PERMUTATION TEST EXERCISES

Implement the bivariate Spearman rank correlation test for independence as a permutation test. The Spearman rank correlation test statistic can be obtained using the R function **`cor.test()`** with **`method = "spearman"`**. Compare the achieved significance level of the permutation test with the p-value reported by **`cor.test()`** on the two different samples of data that you generate as per these instructions:

Use the **`mvrnorm()`** function to generate two correlated pairs of samples to test. In the first example, the two samples are bivariate normal; in the second, lognormal. The p-values for **`cor.test()`** and **`spear.perm()`** (a function you create yourself) should be approximately equal in both cases:

```
spear.perm <- function(x, y){
   (your permutation function work goes here)
}

library(MASS)
mu <- c(0, 0)
Sigma <- matrix(c(1, 0.5, 0.5, 1), 2, 2)
n <- 30
R <- 499

# samples are bivariate normal:
x <- mvrnorm(n, mu, Sigma)

# exact estimate:
cor.test(x[,1], x[,2], method = 'spearman')

# estimate from your simulated function:
spear.perm(x[,1], x[,2])

# samples are lognormal
x <- exp(mvrnorm(n, mu, Sigma))

# exact estimate
cor.test(x[,1], x[,2], method = 'spearman')

# estimate from your simulated function:
spear.man(x[,1], x[,2])

# p-values for both tests are both
# significant and close in value
```