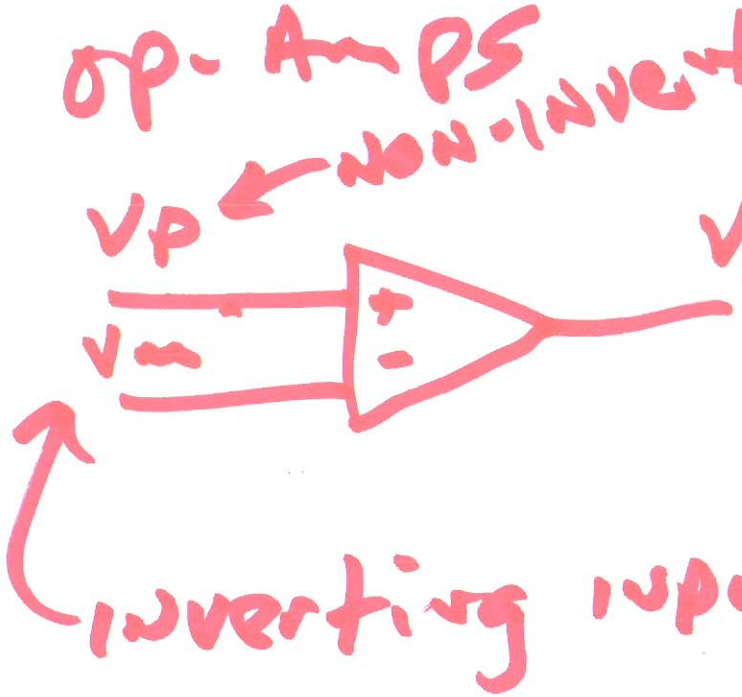
Lecture 2 1/27/14

EE 320

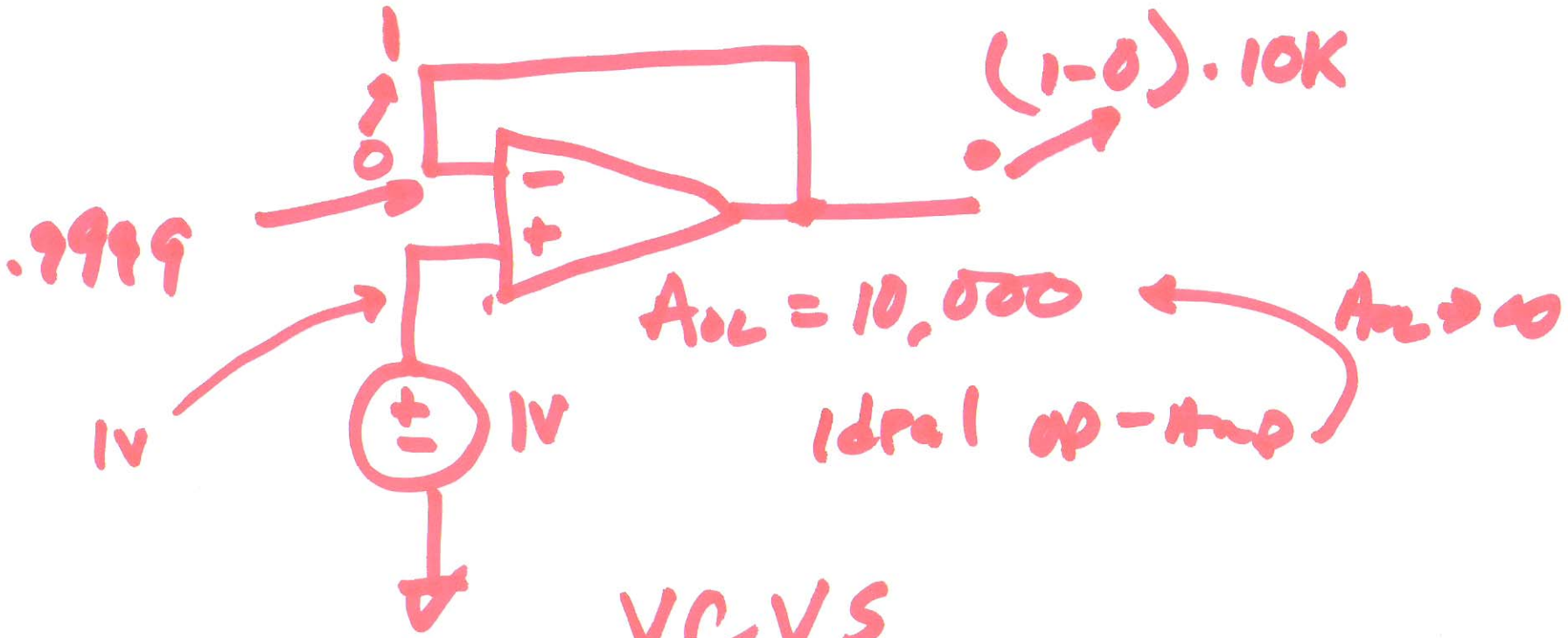
Op. Amps



$V_{OUT} = A_{OL}(V_P - V_-)$

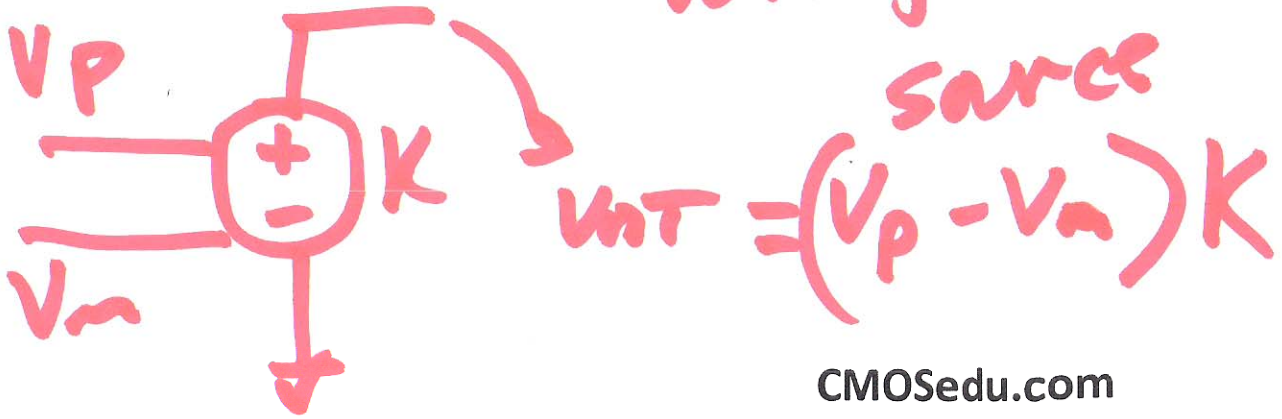
$A_{OL} \to \infty$

$V_P = V_-$

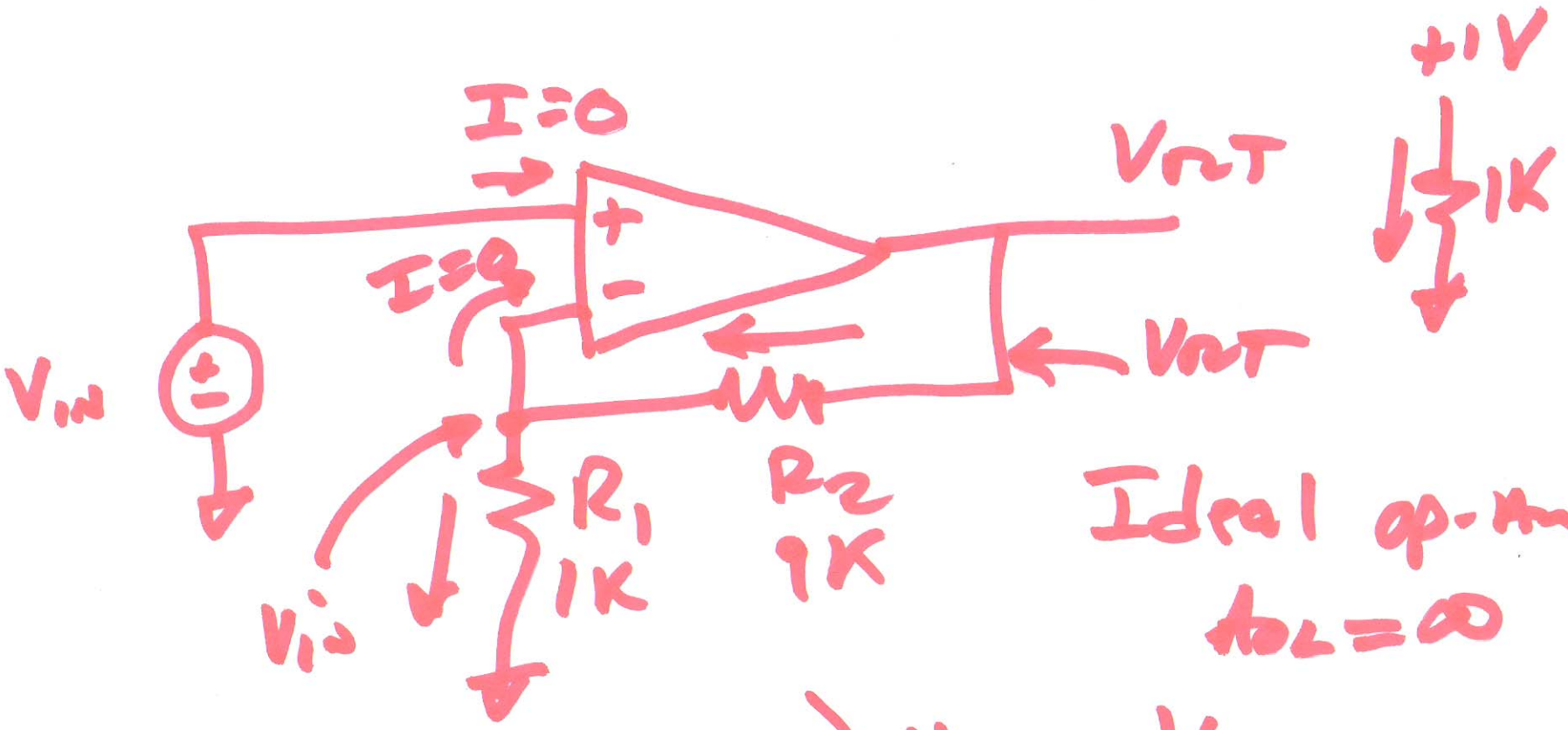


VCVS

Voltage Controlled Voltage source



UNLV
UNIVERSITY OF NEVADA LAS VEGAS



