1. If the data is in the critical region we...
   (a) □ Accept $H_0$
   (b) □ Reject $H_0$
   (c) □ It depends on the nature of the test
   (d) □ It depends on the size of the test

2. Saying that a test is of size 5% means that...
   (a) □ The probability to accept $H_0$ when $H_0$ does not hold is $\leq 0.05$
   (b) □ The probability to reject $H_0$ when $H_0$ it holds is $\leq 0.05$
   (c) □ Both

3. If the $p$−value of a test is small we ...
   (a) □ Accept $H_0$
   (b) □ Reject $H_0$
   (c) □ It depends on the nature of the test
   (d) □ It depends on the size of the test

We have a collection of random variables $X_i, Y_i$ which correspond to non paired simulation results with configuration 1 or 2. How can you test whether the configuration plays a role or not ?
   (a) □ With a Wilcoxon Rank Sum test
   (b) □ With an ANOVA test
   (c) □ With either
   (d) □ With none

4. We test whether a distribution is gaussian using a Kolmogorov-Smirnov test against the fitted distribution. We obtain a $p$−value.
   (a) □ The true $p$−value is smaller
   (b) □ We have obtained the true $p$−value
   (c) □ The true $p$−value is larger
(d)  □  It depends on the data

5. We have two data sets $X_i$ and $Y_j$ believed to be iid and from one exponential distribution each. We want to test whether the parameter of their exponential distribution is the same.

Give the design of a corresponding likelihood ratio test. Give a formula for the $p$–value when $m, n$ are large.

6. We have some data set $\bar{Y} = Y_{i=1:t}$ modelled with a parametric model with $\theta \in \Theta$. Let $f_{\bar{Y}}(\bar{y}|\theta)$ be the PDF of the observation $\bar{y} = y_{1:t}$. We assume that we have a method to compute $\hat{\theta}(\bar{y})$, the maximum likelihood estimator of $\theta$ for value of the data set $\bar{y}$.

   (a) Give a likelihood ratio test for the test
   \[ H_0 : \theta = \theta_0 \text{ versus } H_1 : \theta \in \Theta \]

   (b) Give the pseudo-code of an algorithm to compute the $p$–value of this test using Monte–Carlo simulation with $R$ runs.

   (c) We run this algorithm with $R = 10,000$ and find $p = 0$. Give a 99% confidence for the true $p$–value. What can we conclude at a size of 5% ?

7. We consider again the case in the previous question. Using Monte-Carlo simulation, we have obtained a 99% confidence interval $[\ell(\bar{y}), u(\bar{y})]$ for the $p$–value. We reject $H_0$ if the true $p$ is small, but since we don’t know the true $p$–value, we use the rejection condition $u(\bar{y}) < \alpha$. What value of $\alpha$ should we chose to ensure that this way of doing provides a test of size 5% ?