Project 1: Simulation of ML and MAP estimation

Digital Communication Systems

1 Objective

The objective of this project is to simulate maximum likelihood (ML) and maximum apriori probability (MAP) estimation. We will simulate the estimations for varying input distributions.

2 Details

2.1 Simulation parameters

1. Let the input probability distribution be $(q, 1-q)$. Generates values of q from the set $\{0, 0.01, 0.02, \ldots, 1\}$.
2. For each q from the above set, transmit 10^5 bits through two channels:
   (a) Channel A: a BSC with transition probability 0.35.
   (b) Channel B: a channel with transition probability 0.35 when the input is zero and 0.4 when the input is 1.

   At the output, perform both ML and MAP detection.
3. For each q, calculate the probability of error (fraction of incorrect estimations) for both estimation methods in both the channels.

2.2 Output

Generate two figures (one for each channel) with

1. q on the x-axis
2. probability of error on the y-axis
3. each figure should show two plots, one each for indicating the probability of error for ML and MAP estimation.

3 Submission

Submit two files:

1. A .pdf file containing the (copy-pasted) script and the figures.
2. A .py file containing the script.