!

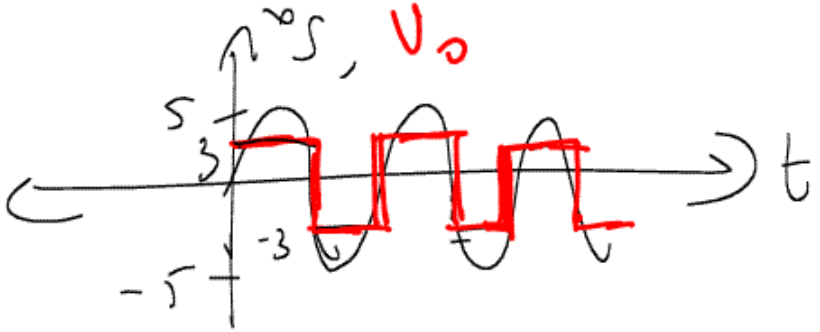
(b)



(a)

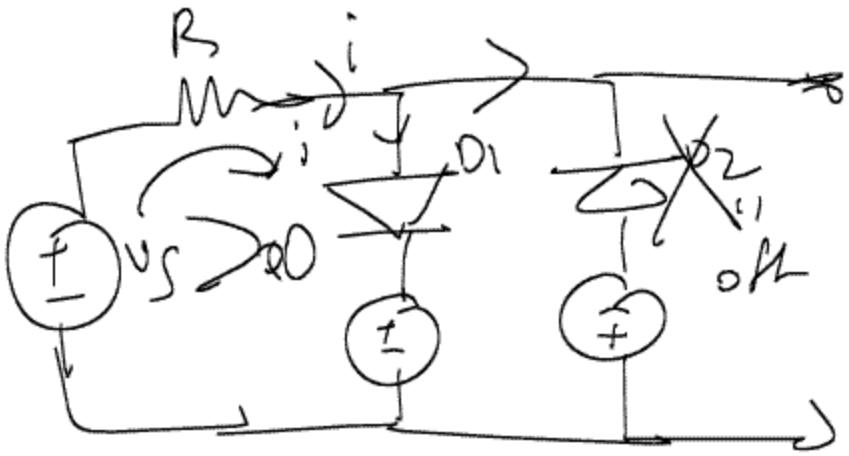


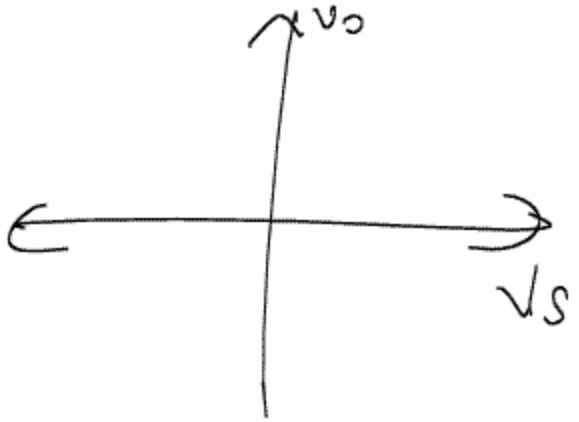
(b)



Suppose ↗

(i.e. v_o w.r.t. v_s for this problem is different

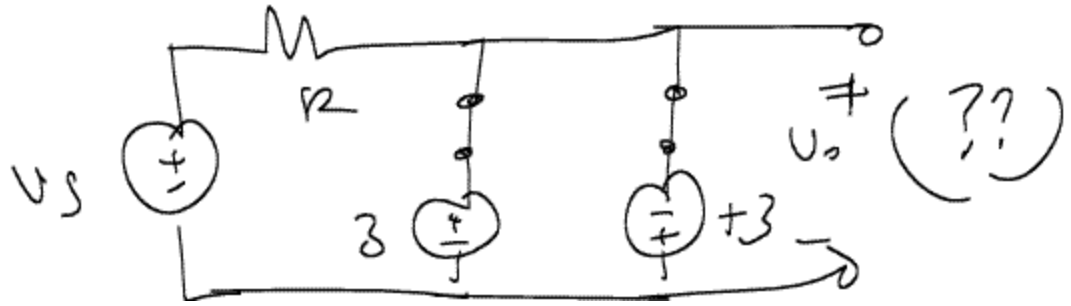




Similarly, $v_s < 0$ D2 is off, D2 may be on.

