

Stimulation 1

2024-10-4

```
#Laplace
library(extraDistr)
# Unique seed
set.seed(0304)
sample.mean20 = numeric(1000)
for (i in 1:1000) {
  b = 1 #scale parameter
  loc = 1 #mean
  sample = rlaplace(n = 20, loc, b)
  sample.mean20[i] = mean(sample)
}
empirical_meanlaplace = mean(sample.mean20)
empirical_sdlaplace = sd(sample.mean20)

# Empirical mean
empirical_meanlaplace
```

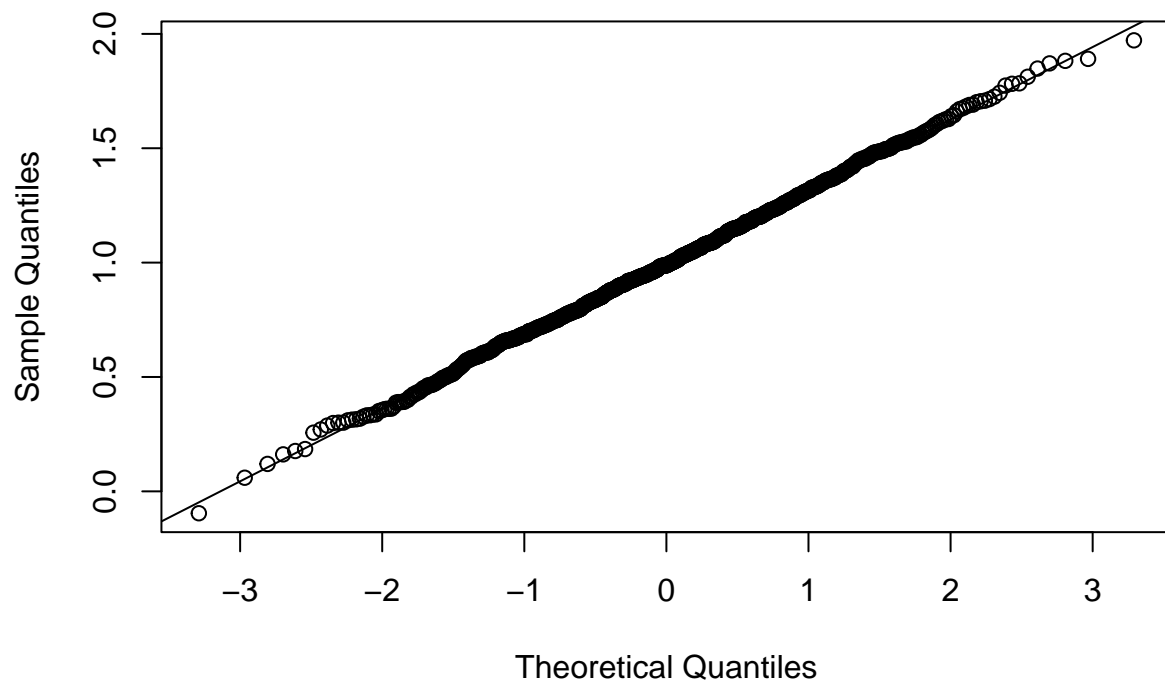
```
## [1] 0.9978674
```

```
# Empirical SD
empirical_sdlaplace
```

```
## [1] 0.3164658
```

```
qqnorm(sample.mean20)
qqline(sample.mean20)
```

Normal Q-Q Plot



```
# Laplace Distribution for sample size 250
set.seed(0304)
sample.mean250 = numeric(1000)
b = 1 #scale parameter
loc = 1 #mean
for (i in 1:1000) {
  sample = rlaplace(n = 250, loc, b)
  sample.mean250[i] = mean(sample)
}
empirical_meanlaplace250 = mean(sample.mean250)
empirical_sdlaplace250 = sd(sample.mean250)

# Empirical mean
empirical_meanlaplace250
```