Ideal op-Amp

$A_{OL} = \infty$

$$\frac{V_{in}}{R_1} = \frac{V_{OUT} - V_{in}}{R_2}$$

1) $V_p = V_m$

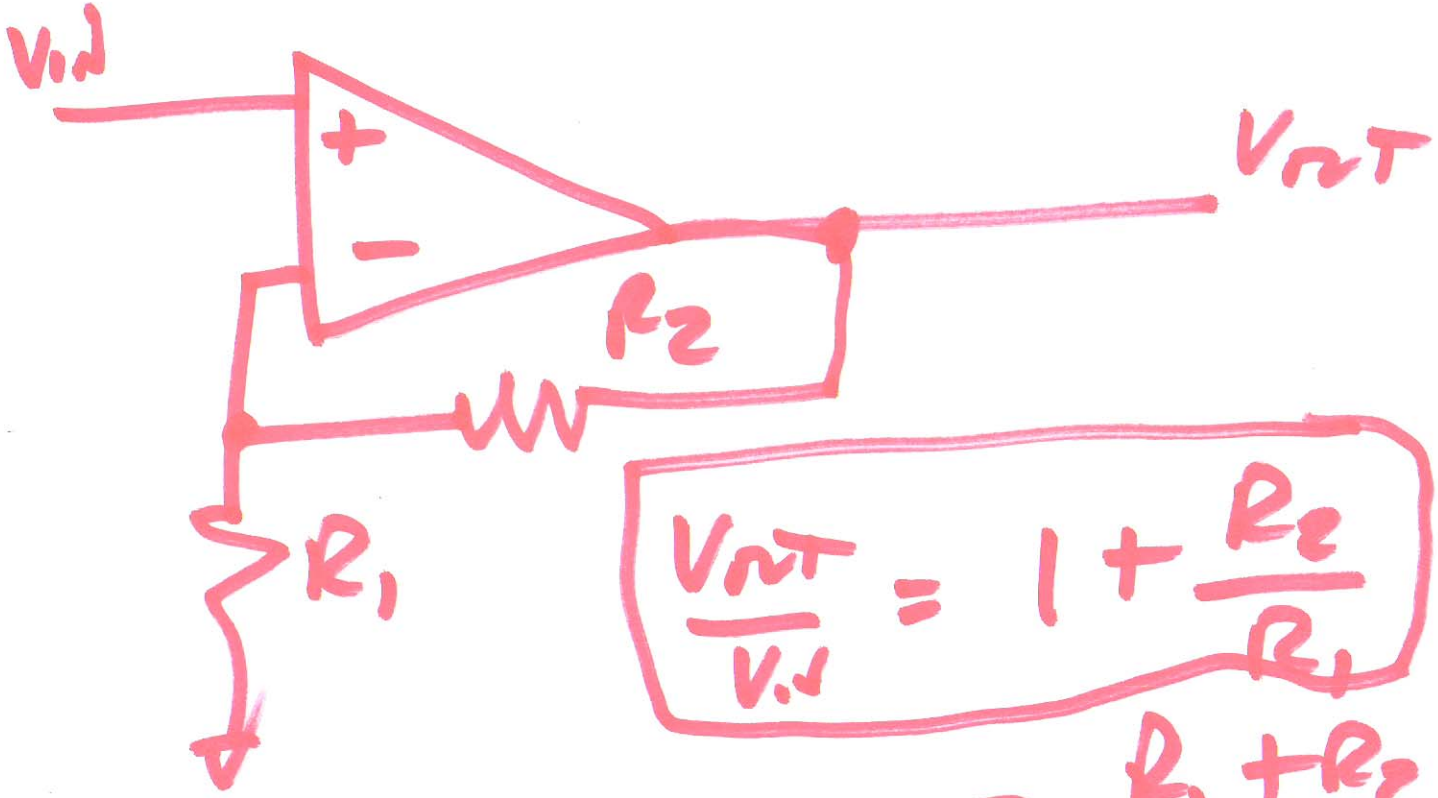
2) KCL @ minus input

$$V_{IN}\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{V_{OUT}}{R_2}$$

$$\frac{V_{OUT}}{V_{IN}} = 1 + \frac{R_2}{R_1} = \frac{R_1 + R_2}{R_1}$$

3)

