Suggested Reading: Read as many of the following as you can. All of the recommended references are on reserve at Barker Library.

1. Lundberg sections 33-37.
2. Gray and Meyer section 4.4.

Problem 1: In the following circuit, assume $I_2=1\text{mA}$ and $\beta=100$.

(a) Express $I_O$ in terms of $I_1$ and $I_2$.

(b) Assume we can tolerate a maximum $I_O$ error due to $\beta$ of 50 percent. For what range of $I_1$ is this circuit valid?

Problem 2: Circuit Dependencies.

When we design a circuit, we prefer that it operate over a wide range of temperature. In the following circuits, assume that $\frac{dR}{dT}=600\text{ppm/°C}$ and $\frac{dV_{bb}}{dT}=-2\text{mV/°C}$. For each of the following circuits, find $\frac{dI_O}{dT}$.

(a) Assume $V_{bb}$ is temperature independent.
(b) Assume the current source, $I$, is temperature independent.

\[
\begin{array}{c}
\text{Problem 3: Wiggler ADCs.} \\
\text{Given a folding amplifier that implements the following function} \\
\end{array}
\]

\[
\text{where } V_F \text{ is } 5V, \text{ indicate the succession of grey codes at the output of a comparator when the input ramps from } -5V \text{ to } 5V \text{ when the folding amplifier is used in the following configuration.}
\]