1. De Moivre's Central Limit Theorem.

   (a) Using the `rbinom` generate 100 samples of Binomial$(20, 0.5)$ and plot the histogram of the data-set.

   (b) Using the `rnorm` generate 100 samples of Normal(10, 5) and plot the histogram of the data set.

   Think of ways you can enhance the above exercise to come up with a computer proof of the Central Limit Theorem.

2. Poisson Approximation

   (a) Using the `rbinom` generate 100 samples of Binomial(2000,0.001), save it in a dataframe `dfbinomial` and plot the histogram of the data-set.

   (b) Using the `rpois` generate 100 samples of Poisson(2), save it in a dataframe `dfnormal` and plot the histogram of the data set

   Think of ways you can enhance the above exercise to come up with a computer proof of the Poisson Approximation, even though we have seen a proof in class.

3. The following result is a Berry-Eseen Type bound.

   Theorem: *Let $X_n \sim$ Binomial(n, p), then there exists $C > 0$ such that*

$$\sup_{x \in R} \left| P\left(\frac{X_n - np}{\sqrt{np(1-p)}} \leq x\right) - \int_{\infty}^{x} \frac{\exp(-\frac{y^2}{2})}{\sqrt{2\pi}} dt \right| \leq \frac{(p^2 + (1-p)^2)}{2\sqrt{np(1-p)}}$$

   We shall prove it by simulation by the below algorithm.

```
For x = -2,-1.9,-1,8,...0,...,1.9,2
    using inbuilt pnorm find z[x]:- pnorm(x)
Set p
For m = 1,50,100,150,...,1000
    For x = -2,-1.9,-1,8,...0,...,1.9,2
      1)Generate B: 1000 Samples of Binomial (m,p) using inbuilt rbinom function
        Compute SB:  (B-m*p)/((m*p(1-p))^(0.5))
      2)Compute y[x] : the proportion of samples  in SB less than equal to x
      3)Repeat steps 1) and 2) 100 times and compute average --  my[x] over each trial.
      4)Calculate   diff[m]=  max(abs(my[x]- z[x]))

For m = 1,50,100,150,...,1000
    Calculate  error(m)= [p^2+(1-p)^2]/[2*(m*p*(1-p))^0.5]

Plot diff and error.
```

   See if result is verified by picture. Can you do anything additional to verify the Theorem ?