NON-inverting op amp

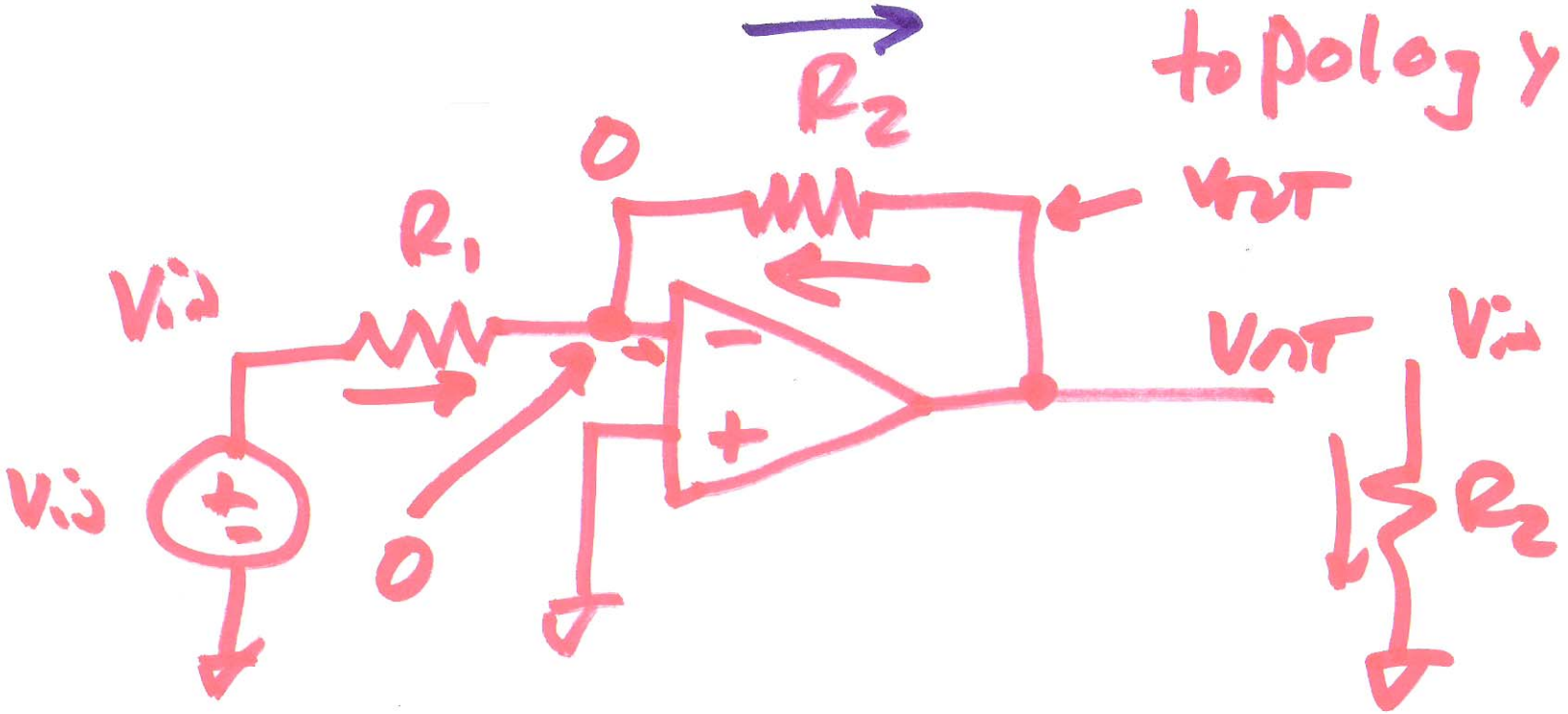


$$\frac{V_{out}}{V_{id}} = 1 + \frac{R_2}{R_1}$$

$$= \frac{R_1 + R_2}{R_1}$$

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Inverting op-Amp topology

