HW6

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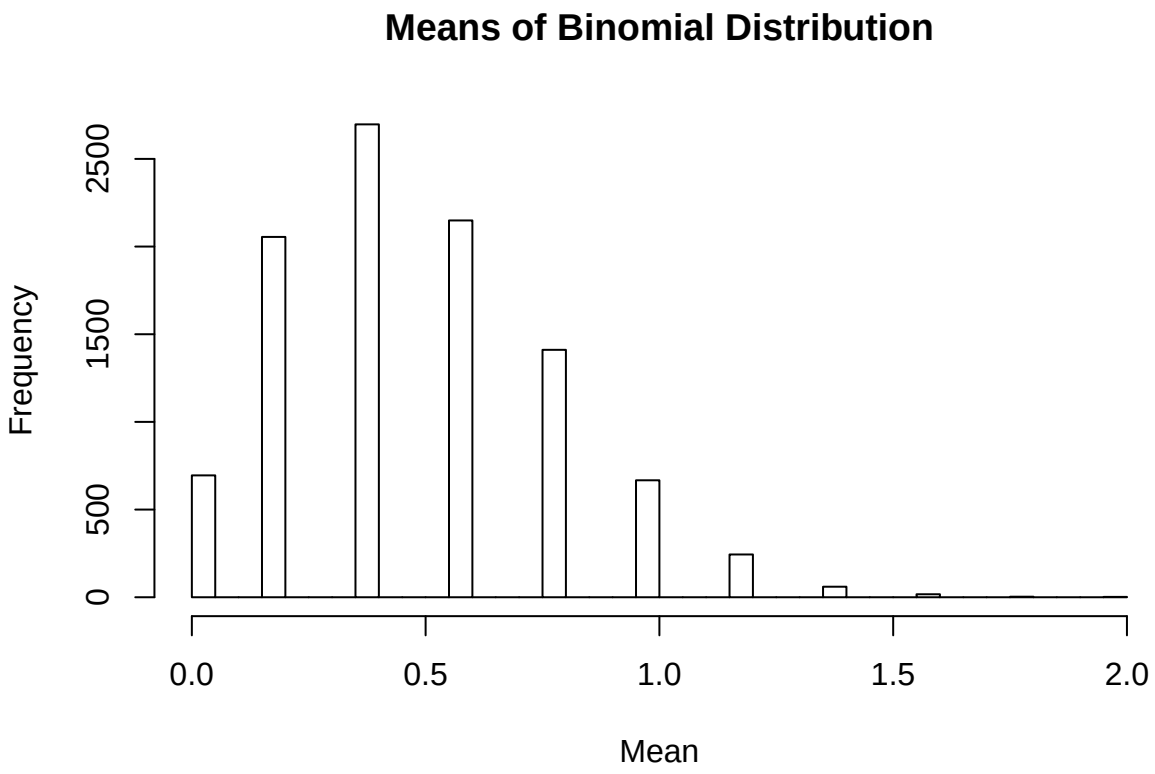
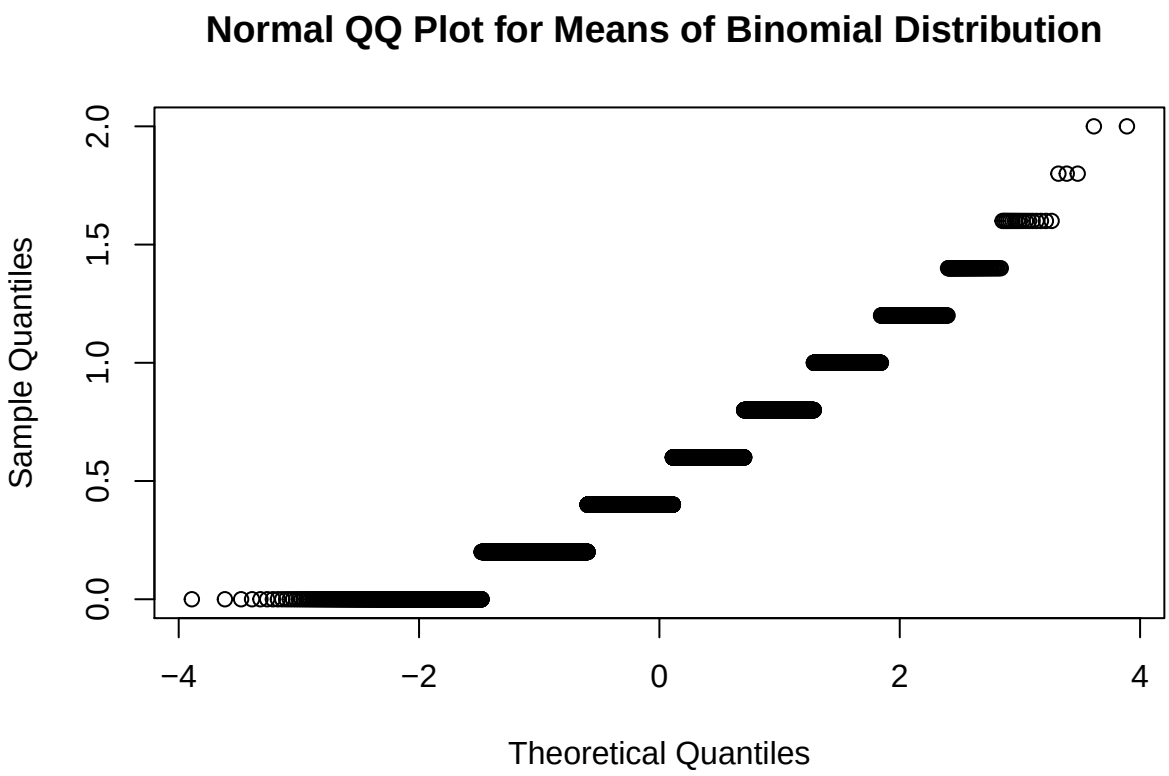
```
centralLimit = function(nsamps,nb,trials, ps, hist=FALSE, qqnorm=FALSE){
    set.seed(193857)
    binomSamps = vector("list", nsamps)
    for(i in 1:nsamps){
        binomSamps[[i]] = rbinom(n=nb, size=trials, prob=ps)
    }
    mymeans = sapply(binomSamps, mean)
    if (hist==TRUE && qqnorm==TRUE){
        hist(mymeans, breaks=35, main="Means of Binomial Distribution", xlab="Mean")
        qqnorm(mymeans, main="Normal QQ Plot for Means of Binomial Distribution ")
        }
    else if (hist==TRUE){
        hist(mymeans, breaks=35, main="Means of Binomial Distribution", xlab="Mean")
        }
    else if (qqnorm==TRUE){
        qqnorm(mymeans, main="Normal QQ Plot for Means of Binomial Distribution ")
        }
}
```