(Q:) Can both be on at the same time?

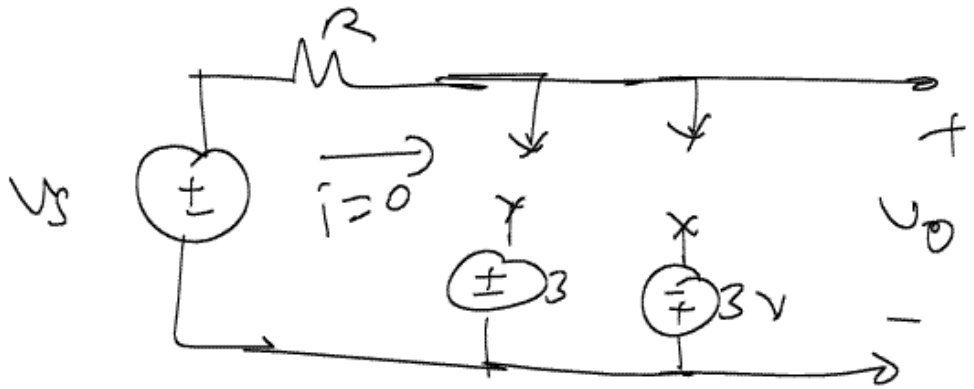
i.e..



No ⇒ $3 = -3$ (?!)

(Q.) Can both be off @ the same time?