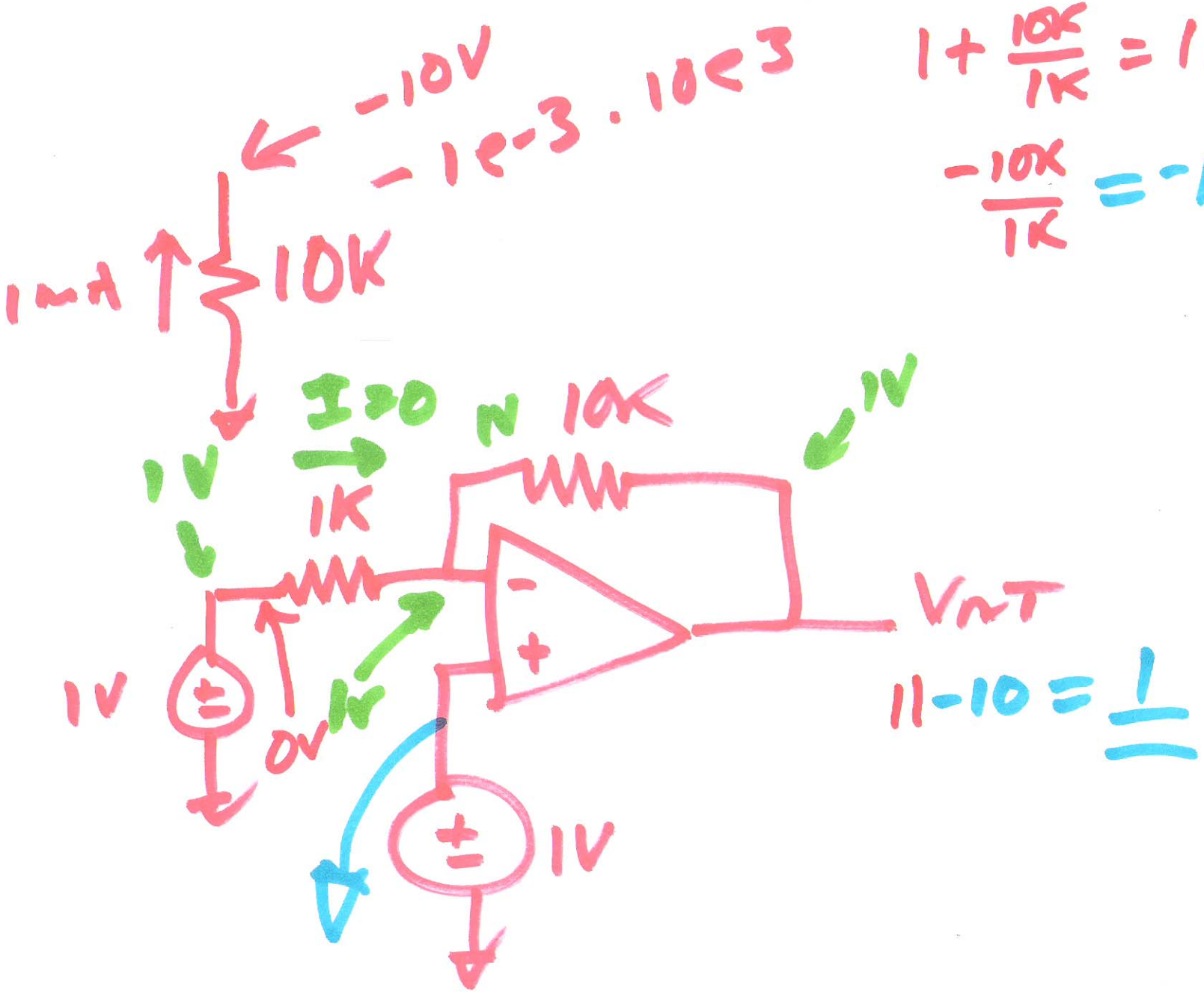


$$\frac{V_{in}}{R_1} + \frac{V_{out} - 0}{R_2} = 0$$

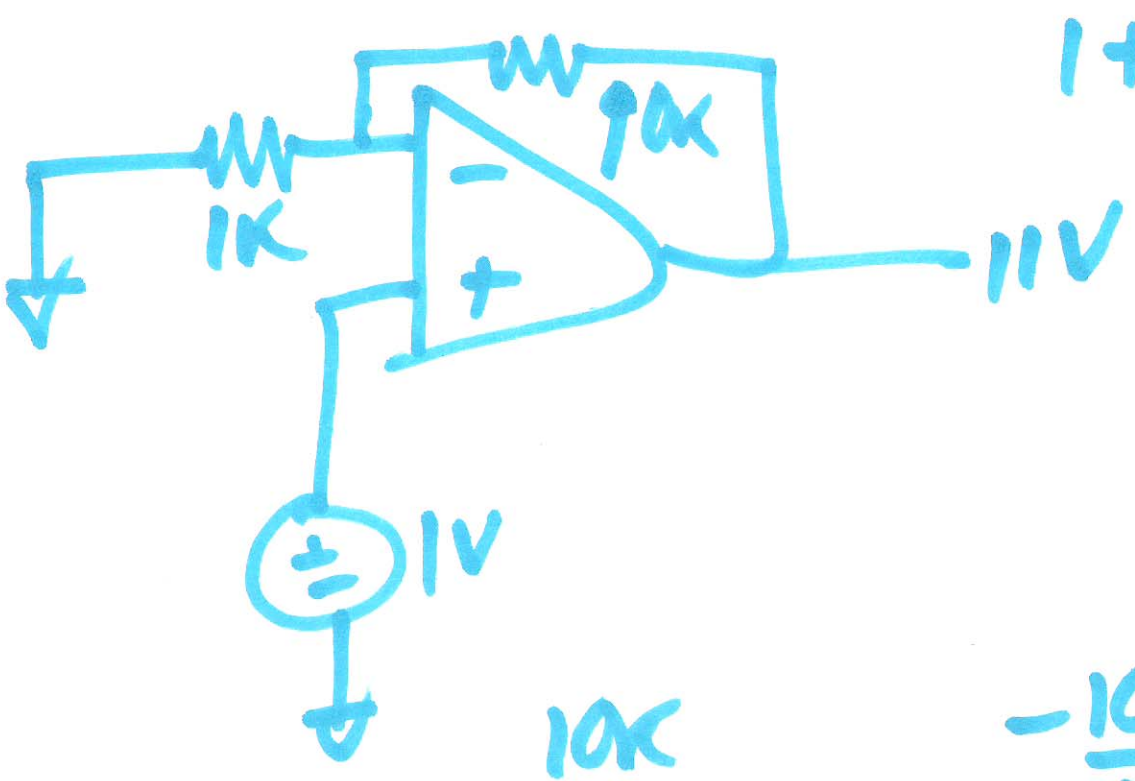
$$\frac{V_{in}}{R_1} = \frac{0 - V_{out}}{R_2}$$