5 Observations

```
centralLimit(10000, 5, 5, .1, hist=TRUE, qqnorm=TRUE)
```

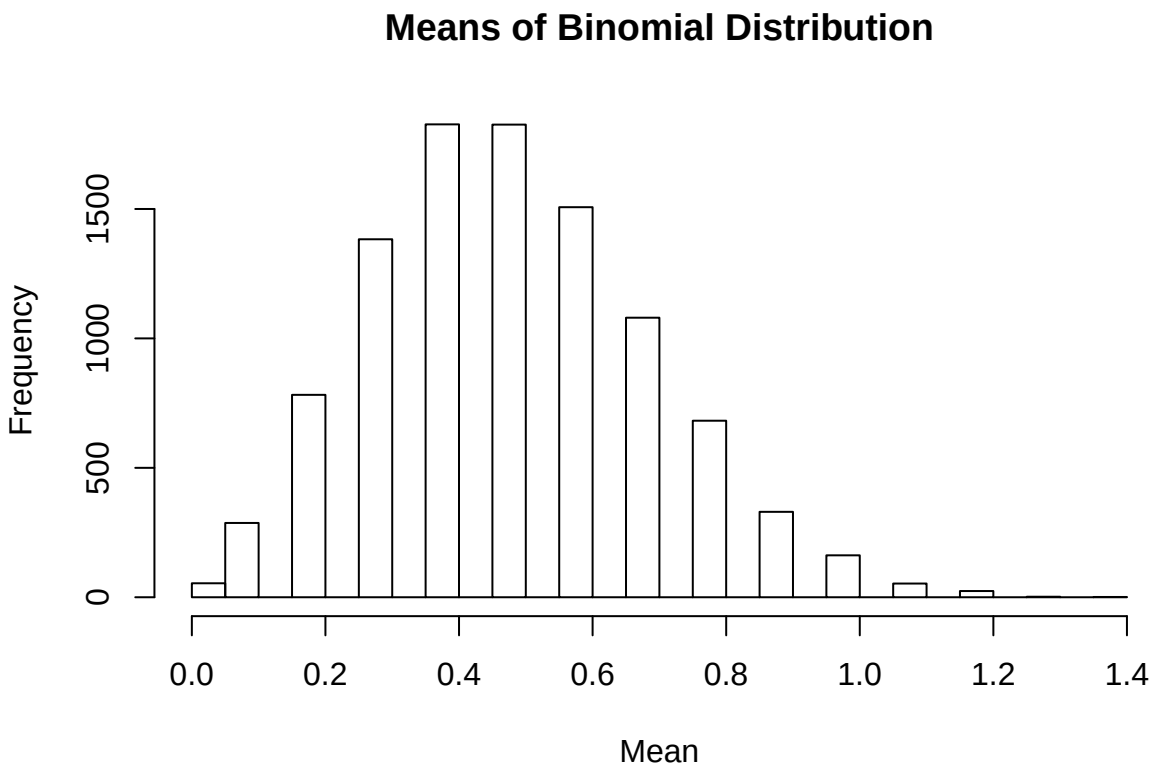

Means of Binomial Distribution
Frequency
0
500
1500
2500
0.0
0.5
1.0
1.5
2.0
Mean

