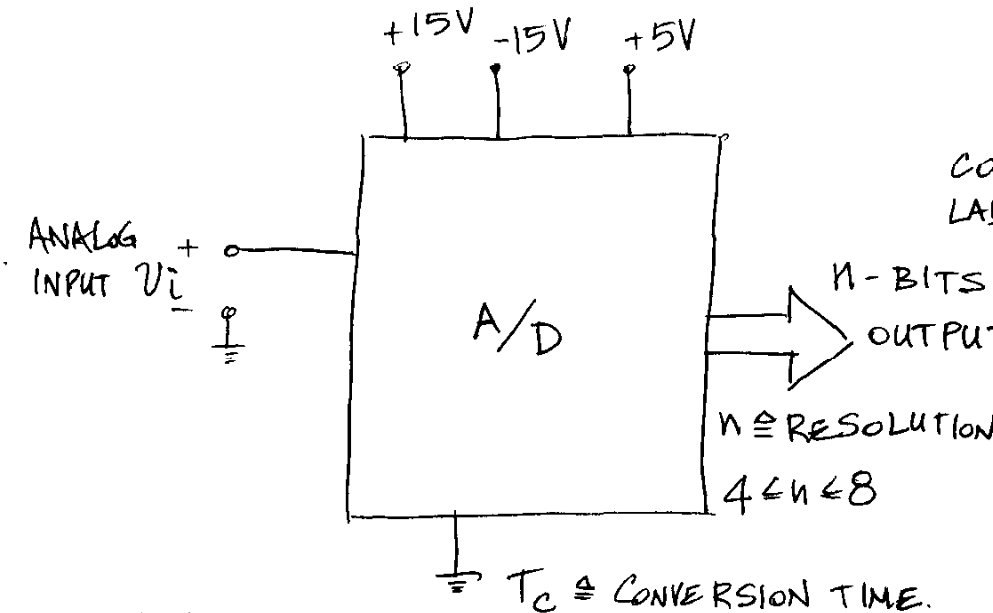
LAB 6: A/D CONVERTER DESIGN
(OR CHOOSE ANOTHER TOPIC)



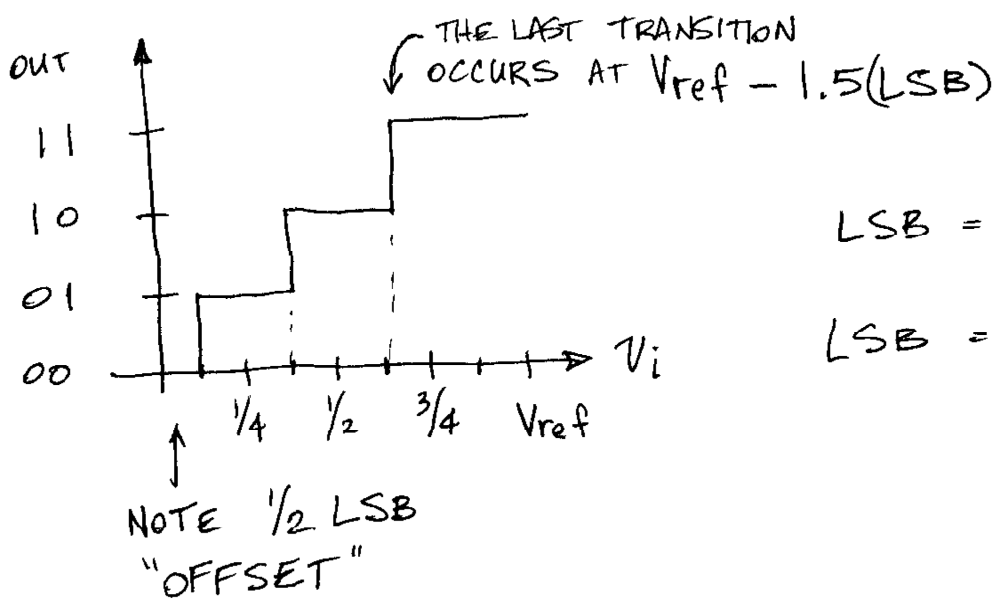
YOU MAY USE ANY COMPONENTS FROM PREVIOUS LABS (INCLUDING DAC0808), AS WELL AS ANY DIGITAL GATES, COUNTERS, LATCHES, ETC.

WHAT IS <u>NOT</u> ALLOWED IS AN A/D CHIP!

