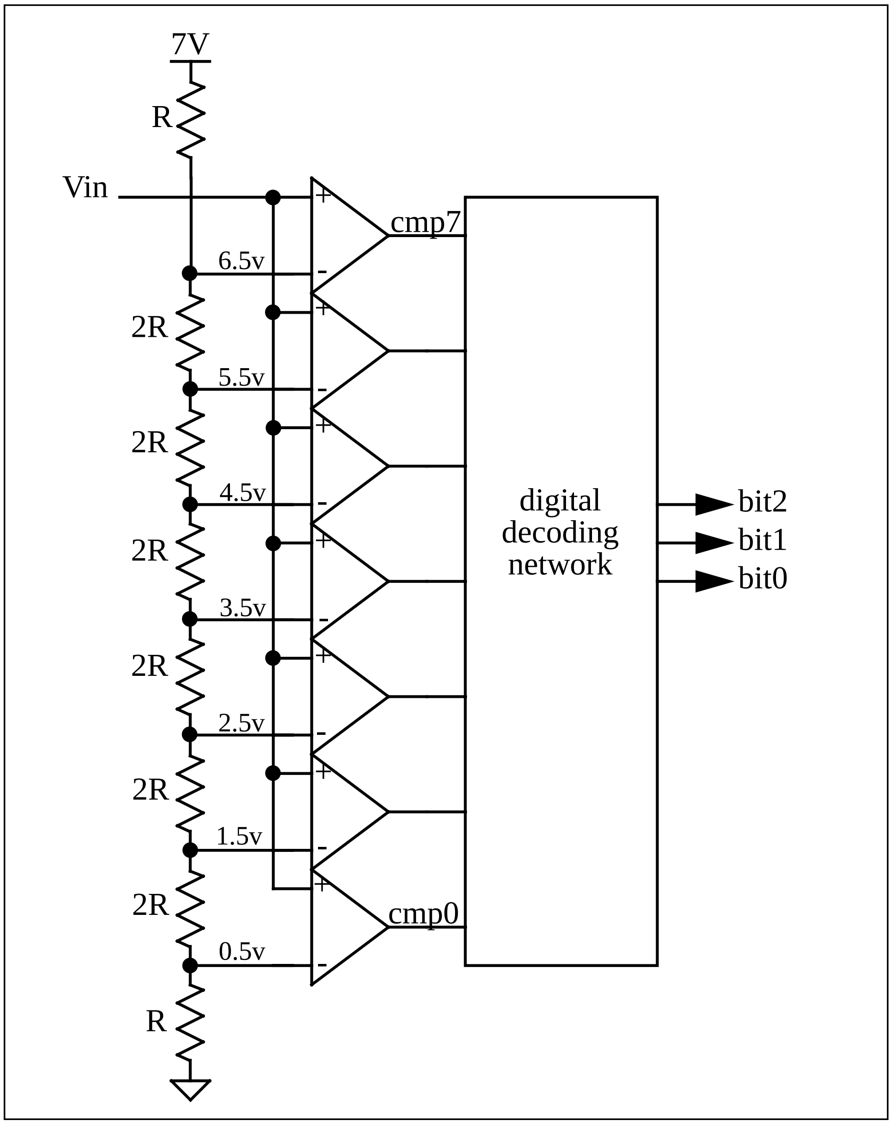
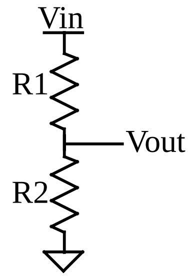
An A to D converter (ADC)

Using the comparator we looked at before, we can implement a A to D converter. Suppose we could produce a set of voltages to serve as reference inputs to multiple comparators. Then we could tell if the input voltage is above or below the reference voltage at each comparator. We could create the reference voltages using resistive voltage dividers as shown below. The resistor network creates the reference voltages required by using only 2 different values of resistor. Their absolute values are not critical as long as R is one-half of 2R.



The voltage at the bottom tap follows the voltage divider equation we studied before.

$$Vout = Vin \frac{R2}{R1 + R2}$$ where;



For the bottom tap on the resistor network we have,

$$Vout = 7\frac{R}{14R} = \frac{7}{14} = 0.5V$$

At the next tap,

$$Vout = 7\frac{3R}{14R} = \frac{21}{14} = 1.5V$$

The reference input to each comparator is connected to one of the voltage reference taps. The output of each comparator indicates if the input signal exceeds that reference input.

The output of each comparator is applied to a digital encoding network. The output of each comparator would correspond to a yes or no decision as to if the input signal exceeded the reference voltage. This network would map the eight possible combinations of comparator outputs to a binary value representing the possible voltages at Vin.

Table 2: Mapping of comparator outputs to DAC output

comparator outputs cmp7 - cmp0	encoding network outputs	voltage indicated by DAC
0000000	000	0
0000001	001	1
0000011	010	2
0000111	011	3
0001111	100	4
0011111	101	5
0111111	110	6
1111111	111	7