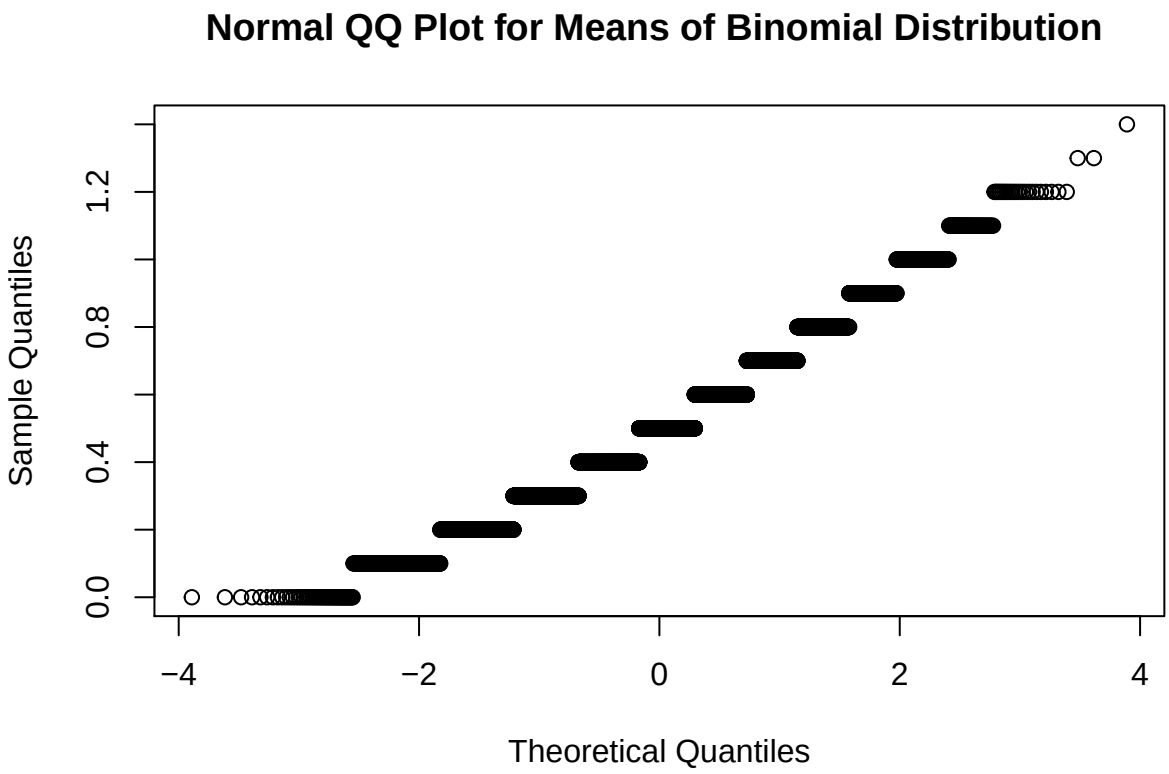


The histogram shows the means are unimodal and clustered around 0.2 to 0.6, and skewed a lot to the right with values as high as 1.6. Due to the significant skewness it is not normally distributed. The normal qq plot of the means show the data is not normally distributed because they are not in a straight diagonal line and look like steps. It also shows the means are skewed to the right because of the points being in the bottom right corner of the graph.

10 Observations

```
centralLimit(10000, 10, 5, .1, hist=TRUE, qqnorm=TRUE)
```

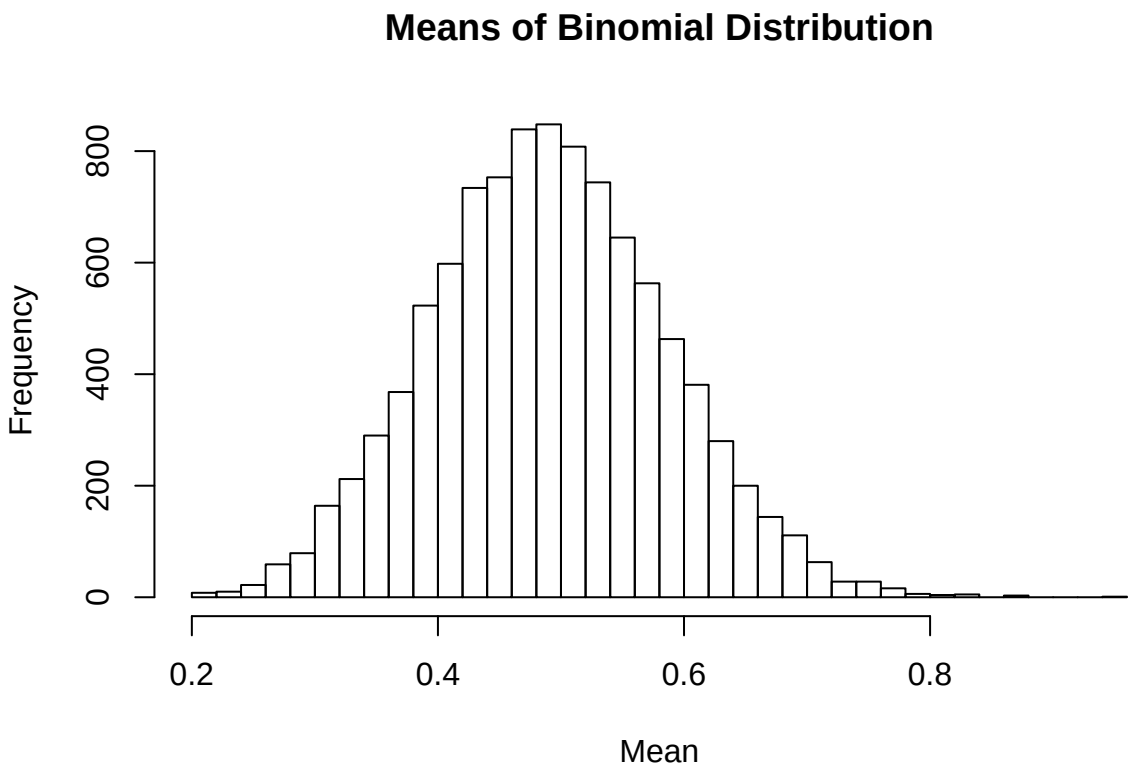

Means of Binomial Distribution
Frequency
0
500
1000
1500
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Mean