$$\boxed{\frac{V_{out}}{V_{in}} = -\frac{R_2}{R_1}}$$

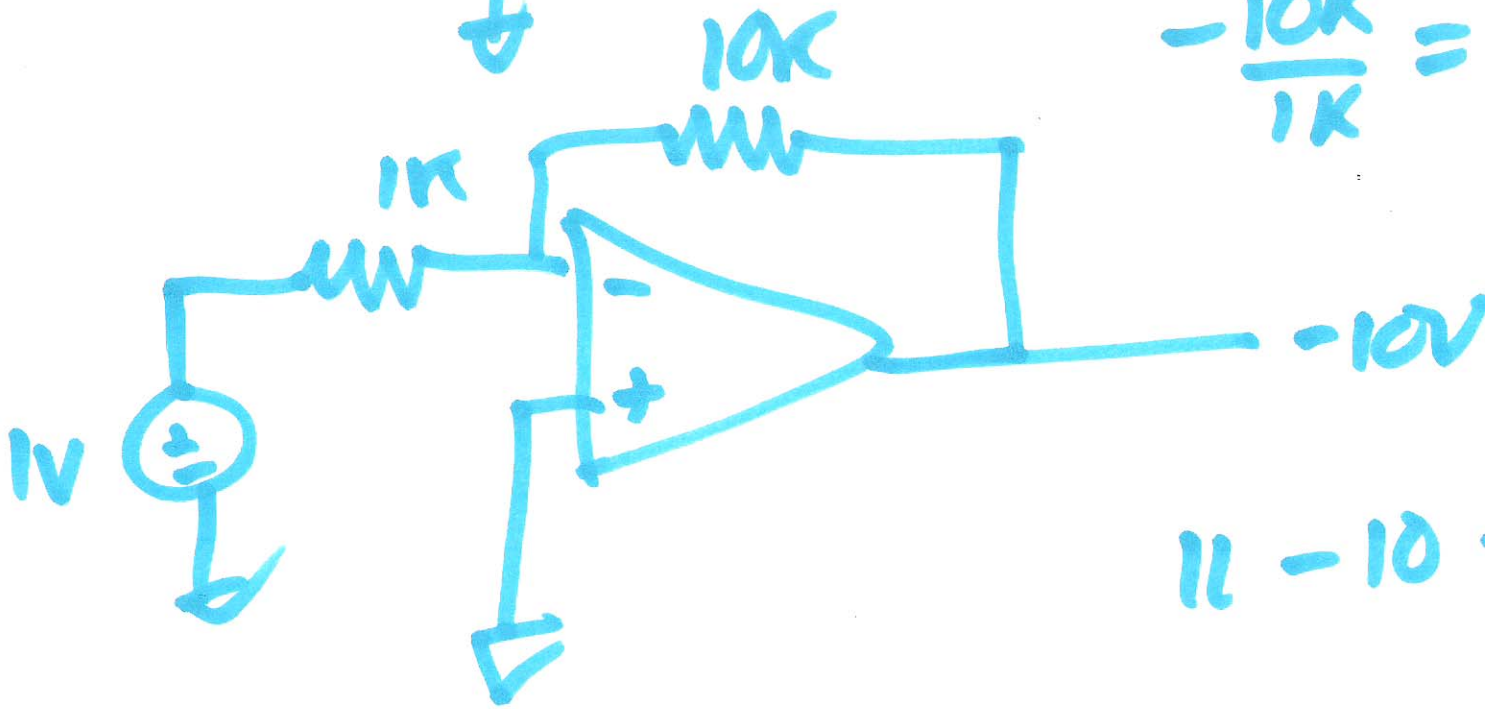
UNLV
UNIVERSITY OF NEVADA LAS VEGAS



UNLV
UNIVERSITY OF NEVADA LAS VEGAS



$1 + \frac{10K}{1K} = 11$