$0 \le V_i \le 10V$

$V_{ref} \triangleq$ FULL SCALE VOLTAGE

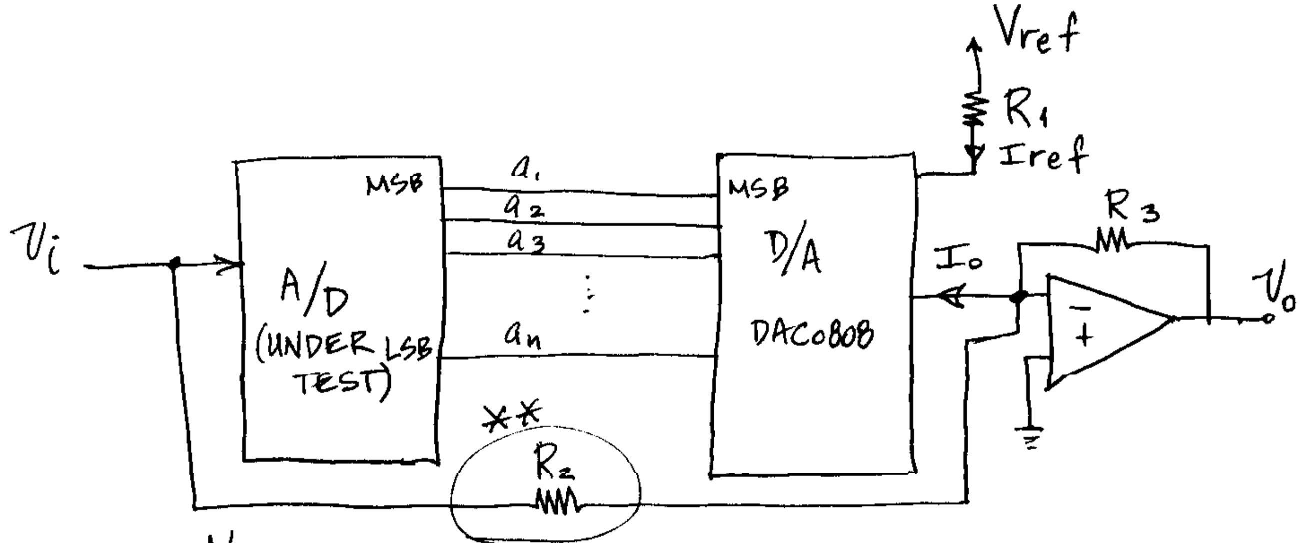
EXAMPLE OF OPERATION FOR $n = 2$



LSB = ANALOG VOLTAGE EQUIVALENT OF 1 BIT

$$LSB = \frac{V_{ref}}{2^n}$$

TESTING OF YOUR A/D CONVERTER



$$I_o = \frac{N}{2^n} \cdot I_{ref}$$

WHERE N IS THE DECIMAL EQUIVALENT OF THE DIGITAL WORD OUTPUT

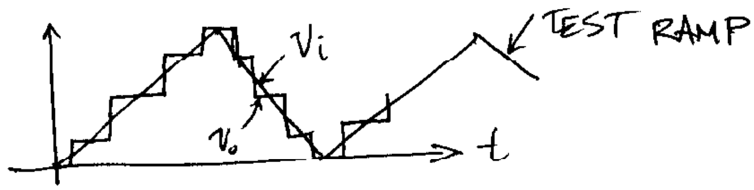
$$N = \sum_{k=1}^{n} a_k 2^{n-k}$$

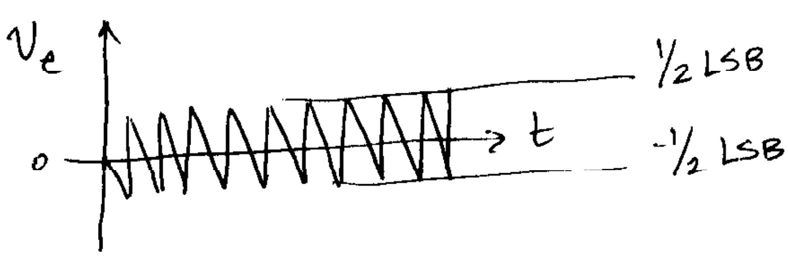
$$V_o = R_3 I_o = R_3 \frac{N}{2^n} I_{ref} = \frac{R_3}{R_1}(V_{ref}) \frac{N}{2^n}$$

IF YOU CHOOSE $R_3 = R_1$, $V_o = V_{ref} \frac{N}{2^n}$

DEFINE:

$V_e = V_i - V_o \triangleq$ ERROR OF A/D





** BY ADDING R_2, V_o BECOMES V_e (ERROR)

MAKE SURE THAT $R_1 = R_2$

$$V_o = V_e = R_3 I_o - \frac{R_3}{R_2} V_i$$

$$V_o = V_e = R_3\left(\frac{N}{2^n}\frac{V_{ref}}{R_1} - \frac{1}{R_2} V_i\right)$$

$$V_e = \frac{R_3}{R_1}\left(\frac{N}{2^n} V_{ref} - V_i\right)$$