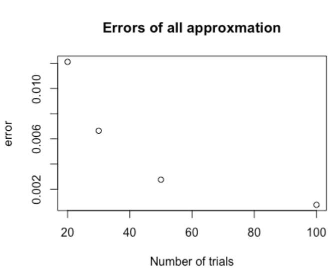
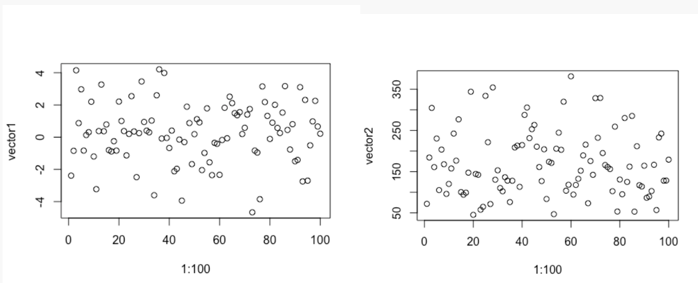
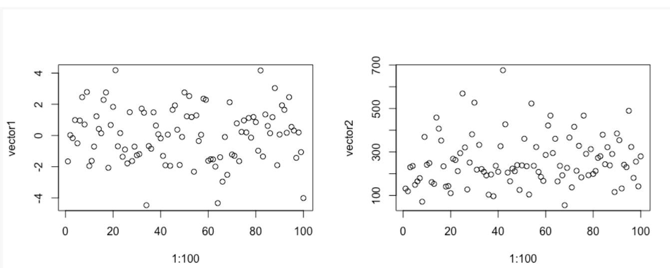
```r
#Tyler Sulsenti
#HW 2
#1.

#i
p = 0.4
m = 8.25
n <- c(20,30,50,100)
for(i in 1:4) {
  print(paste("P(N<=8.25) for n =", n[i] ,"is:", pbinom(8.25, n[i], p)))
}

## [1] "P(N<=8.25) for n = 20 is: 0.595598725312224"
## [1] "P(N<=8.25) for n = 30 is: 0.0940112158300952"
## [1] "P(N<=8.25) for n = 50 is: 0.000230522860591324"
## [1] "P(N<=8.25) for n = 100 is: 5.43112664040676e-13"

#ii
## Laplace Theorem
for(i in 1:4){
  num = (m - n[i]*p)
  sigma = sqrt((n[i]*p)*(1-p))
  print(paste("The normal approximation through the Laplace Theorem for n=", n[i], "is:",
pnorm(num/sigma)))
}

## [1] "The normal approximation through the Laplace Theorem for n= 20 is: 0.545424253017067"
## [1] "The normal approximation through the Laplace Theorem for n= 30 is: 0.0811252499236159"
## [1] "The normal approximation through the Laplace Theorem for n= 50 is:
0.000347007256425347"
## [1] "The normal approximation through the Laplace Theorem for n= 100 is: 4.55759723740118e-
11"

#iii
error = c()
for(i in 1:4){
  phat = 8.25/n[i]
  errorApprox = (phat*(1-phat))/n[i]
  error[i] = errorApprox
  print(paste("The error of approxmination for n=", n[i], "is:", error[i]))
}

## [1] "The error of approxmination for n= 20 is: 0.0121171875"
## [1] "The error of approxmination for n= 30 is: 0.00664583333333333"
## [1] "The error of approxmination for n= 50 is: 0.0027555"
## [1] "The error of approxmination for n= 100 is: 0.0007569375"

plot(n,error, xlab ="Number of trials")
title(main = "Errors of all approxmation")
```



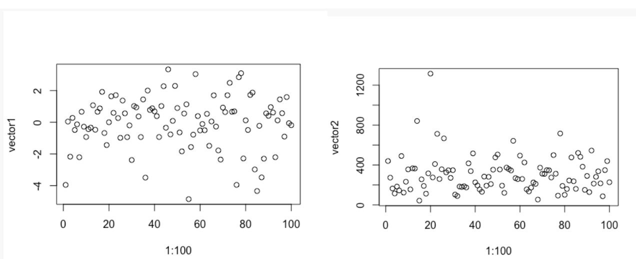
```
#iv
## Based on the error plot in iii, i can see that the error gets smaller and smaller the more trials, n, that there are.
#2 -> this function covers the compuations for i, ii, and iii.
hw2_func = function(n, times){
  vector1 = c()
  vector2 = c()
  for(i in 1:times){
    x = rnorm(n,2,3)
    xbar = mean(x)
    numerator = xbar-2
    denominator = sqrt((3) / n)
    compute1 = numerator/denominator
    numerator = (n-1) * var(x)^2
    compute2 = numerator/3^2
    vector1 = c(vector1, compute1)
    vector2 = c(vector2, compute2)
  }
  plot(1:100, vector1)
  plot(1:100, vector2)
}
```




```
#i hw2_func(20, 100)
```




```
#ii hw2_func(30, 100)
```




```
#iii hw2_func(50, 100)

#iv
## We can see based upon the information in i, ii, and iii, that while n increases in value, the result of the fucntion (xbar - 2)/sqrt((3^2) / n) stays near 0 or becomes 0
## However, in the fucntion ((n - 1)S^2)/3^2, as the value of n increases, so does the reuslt of the function
```