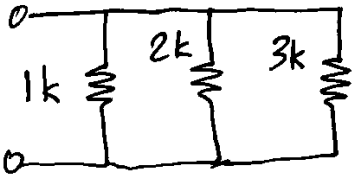
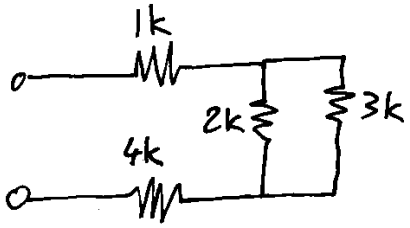
Tutorial #1: Page #1

(1) Find Equivalent Resistor

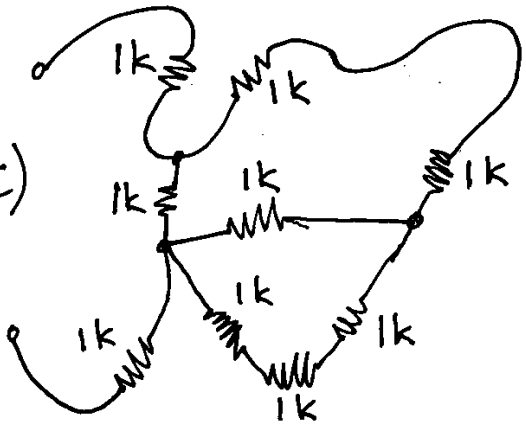
A)



B)

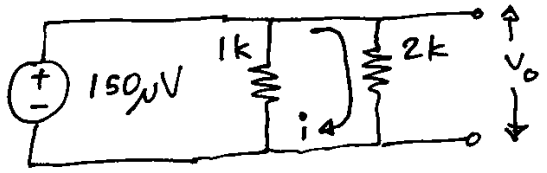


C)

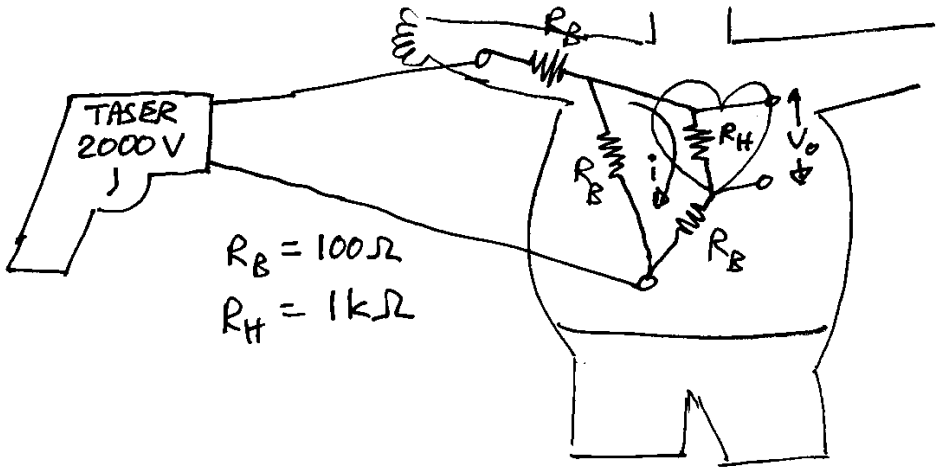


(2) Find V_o and i using Equivalent Resistances

A)



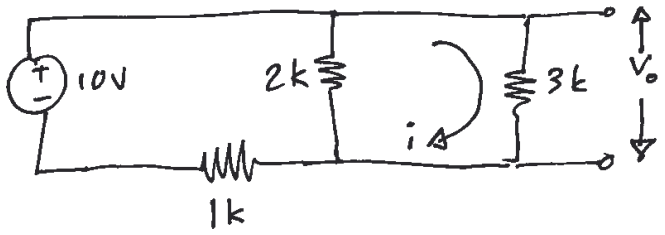
B)