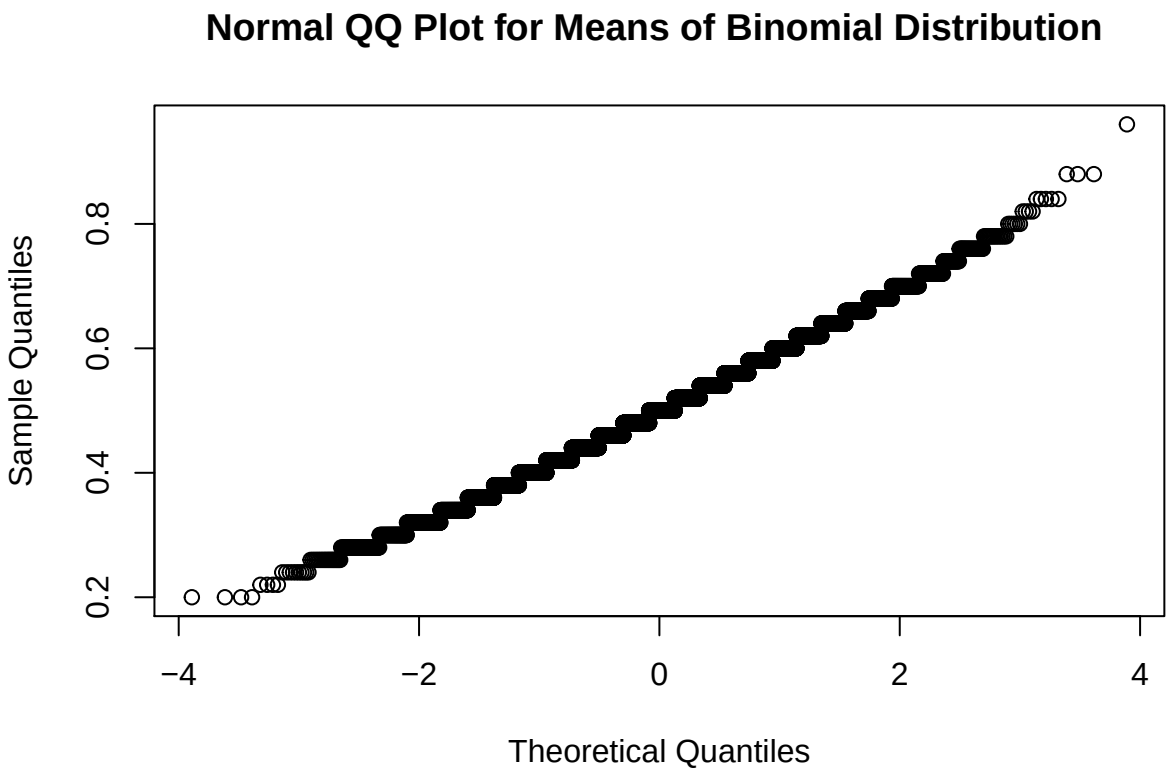


The histogram of the means are unimodal and clustered from around 0.2 to 0.8, and skewed somewhat to the right. Due to the skewness and tail on the right side it isn't quite normally distributed. The normall qq plot of the means show the data is close to a straight line, but still skewed to the right slightly and still look like steps. This suggests it is not normally distributed.

