Project1.1

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```r
#library
library(ggplot2)
library(gridExtra)

#initializing the variables
lambda<-0.2
samples<-40
trials<-1000


sampleDist<-0 #exponential distribution of every 40 samples
meanSample<-0 #mean of the 40 samples
dist<-0 #saving all the distributions over 1000 trials
mean<-0 #saving all the means from teh 1000 trials.

for (i in 1:trials){
  sampleDist<-rexp(samples,lambda)
  meanSample<-mean(sampleDist)
  dist<-c(dist,sampleDist)
  mean<-c(mean,meanSample)
}
mean<-data.frame(mean=mean[-1])
dist<-data.frame(dist=dist[-1])

#comparing means
meanT<-1/lambda
meanD<-colMeans(mean)

#comparing the sds
sdT<-1/(lambda*sqrt(samples))
sdD<-sd(mean$mean)

#finding the 95% interval about the mean
range<-round(c((qnorm(.975)*sdT*c(-1,1)+meanT),as.numeric(meanT)),2)

#checking to see % of means of the 1000 trials within 95% of the population mean.
confidence<-100*(sum(mean$mean<range[2] & mean$mean>range[1]))/trials
```

The following are plots explaing the exponential distribution (plot1) and the distribution of means of the sampling mean (plot2)

40 samples of the exponential distribution are pooled 1000 times. Plot 2 shows the mean of each of these pooled trials with the blue dotted lines indicating the 95% interval.

I have not show the code for the graphs since it would not fit in one page.
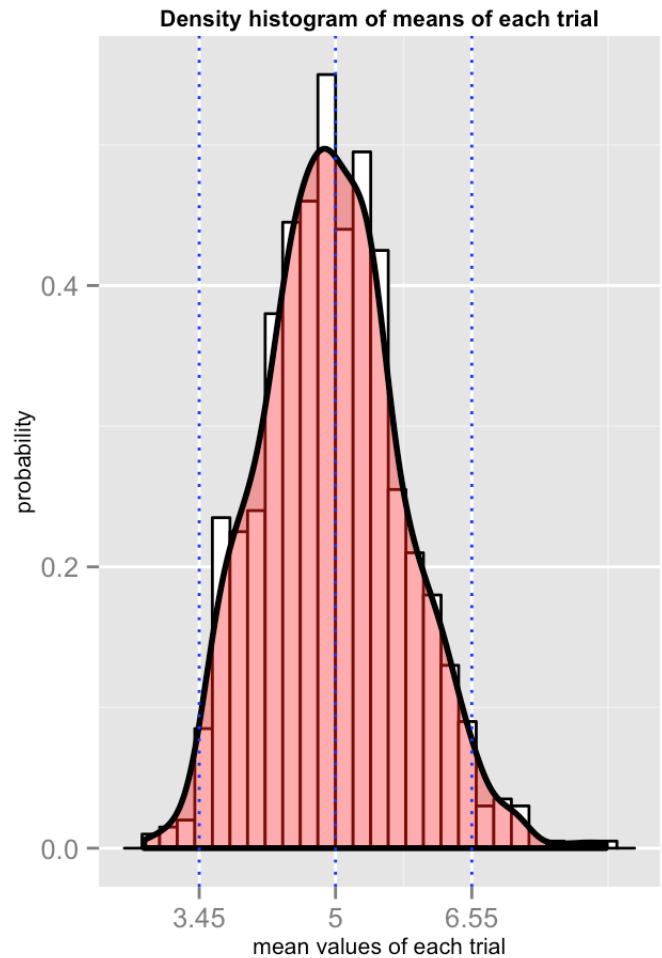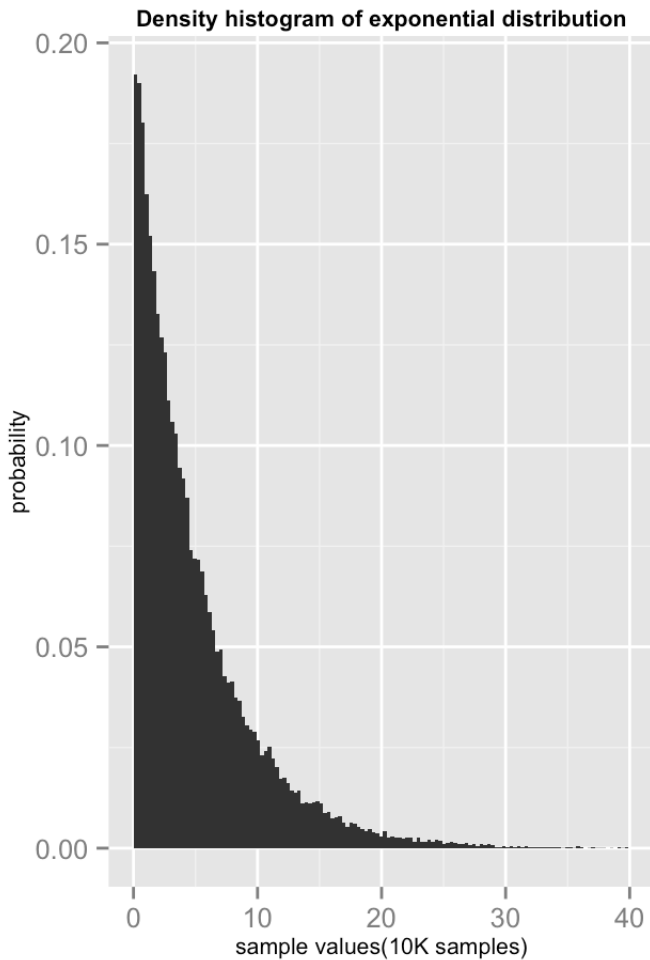
1. Show where the distribution is centered at and compares it to the theoretical center of the distribution.
   As shown above in plot 2, the distribution is centered around 4.9657 while the theoratical center is at 5.

2. Show how variable it is and compare it to the theoretical variance of the distribution.
   As shown above in plot 2, the distribution has a standard deviation of 0.7876, while the theoratical standard deviation is 0.7906.

3. Show that the distribution is approximately normal.
   As shown in plot 2, the distirbution of the means is approximately normal with 95% of the readings within 2 standard deviations of the mean. There are 96% of means of the 1000 trials within 2 standard deviations of the population mean

4. Evaluate the coverage of the confidence interval for 1/lambda: $\bar{X} \pm 1.96 S_n \sqrt{n}$.
   From plot 2 one can see the 95% confidence interval points as 3.45 and 6.55. This suggests that the population mean (mean of the exponential distribution) with a 95% probabilty if within the range defined above.