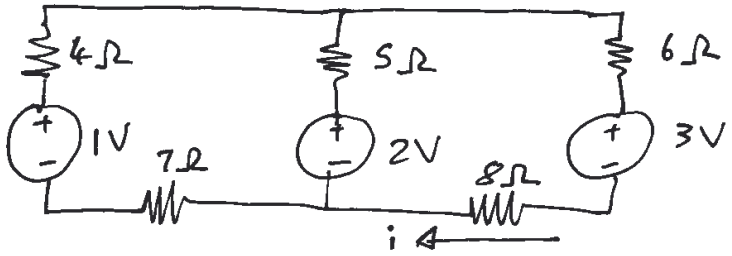
Tutorial #1: Page #2

③ Solve for i and V_o using KVL and KCL
write loops and equations

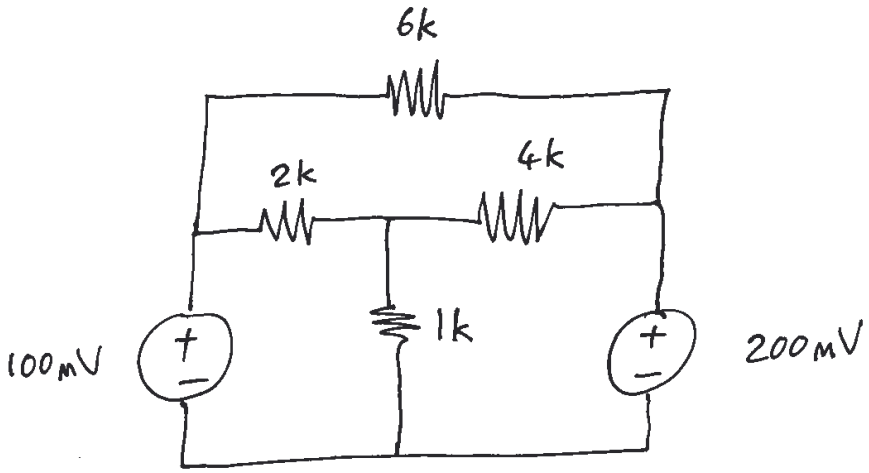
A)



B)



C)



1A $R = 1k \| 2k \| 3k$

1B $R = 1k + (2k \| 3k) + 4k$

1C $R = 1k + (1k \| (1k + 1k + (1k \| (1k + 1k + 1K)))) + 1k$

2A $V_o = 150\mu V$
$i = \frac{150\mu V}{2k\Omega}$

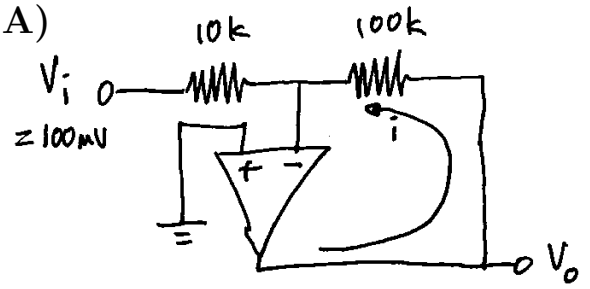
2B Define point x with V_x at armpit
Equivalent Resistance, R_{eq}, from V_x to bottom
$R_{eq} = R_B \| (R_H + R_B)$
Voltage divider: $V_x = \frac{R_eq}{R_eq + R_B}$
$i = \frac{V_x}{R_B + R_H}$
$V_o = iR_H$

3A Define loop current in left (i_l) and right ($i_r = i$) loop
KVL for i_l: $+10V - 2k(i_l - i_r) - 1k(i_l) = 0$
KVL for i_r: $-2k(i_r - i_l) - 3k(i_r) = 0$
$2k(i_r - i_l) + 3k(i_r) = 0$
$2k(i_r) + 3k(i_r) = 2k(i_l)$
$5k(i_r) = 2k(i_l)$
$i_l = 2.5i_r$
KVL #1: $10V = 2k(i_l - i_r) + 1k(i_l)$
$10V = 2k(2.5i_r - i_r) + 1k(2.5i_r)$
$10V = 5.5ki_r$

