Question list is from Communication Systems Engineering (Proakis) V2 and Digital Communications (Proakis) V5:

Q1: Communication Systems Engineering (Proakis Q-7.10)
Q2: Communication Systems Engineering (Proakis Q-7.42)
Q3: Communication Systems Engineering (Proakis Q-7.34)
Q4: Digital Communications (Proakis Q-4.39)

Binary PAM

Alternatives:

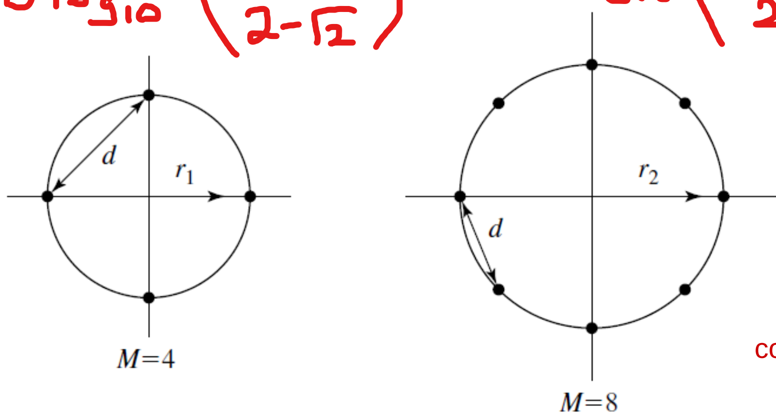
$$P(e) = Q\left[\sqrt{\frac{2E_b}{N_0}}\right]$$

$$E_b = A^2 T_b$$

Questions

1. A binary PAM communication system employs rectangular pulses of duration Tb and amplitudes ±A to transmit digital information at a rate $R_b = 10^5$ bps. If the power-spectral density of the additive Gaussian noise is $N_0/2$, where $N_0 = 10^{-2}$ W/Hz, determine the value of A that is required to achieve a probability of error $P_b = 10^{-6}$. Q function table a göre çöz
2. Consider the four-phase and eight-phase signal constellations shown in the figure. Determine the radii r1 and r2 of the circles, such that the distance between two adjacent points in the two constellations is d. From this result, determine the additional transmitted energy required in the 8-PSK signal to achieve the same error probability as the four-phase signal at high SNR, where the probability of error is determined by errors in selecting adjacent points.

$$P_{add\,dB} = 10\log_{10}\left(\frac{d^2}{2-\sqrt{2}}\right) - 10\log_{10}\left(\frac{d^2}{2}\right)$$



cosine law

q3 is same as q1

3. Suppose that binary PSK is used for transmitting information over an AWGN with power-spectral density of $N_0/2 = 10^{-10}$ W/Hz. The transmitted signal energy is $E_b = A^2T/2$, where T is the bit interval and A is the signal amplitude. Determine the signal amplitude required to achieve an error probability of 10^{-6}, if the data rate is (a) 10 kbps, (b) 100 kbps, (c) 1 Mbps.
4. Assuming that it is desired to transmit information at the rate of R bits/s, determine the required transmission bandwidth of each of the following five communication systems, and arrange them

in order of bandwidth efficiency, starting from the most bandwidth-efficient and ending at the least bandwidth-efficient.

- Orthogonal BFSK
- 8PSK
- QPSK
- BPSK
- Orthogonal 16-FSK

bandwidth efficiency
r = R/W = 2log2(M)/N