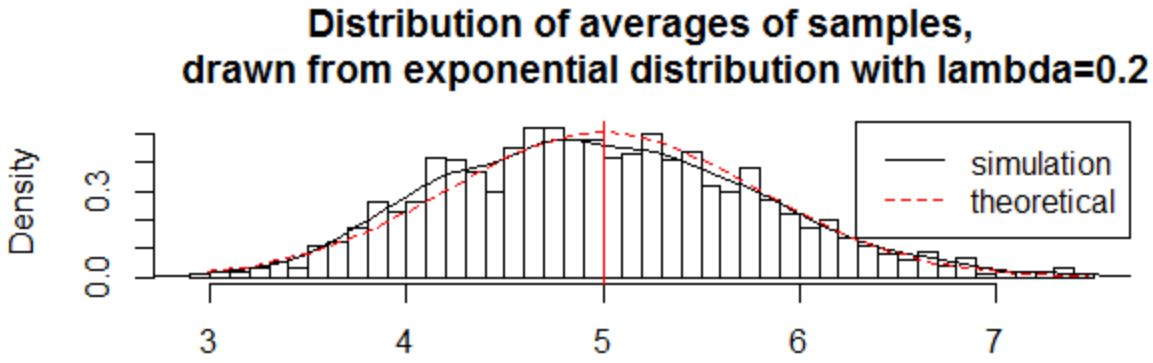
Eric Glass

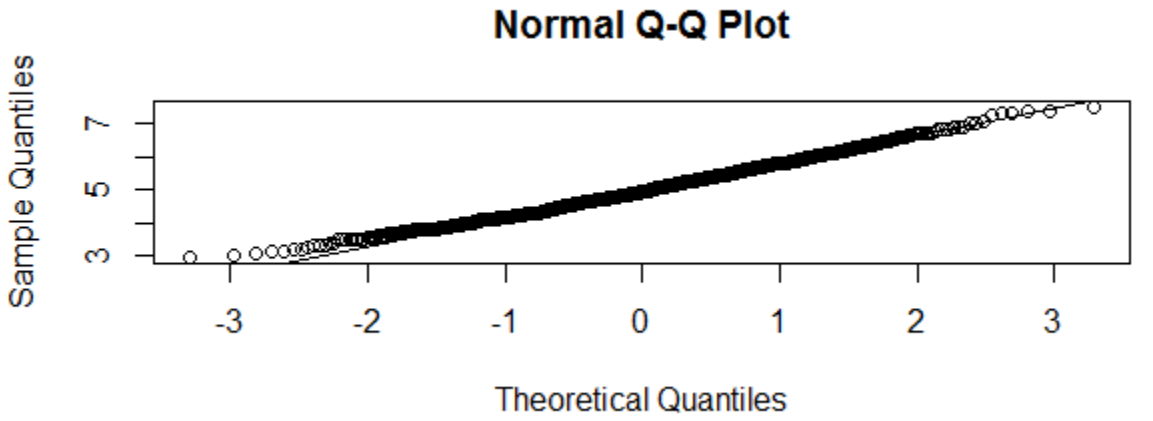
Statistical Inference: Project 1, Part 1

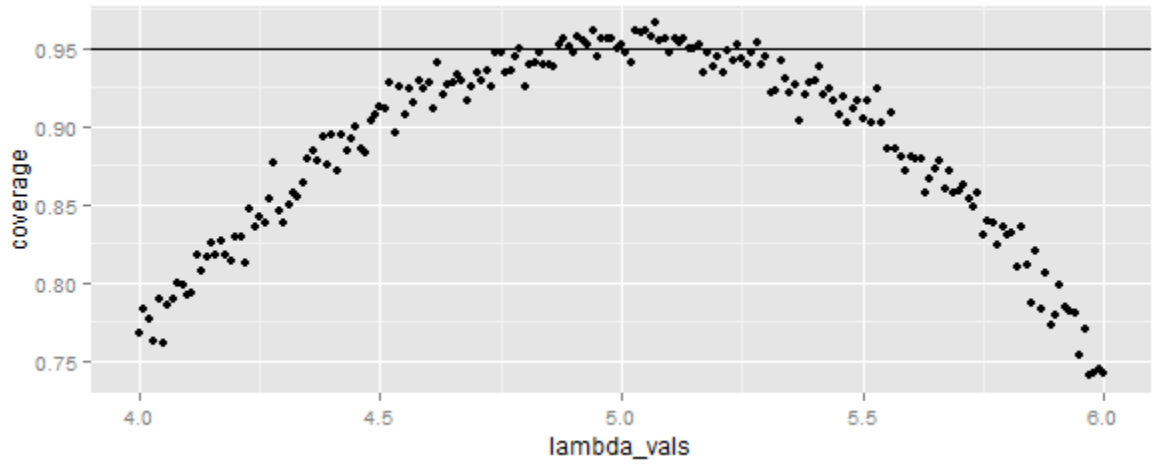
R code followed by plots

```
## ------------------------------------------------------------------------
## simulation
set.seed(100)
lambda <- 0.2
num_sim <- 1000
sample_size <- 40
sim <- matrix(rexp(num_sim*sample_size, rate=lambda), num_sim, sample_size)
row_means <- rowMeans(sim)



## ------------------------------------------------------------------------
# plot the histogram of averages
hist(row_means, breaks=50, prob=TRUE,
     main="Distribution of averages of samples,
     drawn from exponential distribution with lambda=0.2",
     xlab="")
# density of the averages of samples
lines(density(row_means))
# theoretical center of distribution
abline(v=1/lambda, col="red")
# theoretical density of the averages of samples
xfit <- seq(min(row_means), max(row_means), length=100)
yfit <- dnorm(xfit, mean=1/lambda, sd=(1/lambda/sqrt(sample_size)))
lines(xfit, yfit, pch=22, col="red", lty=2)
# add legend
legend('topright', c("simulation", "theoretical"), lty=c(1,2), col=c("black", "red"))


## ------------------------------------------------------------------------
qqnorm(row_means); qqline(row_means)


## ------------------------------------------------------------------------
lambda_vals <- seq(4, 6, by=0.01)
coverage <- sapply(lambda_vals, function(lamb) {
    mu_hats <- rowMeans(matrix(rexp(sample_size*num_sim, rate=0.2),
                               num_sim, sample_size))
    ll <- mu_hats - qnorm(0.975) * sqrt(1/lambda**2/sample_size)
    ul <- mu_hats + qnorm(0.975) * sqrt(1/lambda**2/sample_size)
    mean(ll < lamb & ul > lamb)
})
```

```
library(ggplot2)
qplot(lambda_vals, coverage) + geom_hline(yintercept=0.95)
```






0.95
0.90
0.85
0.80
0.75
coverage
4.0
4.5
5.0
5.5
6.0
lambda_vals