Computer Exercise 1 Solutions

1. The sample averages for some estimators could be close to the true values. Don't be surprised if you see some are far away.

2. The probability of committing Type I error should be the same as the level of significance. Hence we should expect $t1err$ to be close to 0.05.

3. The further the wrong test value is from the true value, the higher the power of the test should be. That is why the power function has an inverted bell shape. Since we do no generate many artificial data sets, our estimates of the power function are not very accurate. This is why you see the power function is not smooth and has many zig-zags. The minimum value should be close to the level of significance and it should appear near the true value (2) if our power function estimates are accurate enough. The specific values you obtain should be different from others'.

4. You should have different results.

5. As s increases, our estimates should be more accurate and the power function should become smoother. The changes should become smaller with larger $!s$. $\hat{\beta}_1$, $\hat{\beta}_2$ and $\hat{\sigma^2}$ should be unbiased. As we increase $!s$, their sample averages should be closer and closer to their true values. But $\hat{\sigma}$ is biased. Its sample average is around 9.2 for large s, which means $E(\hat{\sigma}) \neq 10$ (our true value). It does not matter if you try larger values of s.

6. Although the larger is s, the more accurate are our results, there is a computation cost involved. It takes more time to run the program for larger s. The shapes of the histograms for $b1hat$ and $b2hat$ should look similar to normal distribution while the histograms for $sigmahat$ and $sigmasqhat$ are kind of skewed. You can calculate the Jarque-Bera statistics.

7. You will not see much change in the sample averages for $b1hat$, $b2hat$ and $sigmasqhat$ since they are unbiased. (Unbiasedness is not related to sample size.) But the sample average of $sigmahat$ should be closer to the true value since the bias will decrease with the increase of the sample size. The mouth of the bell for the power function should

become narrower since with a bigger sample size the power of the t test should get higher.

8. Yes, all the estimators are consistent as can be confirmed in the tighter histograms with bigger sample size: the maximum of the vector containing the estimates should get smaller (e.g. `max(b2hat)`) and the minimum should get bigger. The t-test is consistent since the power becomes unity for more wrong values with the increase of the sample size.

9. The true values of the intercept, slope and the variance of the error term should not affect any properties of the estimators. If we change the significance level (a), the estimate $t1err$ should change and also the power function curve for different sample sizes.