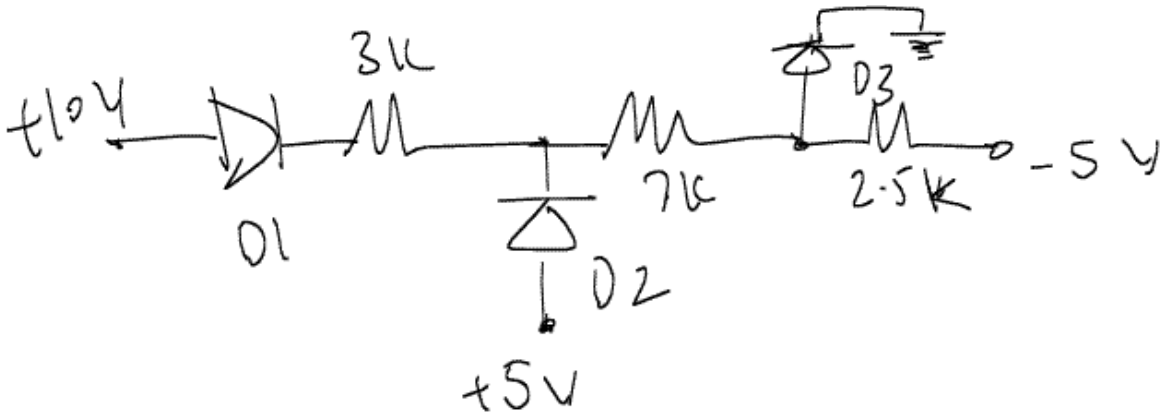
i.e.,



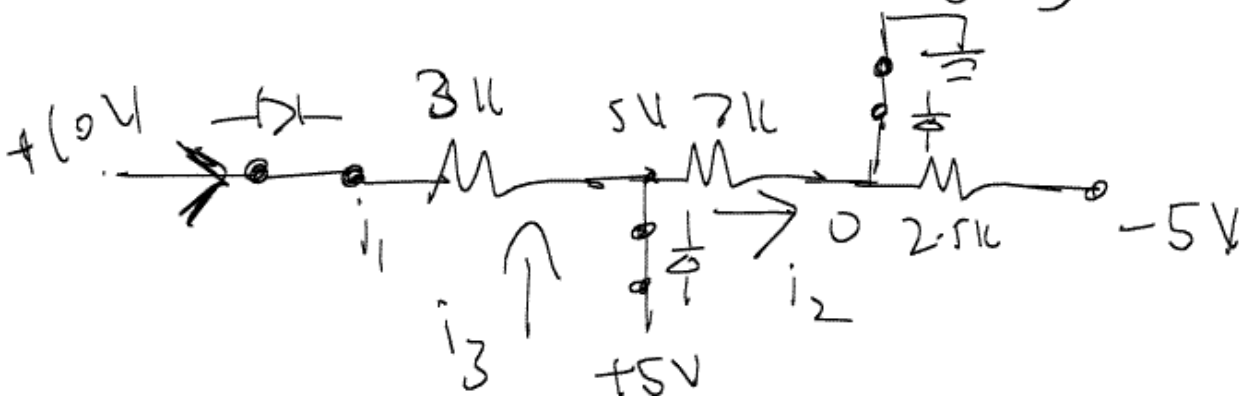
$V_o = f(V_S) = V_S$

THEREFORE; FIND THE RANGE OF V_S FOR WHICH BOTH DIODES ARE OFF

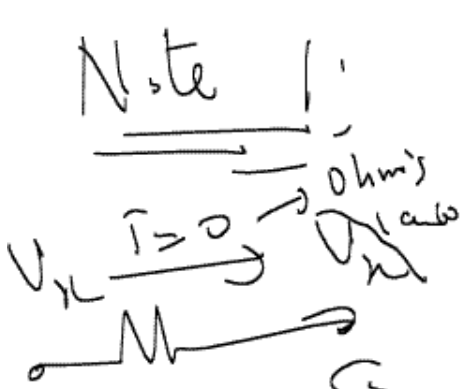
(2)



(2.) Assume all diodes are on ⇒ student gets a valid circuit (?!)

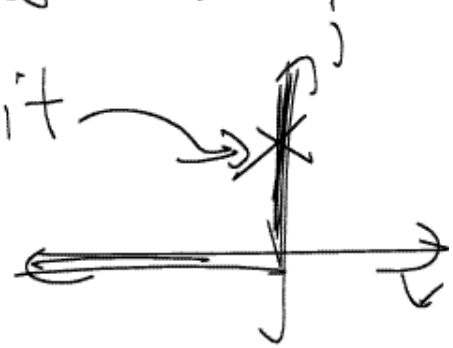


Note 1:



$\Rightarrow$ there can be a current flow because you have a diode!

Unlike a resistor, an ideal diode has current flow with 0 V across it



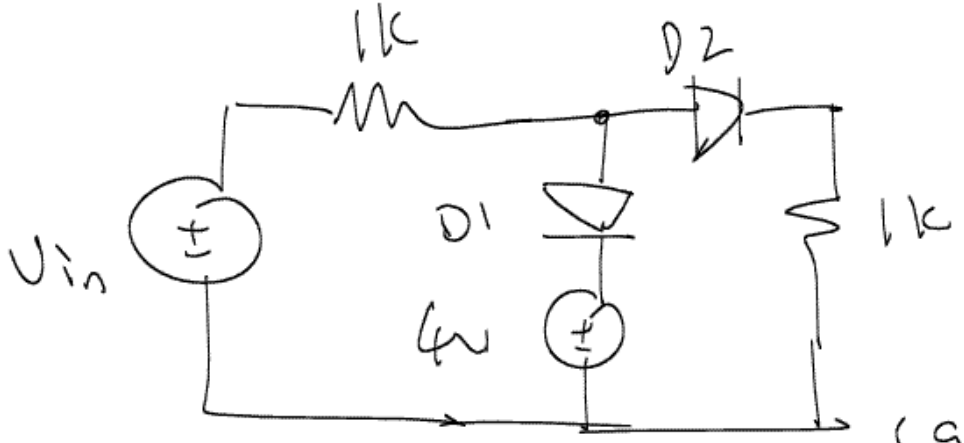
Note 2: Here, $i_1 = \frac{5}{5k} = \frac{5}{5}$ mA

$$i_2 = \frac{5-0}{2k} = \frac{5}{7} \text{ mA}$$

Otherwise, $i_1 > i_2 \Rightarrow i_3 < 0$

$\Rightarrow$ diode D2 cannot be on!