50 Observations

```
centralLimit(10000, 50, 5, .1, hist=TRUE, qqnorm=TRUE)
```

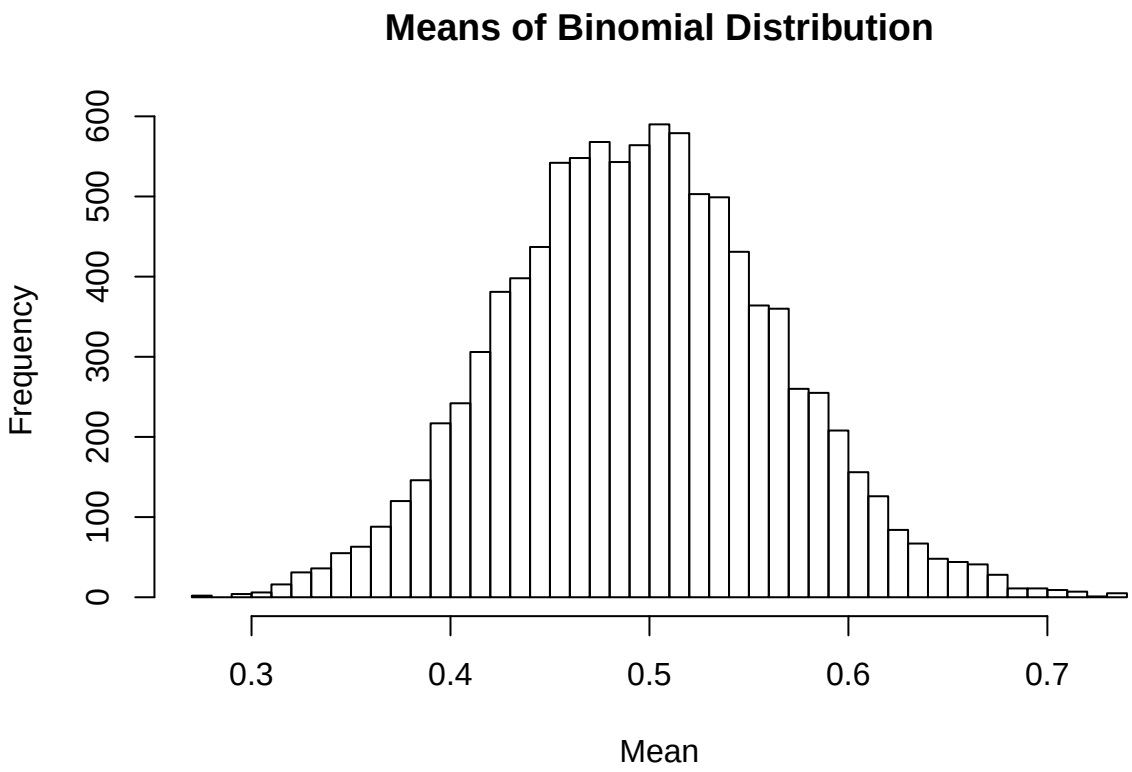

Means of Binomial Distribution
Frequency
0
200
400
600
800
0.2
0.4
0.6
0.8
Mean

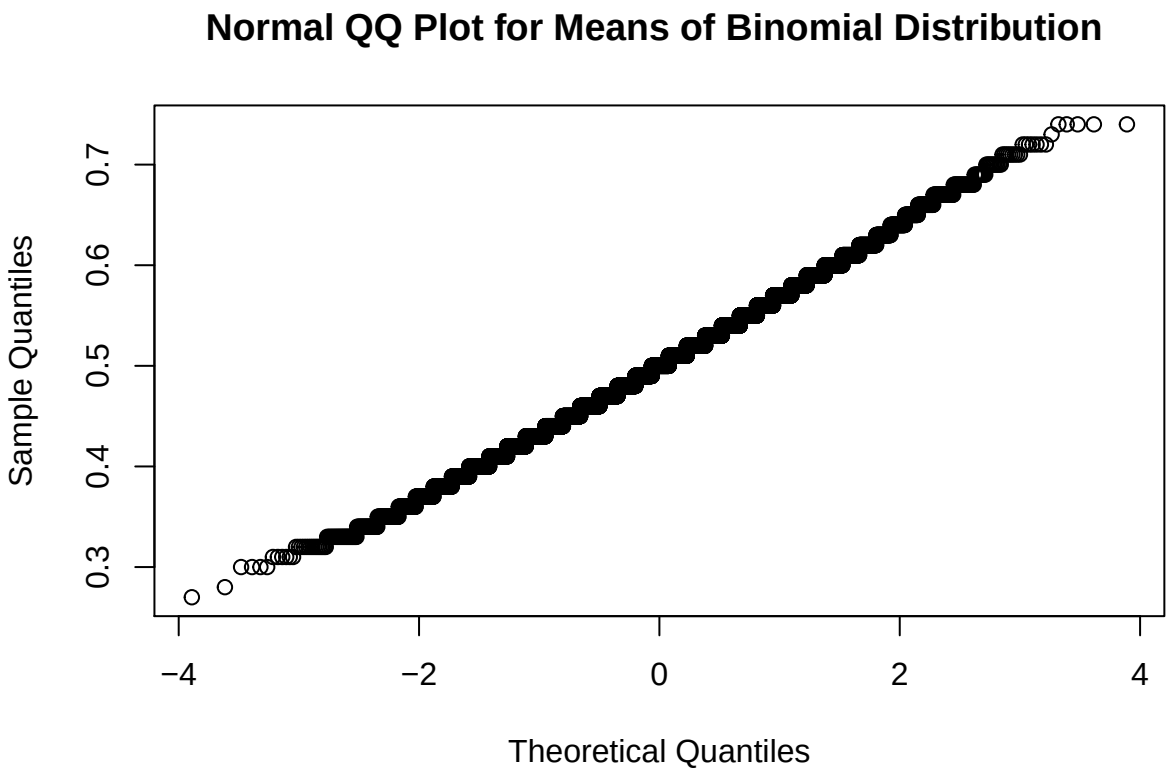


This histogram is unimodal with its peak at about 0.5, and means clustered from 0.4 to 0.58. The min is 0.2 and the max is 1. There is slight