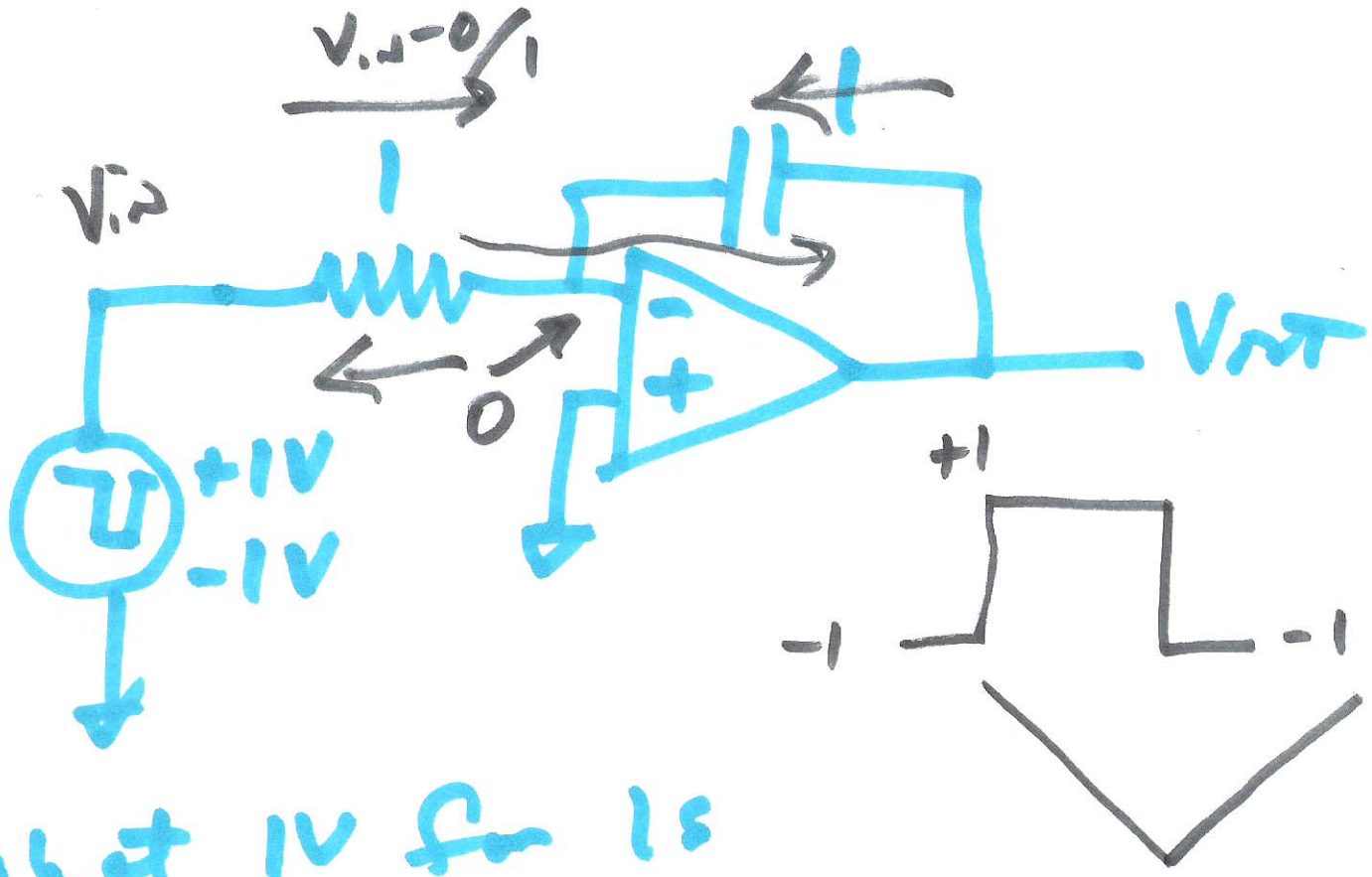
$-\frac{10K}{1K} = -10$

$11 - 10 = \underline{\underline{1V}}$

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

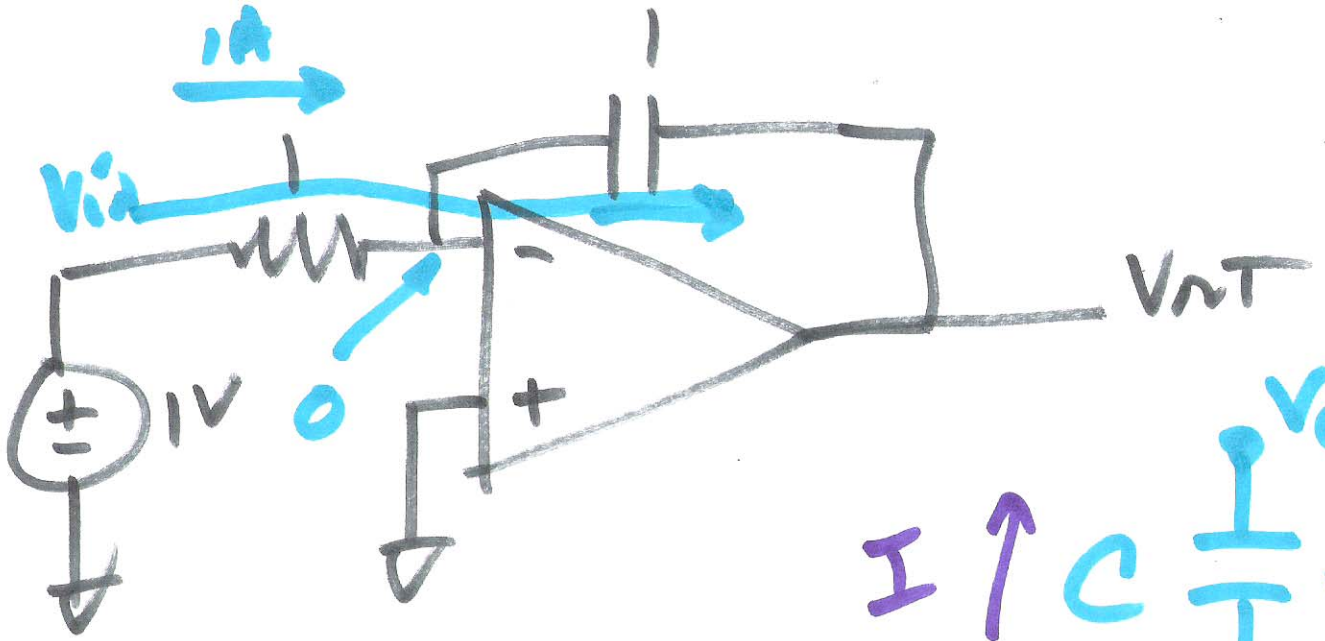
CMOSedu.com

7)



