1. Concept Review:
   - Interval estimators
   - UMP test and Karlin-Rubin Theorem (Revisit)
   - More about hypothesis tests

2. Exercises
   (a) Let $X_1, \ldots, X_n \overset{iid}{\sim} U(\theta, 1)$ and denote $T = \min\{X_1, \ldots, X_n\}$
      i. Derive the density of $T$ and show the family of the distribution has MLR property.
      ii. Give the UMP test of size $\alpha$ for $H_0 : \theta \leq 0$ versus $H_1 : \theta > 0$. Specify all the required constants.
      iii. Suppose we collect a sample of size 10 and observe $t = 0.1$, what is the $p$-value of the test?
   (b) Let $X_1, \ldots, X_n \overset{iid}{\sim} N(\mu, \sigma^2)$ both $\mu$ and $\sigma^2$ are unknown
      i. Argue that $\sqrt{n}(\overline{X} - \mu) / \hat{S}$ is a pivotal quantity, where $\overline{X}$ and $S^2$ are sample mean and variance, respectively. Then construct an equal-tailed confidence interval.
      ii. Justify that the interval above has the shortest length.
   (c) Let $X_1, \ldots, X_n$ be a random sample from $\Gamma(2, \theta^{-1})$
      i. Argue there is no UMP test for testing $H_0 : \theta = 1$ versus $H_1 : \theta \neq 1$.
      ii. Find the UMP test for testing $H_0 : \theta \leq 1$ versus $H_1 : \theta > 1$
      iii. Derive a LRT for testing the hypothesis in (i)
      iv. Invert the LRT above to construct a $1 - \alpha$ confidence interval.

3. Open for questions.