1. The SNR at the output of the channel is 25 dB. An AGC adds noise $n$ that is 10 dB below the noise at the channel output. What is the SNR after the AGC?

\[ \text{SNR} = 25 \text{dB} \quad \text{SNR} = ? \]

2. \[ x[n] = g[n] r[n] \]

A discrete-time AGC is shown above. Let \( r[n] = A \cdot (-1)^n \). Use \( g = G \) and \( \mu = 0.01 \).
a) simulate this AGC. Use \( G[0] = 1 \) and \( A = 0.2 \) Plot \( G(n) \) and \( x(n) \) vs. \( n \).

b) repeat a) with \( A = 5 \).

c) Compare the results of a) and b).

d) Try 3 different values of \( \mu \). What changes when \( \mu \) changes?

e) Let \( g = G + 0.01G^3 \). Simulate the AGC. Does this nonlinearity cause a problem? Why or why not?

f) Introduce a dc offset at the input to the d-time integrator of 0.1. What is its effect? Explain. (Use \( A = 0.2 \).)

g) Add an offset of 0.1 to \( r[n] \). What is its effect? Explain. (Use \( A = 0.2 \).)
3. Plot the magnitude and phase vs. frequency for the \( \frac{z^{-1}}{1-z^{-1}} \) integrator. Compare its mag & phase to that of a C-t integrator: \( \frac{1}{s} \). How are they similar? How do they differ? (using simulation results)

4. Compute the Peak/rms ratio for the channel input and output below:

- \( \text{Input: } a(n) \)  
- \( \text{Channel: } \frac{0.25z^{-1}}{1-0.75z^{-1}} \)  
- Sample rate = bit rate  
- = bit rate.

\[ \text{Peak} = \text{peak magnitude} \]
\[ \text{rms} = \sqrt{\text{Var}(\cdot)} \]