Problem 1. Solve a hypothesis testing problem with probability of false alarm at most $\beta$ in the following setting. Given that $X = 0$, $Y$ is uniformly distributed between 0 and 1. Given that $X = 1$, $Y$ has the distribution $f(y|1) = \frac{3}{2} \times 1\{0 \leq y \leq \frac{1}{2}\} + \frac{1}{2} \times 1\{\frac{1}{2} \leq y \leq 1\}$.

Problem 2. Let $X_1, X_2, \ldots, X_n$ be i.i.d. geometric random variables with parameter $p$. Find $\text{MLE}[p|X_1, X_2, \ldots, X_n]$. 