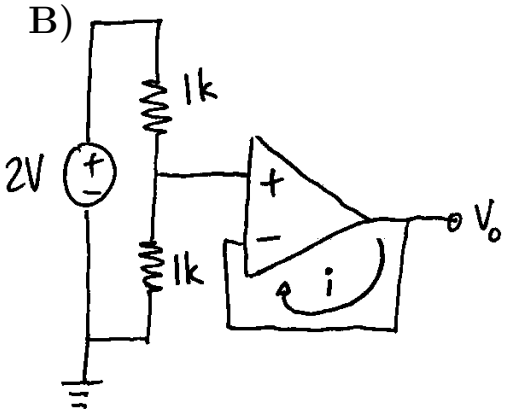
Tutorial #2

Find V_o and i

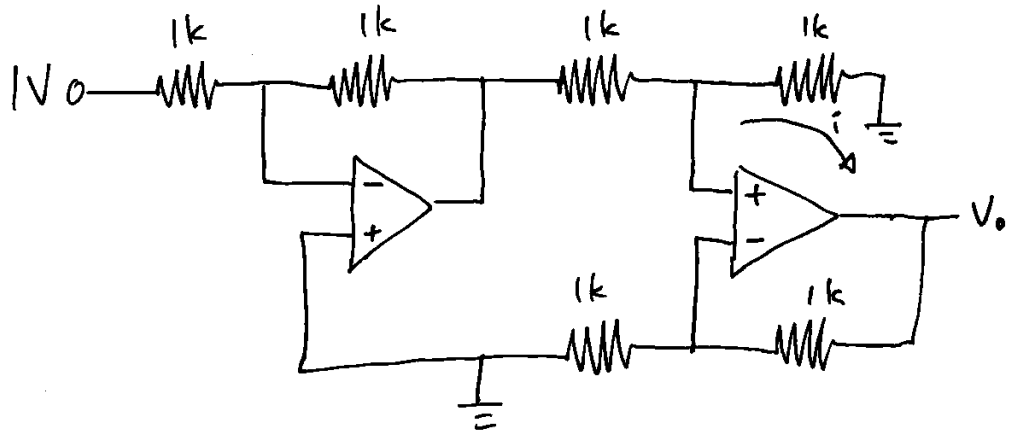
A)



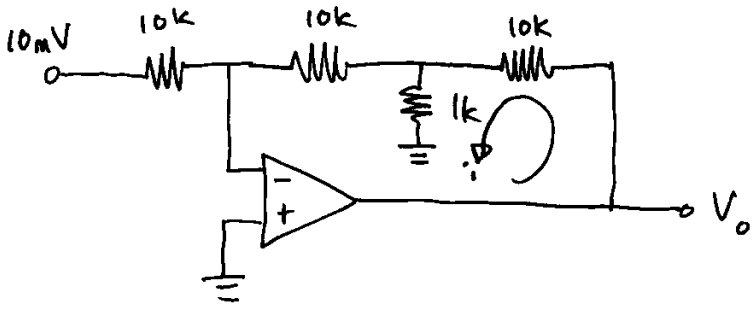
B)



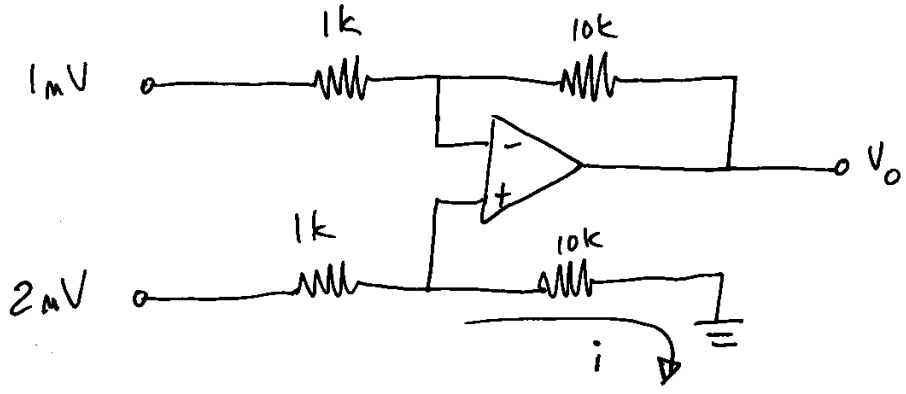
C)