high at 1V for 1s

low at -1V for 1s

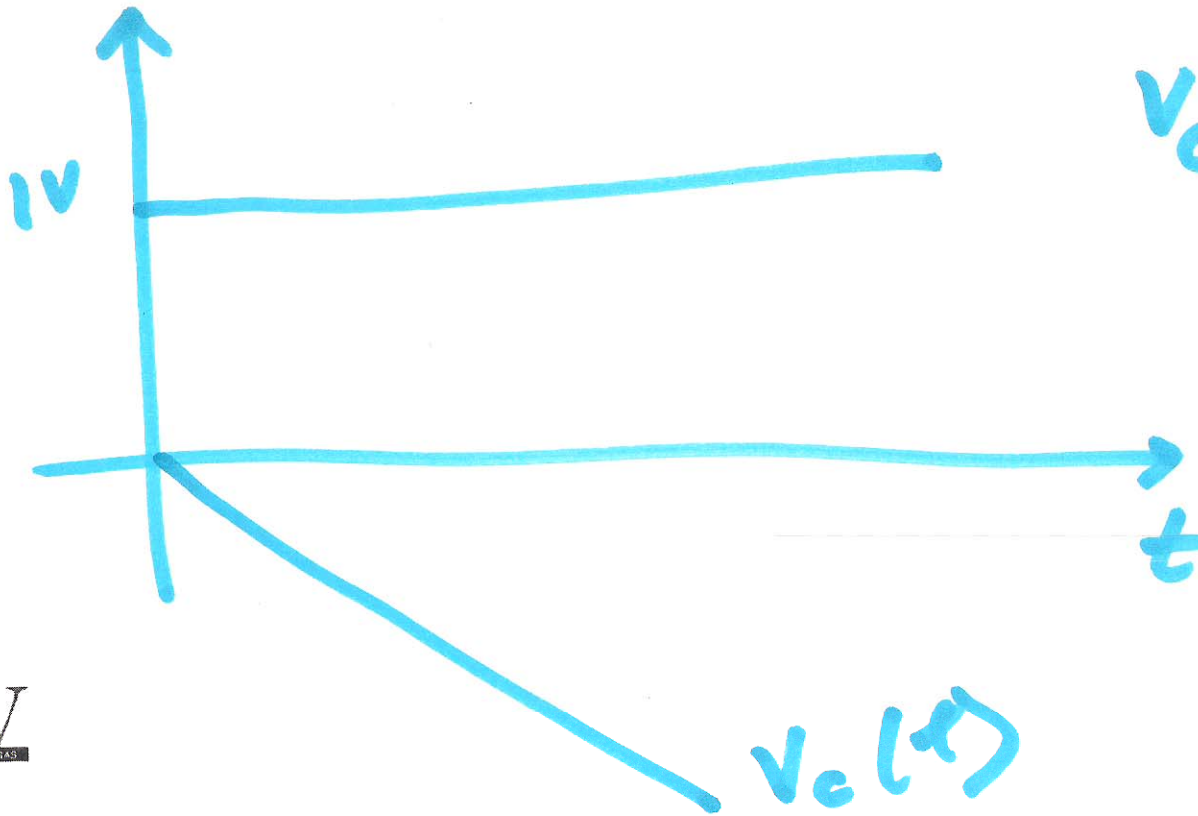


$$I \uparrow C \frac{V_c}{I} \downarrow I$$

$$V_c = \frac{-1}{C}\int_0^t I \cdot dt$$

$$= \frac{I}{C} \cdot t$$

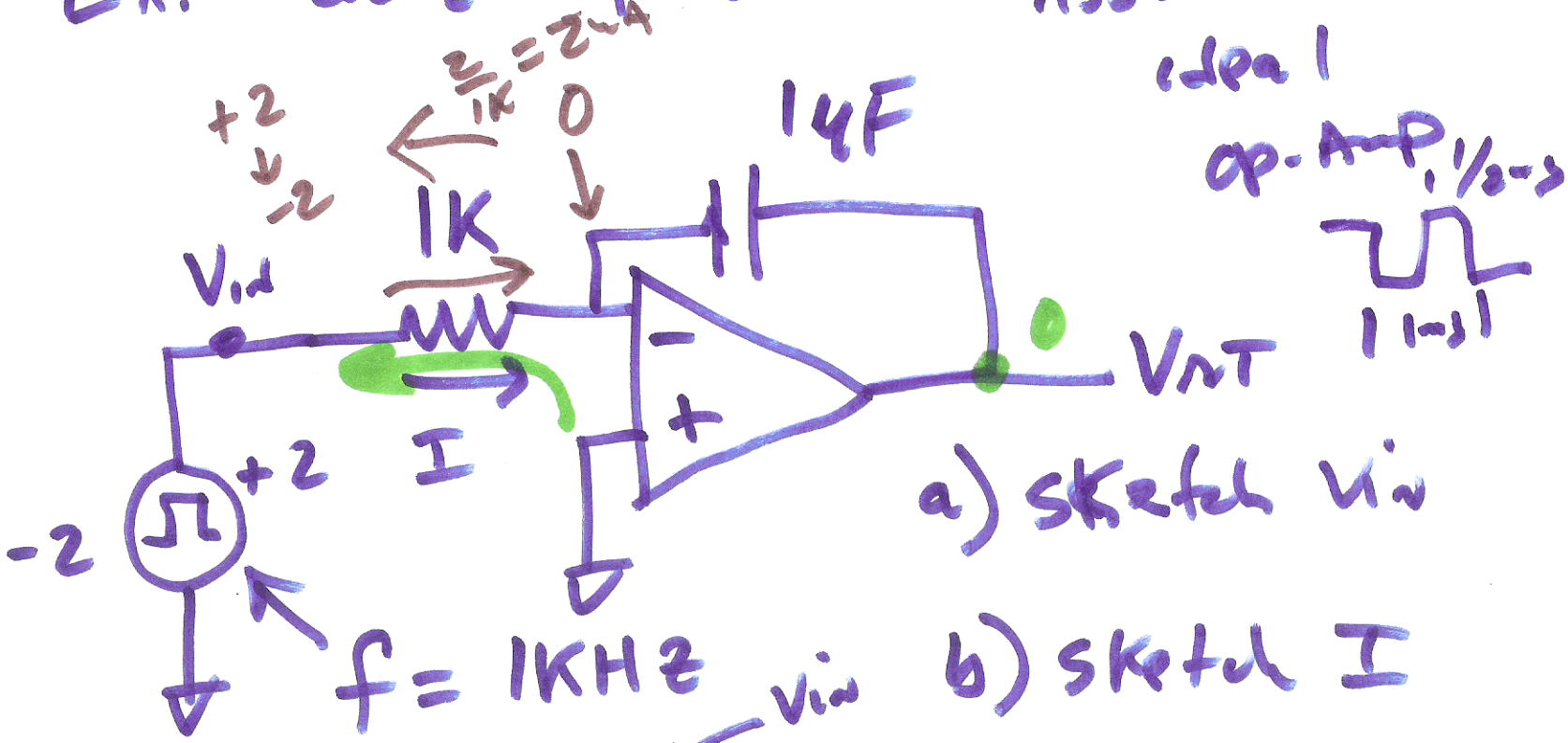
$$\frac{1V}{s}$$



UNLV
UNIVERSITY OF NEVADA, LAS VEGAS

