Lab Assignment # 2: The Central Limit Theorem and Simulations in R

Question 1.

Let X be the random variable associated to drawing a fair dice with outcomes 1,2,3,4,5,6. Suppose X_1, \dots, X_{30} be i.i.d as X.

a) Find the distribution of the random variable $\bar{X} = \frac{X_1 + \dots + X_{30}}{30}$ using CLT. Plot this distribution.

b)This time do not use the CLT, instead by running a simulation in R find the mean and variance of \bar{X} . You can use the "sample" function in R to roll your dice!

c) Plot the distribution found in the first and second part in the same graph.

Question 2.

Let $X, Y \sim U_{[0,1]}$ independent find the following probabilities

- 1. X + Y > 2 (In this case you can compute it mathematically using convolution integrals too. Compare your result.)
- 2. $X + Y > 5X\sqrt{Y}$ (Is it easy to compute this mathematically?)

The more iterations we do, the more exact our answer would be. Increase the number of the iterations until the result becomes almost fixed for both parts. Present the plot of the results against the number of the iterations to show this for both parts.

Note: You can only submit your lab assignment printed or hand written with appropriate graphs printed out form R. Emails are not accepted. Also, note that the way you present your solutions is considered a part of your skills and a portion of the mark is devoted to that.