D)



E)

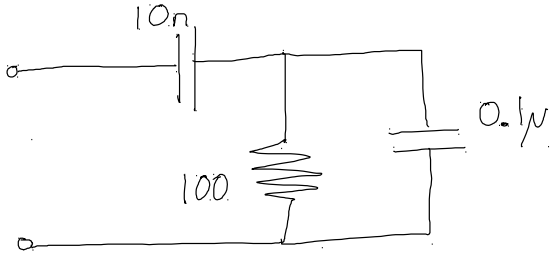


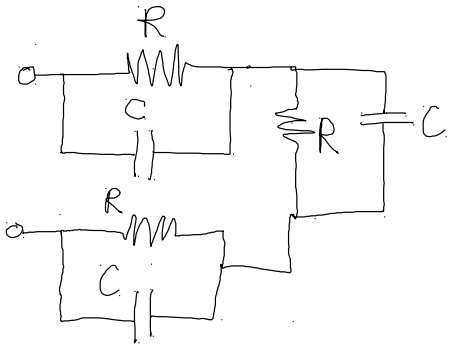
A $V_o = -\frac{100k}{10k}100\mu V$
$i = \frac{V_o}{100k}$

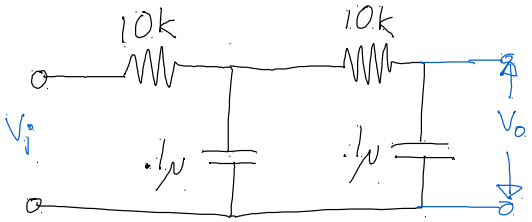
B Voltage divider, then buffer
$Vo = \frac{1k}{1k+1k}2V$

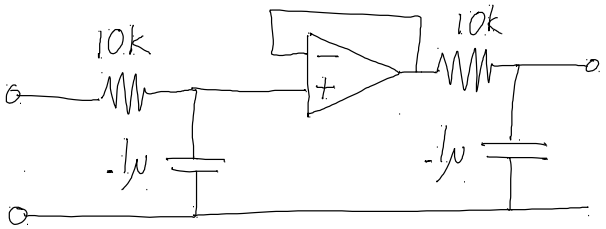
C Output of first op-amp: V_x
$V_x = -\frac{1k}{1k}1V = -1V$
2nd op-amp, $V_+ = \frac{1k}{1k+1k}V_x = -0.5V$
$i = \frac{V_x}{1k+1k} = -0.5mA$
$V_o = (1 + \frac{1k}{1k})V_+ = 2(-0.5V) = -1V$

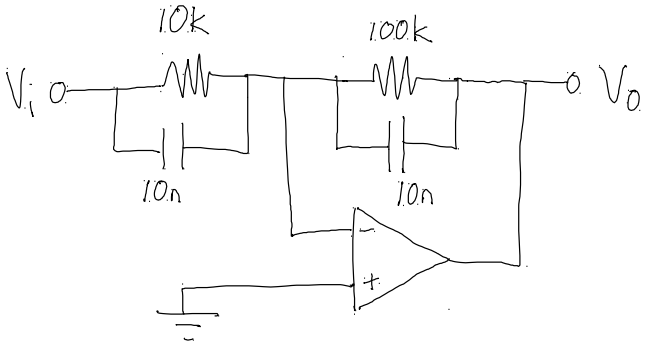
Tutorial #3


10n
0.1μ
100


R
C
R
C
R
C


10k
10k
Vi
.1μ
.1μ
Vo


10k
10k
.1μ
.1μ


10k
100k
Vi
Vo
10n
10n