tail on the right, otherwise the means look close to normal. The normal qq plot has a slight right bend and showing slight steps else it is very straight and almost normal.

100 Observations

```
centralLimit(10000, 100, 5, .1, hist=TRUE, qqnorm=TRUE)
```

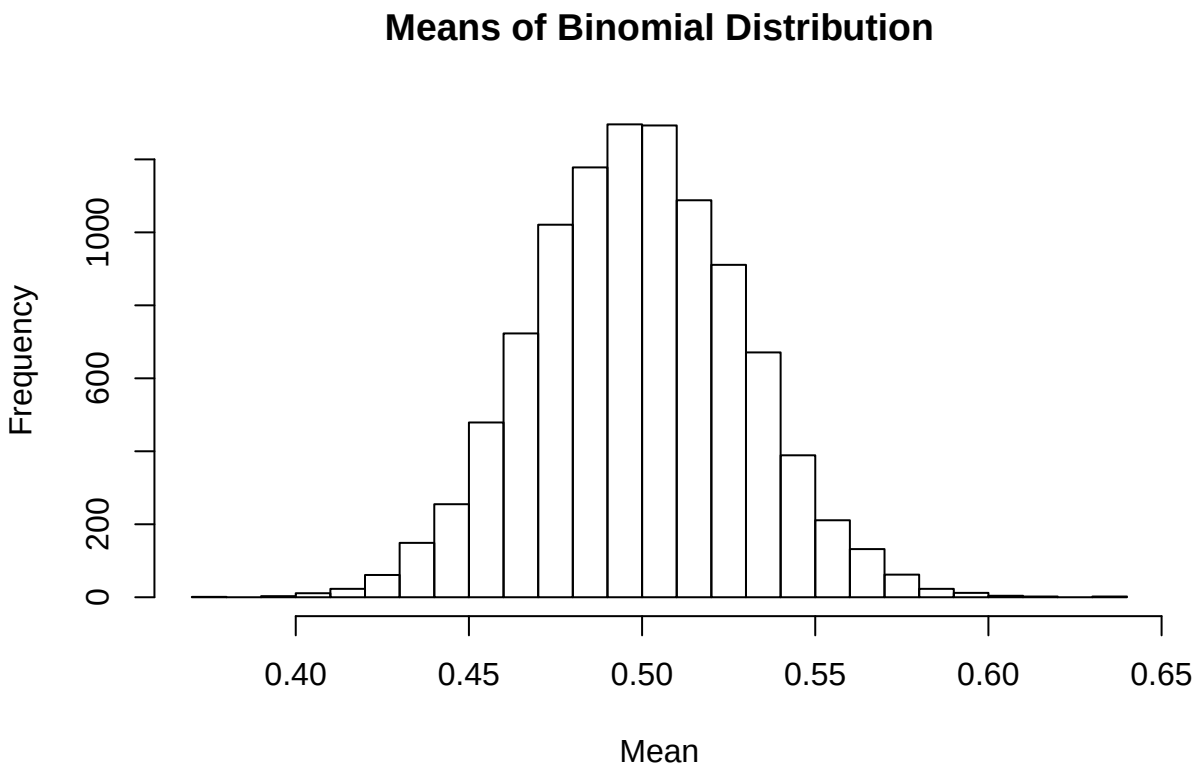

Means of Binomial Distribution
Frequency
0
100
200
300
400
500
600
0.3
0.4
0.5
0.6
0.7
Mean

