1. a) In Fig. 1, let \( G_{ch}(z) = \frac{K}{1 - 0.6z^{-1}}, \) \( K=0.4. \) Use the LMS algorithm to adapt a 2-tap FIR equalizer. Use \( \beta = 0.01. \)

Preset the equalizer coeffs so \( Eq(z) = 1 + 0.2z^{-1}. \) Initially. Plot the coeffs versus time. Also plot \( MSE[n] \approx \frac{1}{20} \sum_{i=0}^{19} e^2[n-i]. \) Show 5000 samples.

b) Repeat (a) using a 4-tap FIR equalizer. What do you notice?

c) Repeat (a) using \( \beta = 0.02. \) Compare (a) and (c).
d) Repeat (a) using channel $G_{ch}(z)$ with $K=1$. Compare (d) with (a).

2. In Fig. 1, let $G_{ch}(z) = 1 - 0.6z^{-1}$.

a) Use a 5-tap equalizer, initialized to $E(2) = 1 + 0.2z^{-1} + 0.2z^{-2} + \ldots + 0.2z^{-4}$. Use $\beta = 0.01$. Plot the coeffs vs. time and the \text{MSE}[n]$ vs. time $n$.

b) Repeat (a) using a 10-tap equalizer. Compare the coeff values and the MSE in (a) vs (b).

3. For a partial-response Class 4 channel, $G(z) = 1 - z^{-2}$ (or "1-0z^n"). Plot $|G(z = e^{j\omega T})|$.
For the analog multiplier shown above, \( i_0 = i_{op} - i_{on} \).

a) Simulate this circuit to find \( A \) in \( i_0 = A N_x N_s \). Make sure all transistors are saturated and use the models in

whurst/215/MOS_models
(also on the 215 web page).

b) Let \( N_x \) be the coeff input \( (C_i) \) and \( N_s \) be the signal input \( (X[n-i]) \) in an analog FIR equalizer. Linearity from the \( X[n-i] \) input to the output must
meet a spec. For $N_x = 0.6 \text{V}_{dc}$, determine the amplitude allowed at $N_5$ to give a total distortion of -40 dB at $f_0$. (Use $N_5 = B \sin(2\pi f_0 t)$, and use .Four to find the distortion - or .FFT.)