Ex. Quiz Question

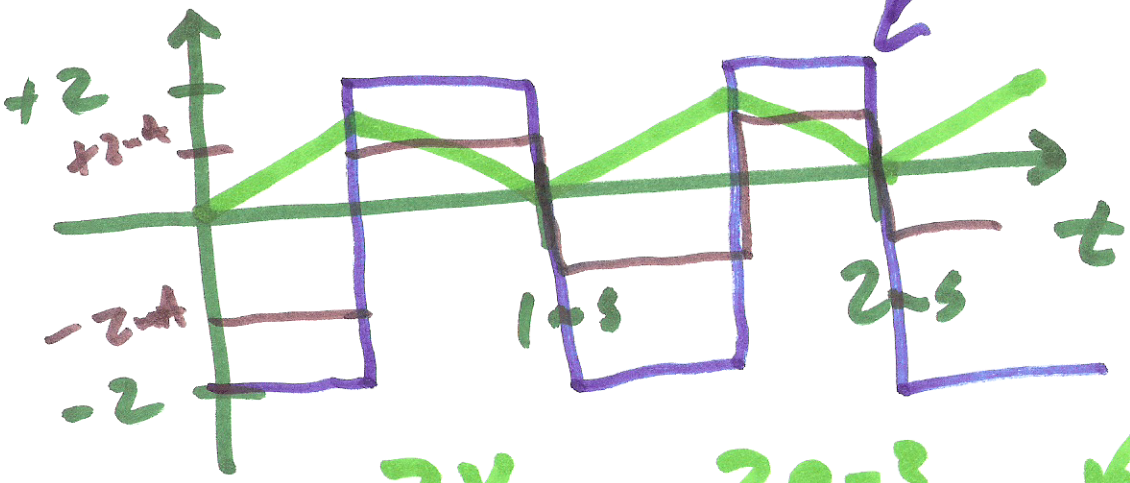
Assume ideal op-Amp, 1/s->



a) Sketch Vin

b) Sketch I

c) Sketch VoT



$$\frac{2V}{ms} = \frac{2e-3}{1e-6}$$

$$V_{oT} = \frac{1}{C}\int_0^{t_{ms}} I \cdot d\tau$$

$$V_{oT} = \frac{2e-3}{1uF} \cdot t$$