ECEG 470/670 Communication and Information Systems Fall 2025

Selected Answers to Graded Problems in HW #5

Remember to explain all answers in your solutions. You will not receive credit for merely repeating an answer given here. If an answer is not given below, it is either because the solution is trivial or because disclosure of the answer would reveal too much of the solution to the problem.

If you suspect that an answer below is incorrect, please let me know as soon as possible.

1. $n = 9$, SQNR = 46 dB [The SQNR is slightly worse for companding compared to the answer to G Prob. 1 of HW #4 for uncompressed PCM because the message signal has a very high amplitude. Note, though, that companding yields a comparable SQNR with one less bit.]

2. $B_T = 28$ kHz, SQNR = 32 dB

3. a. $d_p = 2A\sin\left(\frac{\omega T_s}{2}\right) = 2A\sin\left(\frac{\pi f}{f_s}\right)$ $\rightarrow$ $d_p = 59$ mV [This value is greater than m_p, which is 50 mV. That is not a mistake. For this very simple system that uses a first-order predictor, the SNR is actually worse for DPCM than for PCM for sinusoidal message signals with frequencies greater than $f_s/6$, as will be shown in the solution to Part **b**.]
b. The SNR degrades by a factor of 0.72 or −1.4 dB.

4. a. $E_{\min} = 1.3$ V, if $m(t)$ is expressed in the volt unit
b. $N_o = 60$ mW, if $m(t)$ is expressed in the volt unit and power is normalized to 1 Ω
c. SNR = 28 dB