Question 1

Part A: Generating a Random number, and storing it as mymean

```
> #Generating a random number
> mymean<-round(runif(1,1,100))
> mymean
[1] 26
```

Part B: Generating a sample size of 25 from a normal distribution

```
> # Part b, Generating a random sample of size 25 from Normal distribution
> Muhammad <- rnorm(25,mymean,10)
```

Part C: Getting the lower and upper CI values

```
> #Getting Mean of my random sample, and adding it to the margin of error.
> lower<-mean(Muhammad)+qnorm(0.01)*10/sqrt(25)
> upper <- mean(Muhammad)-qnorm(0.01)*10/sqrt(25)
> lower
[1] 21.74962
> upper
[1] 31.05501
```

As we can see, the 98% Confidence Interval is (21.74962 , 31.05501). We can conclude that the value 26, is indeed inside the confidence interval.

Question 2

```
> # Question 2
> mycount2 <- 0
> for (i in 1:50){
+   mysample <- rnorm(20,mymean,10)
+   aa <- mean(mysample) + qnorm(0.1)*10/sqrt(20)
+   bb <- mean(mysample)+qnorm(0.9)*10/sqrt(20)
+   if(aa<mymean & mymean<bb) mycount2<-mycount2+1
+ }
> mycount2
[1] 41
```

- We set the counter, mycount2 to 0. Then the loop iterates 50 times. For each iteration, it chooses 20 random integers from the N(mean=26, sigma = 10) of sample size 20.
- It then calculates aa and bb, which gets you the 10^{th} percentile and the 90^{th} percentiles
- Then the if statement says if mymean is inside the 80% confidence interval i.e: between aa and bb, then increment mycount2 by 1. It does this for each iteration from 1 to 50.
- The expected value should be: 50*(probability of mymean being within CI) = 50*0.8 = 40.
- As we can see, the value mycount2 is extremely close to it's expected value which is 41.

Question 3

```
> for (i in 1:75){
+   mysample<-rnorm(15,mymean,10)
+   cc <- 2*pnorm(abs(mean(mysample)), mymean,10/sqrt(15))
+   if (cc<=0.04) mycount3<-mycount3+1
+ }
> mycount3
[1] 2
```

- We first set the counter to 0
- Then the loop iterates 75 times.
- For each iteration, it takes a sample of size 15 with mymean = 26 (from pervious parts) and standard deviation = 10. Then it feeds that to get the probability of it from the normal distribution, with the absolute value of mean(mysample) as the quantile, mymean as the mean, and sigma/sqrt(n) as the standard deviation. All of this information, is calculated as the pvalue of a 2tailed test which is then stored inside cc. If that pvalue is below or same as alpha, i.e cc <= 0.04 it increments the count. It does this for 75 times.
- The expected value is 75*pvalue = 75*0.04 = 3 which is very close to our value.