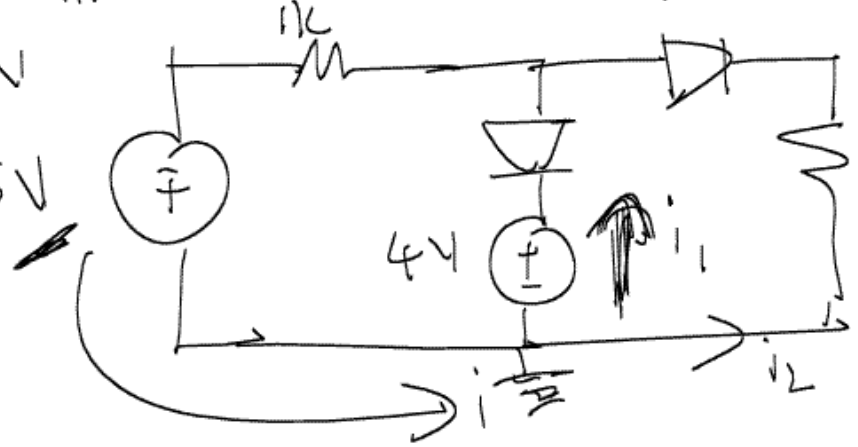
Ex:



(Q:) For what range of Vin is (a) D2 on (b) D1 on

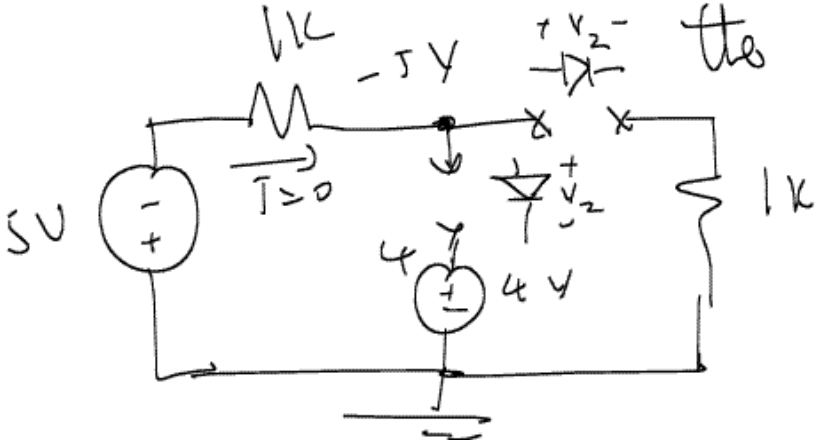
If, $V_{in} < 0$ what happens to D1 & D2?

eg: $V_{in} = -5$ V



i_1 & i_2 have to be zero because they are flowing against the diodes!

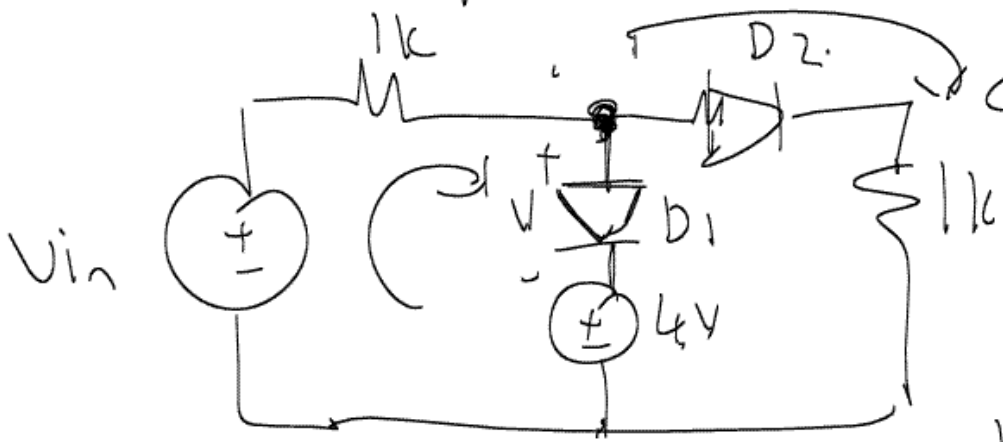
Check:



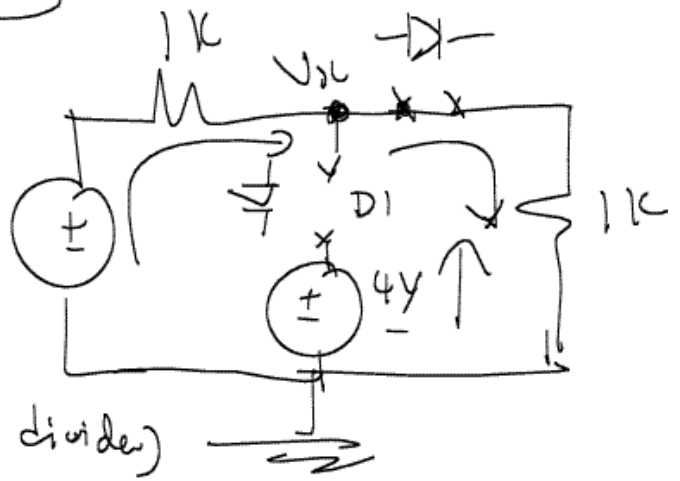
note:

PSPICE works ☺ as well!!!!!

But, what happens if $V_{in} > 0$??



e.g. $V_{in} = 1\ V \Rightarrow$



$$V_x = 1V \cdot \left(\frac{1k}{1k + 1k}\right) \quad \text{(voltage divider)}$$

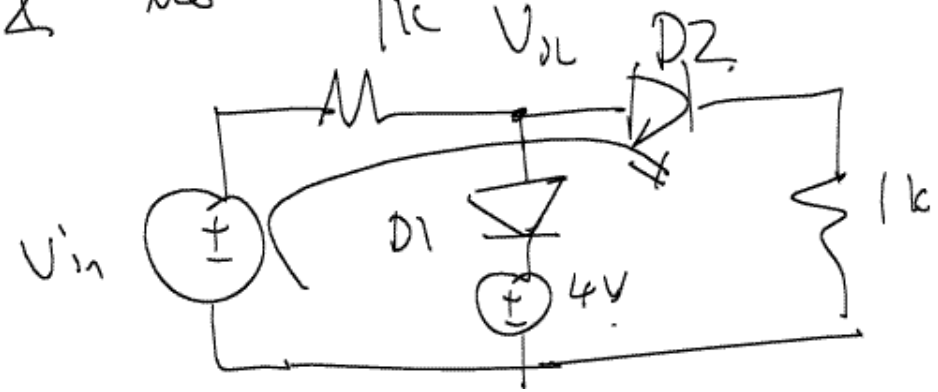
$$= 0.5V$$

Is D1 off? ⇒ Yes! $V_1 = 0.7 - 4 = -3.3 < 0$

D2 on ⇒ Current flows in the correct direction.

Great! D2 is on if $V_{in} > 0$

But, D1 is tricky because of the 4V & the fact that D2 turns on first!



If you think about it, if D1 is on, $V_{RL} = 4V$ (ideally). Does that mean D1 is on if $V_{in} \geq 4$??

No! because D2 turns on if $V_{in} > 0$

(verified above), $V_{RL} \neq V_{in}$

$$\Rightarrow V_{RL} = \left(\frac{1k}{1k+1k}\right) V_{in}$$

$$\therefore V_{RL} = 4 \Rightarrow \boxed{V_{in} = 8V}$$

of course, any value $> 8V$ would work!