## EE 703: Digital Message Transmission (Autumn 2020)

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Assignment 6: 20 points Date: November 3, 2020

- 1. [10 points] Derive the ML estimator of the parameter p given M independent observations  $Y_i \sim \text{Bernoulli}(p)$  where i = 1, 2, ..., M.
- 2. [10 points] Suppose X and Y are jointly Gaussian random variables. Let the joint pdf be given by

$$p_{XY}(x,y) = \frac{1}{2\pi |\mathbf{C}|^{\frac{1}{2}}} \exp\left(-\frac{1}{2}(\mathbf{s} - \boldsymbol{\mu})^T \mathbf{C}^{-1}(\mathbf{s} - \boldsymbol{\mu})\right)$$

where 
$$\mathbf{s} = \begin{bmatrix} x \\ y \end{bmatrix}$$
,  $\boldsymbol{\mu} = \begin{bmatrix} \mu_x \\ \mu_y \end{bmatrix}$  and  $\mathbf{C} = \begin{bmatrix} \sigma_x^2 & \rho \sigma_x \sigma_y \\ \rho \sigma_x \sigma_y & \sigma_y^2 \end{bmatrix}$ .

Suppose Y is observed and we want to estimate X. Derive the MMSE estimator of X.