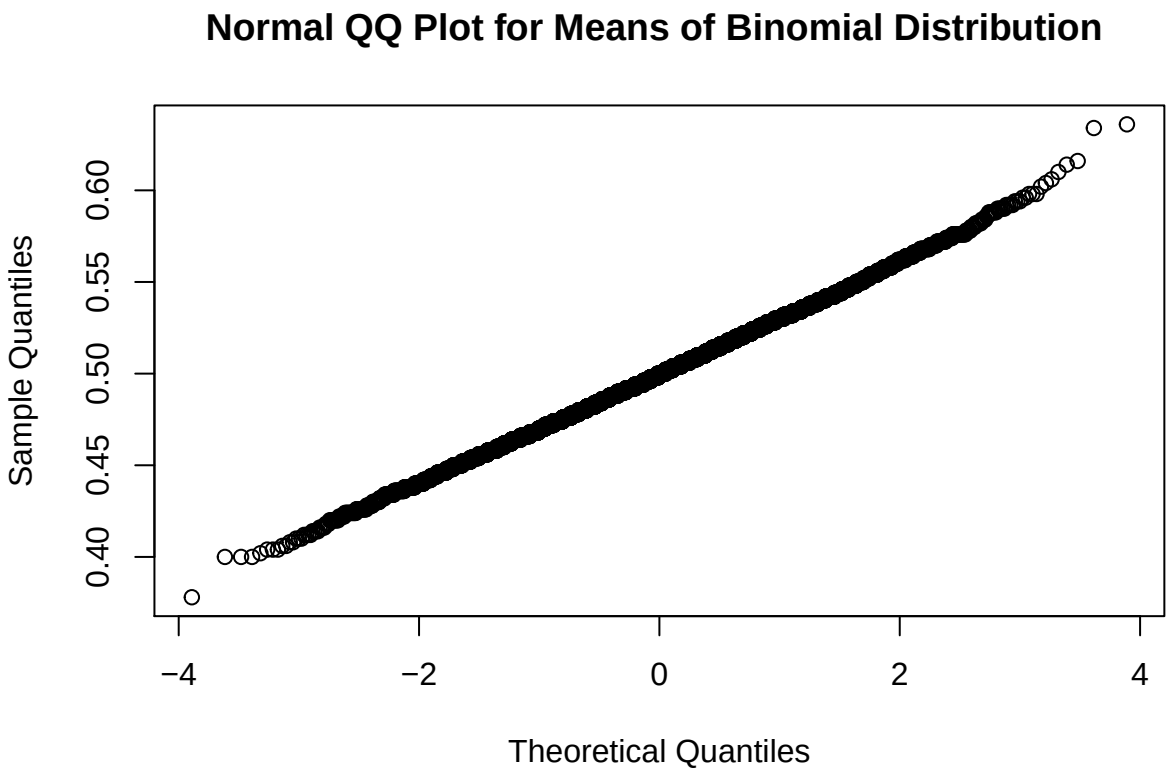


The histogram looks very normal with a peak at around 5.1, and clustered from 0.42 to 0.56. The min is 0.28 and the max is 0.74. Still maybe a bit too spread out to be exactly normal. The normal qq plot shows an almost perfectly straight line indicating the data is very normal in its distribution.

500 Observations

```
centralLimit(10000, 500, 5, .1, hist=TRUE, qqnorm=TRUE)
```


Means of Binomial Distribution
Frequency
0
200
600
1000
0.40
0.45
0.50
0.55
0.60
0.65
Mean



The histogram looks perfectly normal with a peak at 5, and values clustered from 0.47 to 0.57. The min is 0.39 and the max is 0.61. Looks like it came from a normal distribution. The normall qq plot is perfectly straight and the data points are not moved out like steps at all, indicating the means are normally distributed.

Conclusion

As the number of observations (n) increased, the means of the binomial distribution became more and more normally distributed until at 500 observations it was exactly like a normal distribution. The early histograms were more spread out and right skewed. While the early normal qq plots were bent to the bottom right corner and not in a straight line. Essentially this is an example of the central limit theorem. As the number observations increase, a nonnormal distribution's means of independent random variables(this case binomial) will eventually become normally distributed.