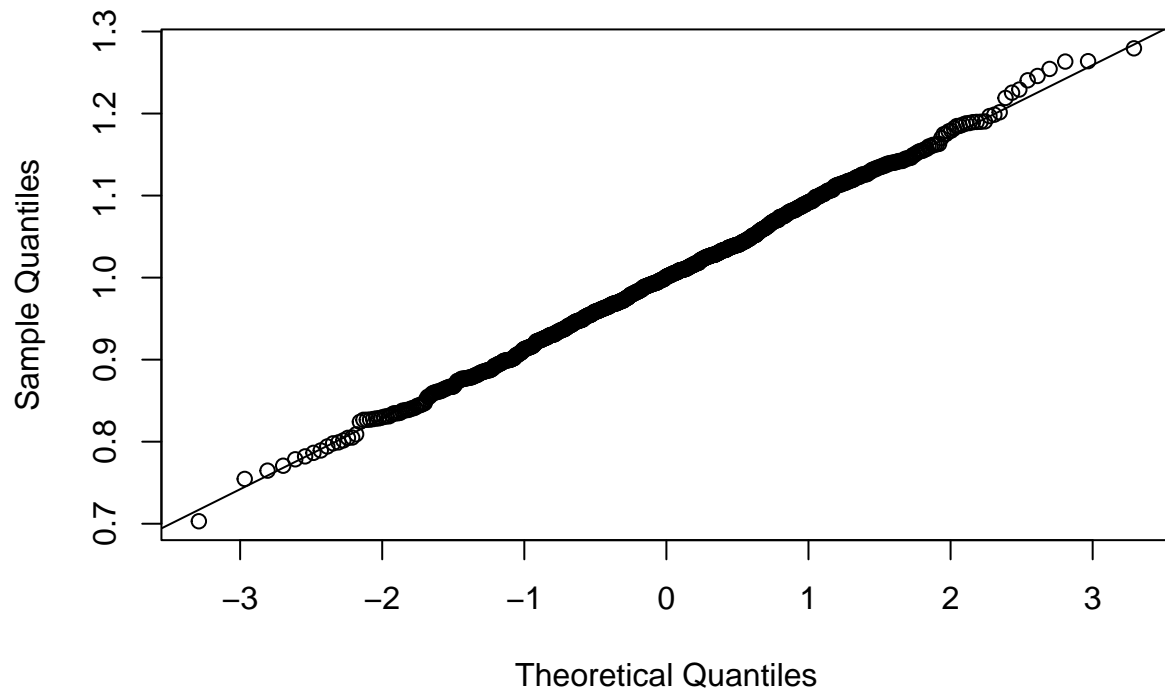
```
## [1] 1.000706
```

```
# Empirical SD
empirical_sdlaplace250
```

```
## [1] 0.08815852
```

```
qqnorm(sample.mean250)
qqline(sample.mean250)
```

Normal Q-Q Plot



```
#Exponential
# unique seed
set.seed(0304)
sample.meanexp20 = numeric(1000)
for (i in 1:1000) {
  sample = rexp(20, rate = 1) # sample size of 20 and parameter of rate of 1
  sample.meanexp20[i] = mean(sample)
}
empirical_meanexp = mean(sample.meanexp20)
empirical_sdexp = sd(sample.meanexp20)

# Empirical mean
empirical_meanexp
```

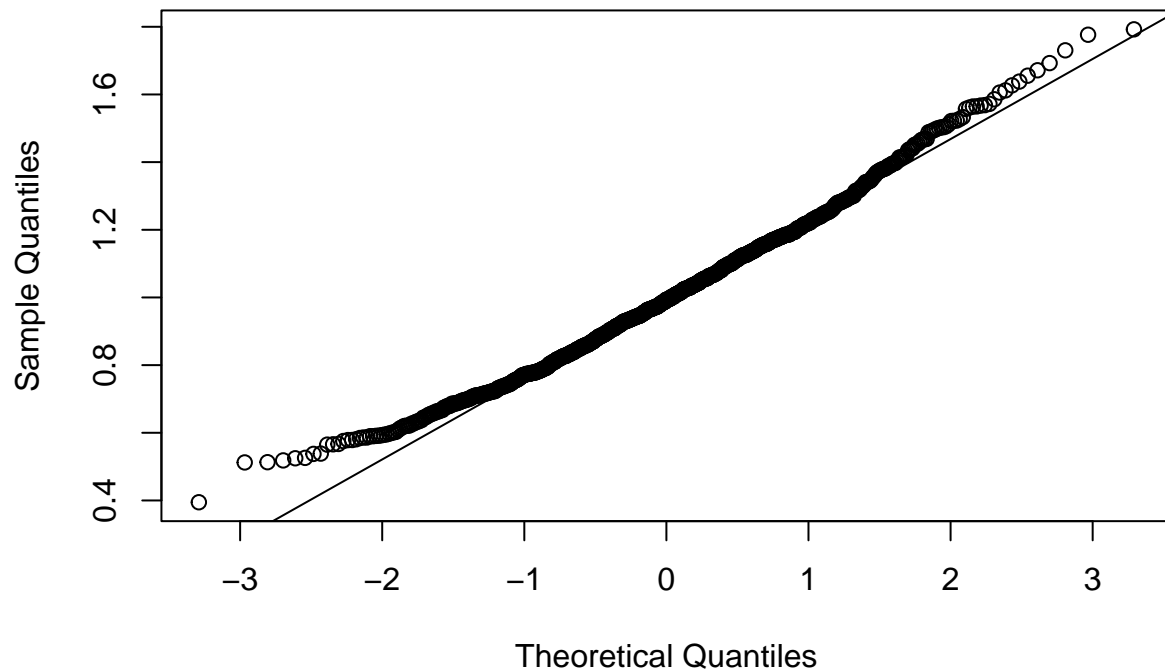
```
## [1] 1.003276
```

```
#Empirical SD
empirical_sdexp
```

```
## [1] 0.2288488
```

```
qqnorm(sample.meanexp20)
qqline(sample.meanexp20)
```

Normal Q-Q Plot



```
# Exponential Distribution for sample size 250
set.seed(0304)
sample.meanexp250 = numeric(1000)
for (i in 1:1000) {
  sample = rexp(250, rate = 1) # sample size of 20 and parameter of rate of 1
  sample.meanexp250[i] = mean(sample)
}
empirical_meanexp250 = mean(sample.meanexp250)
empirical_sdexp250 = sd(sample.meanexp250)

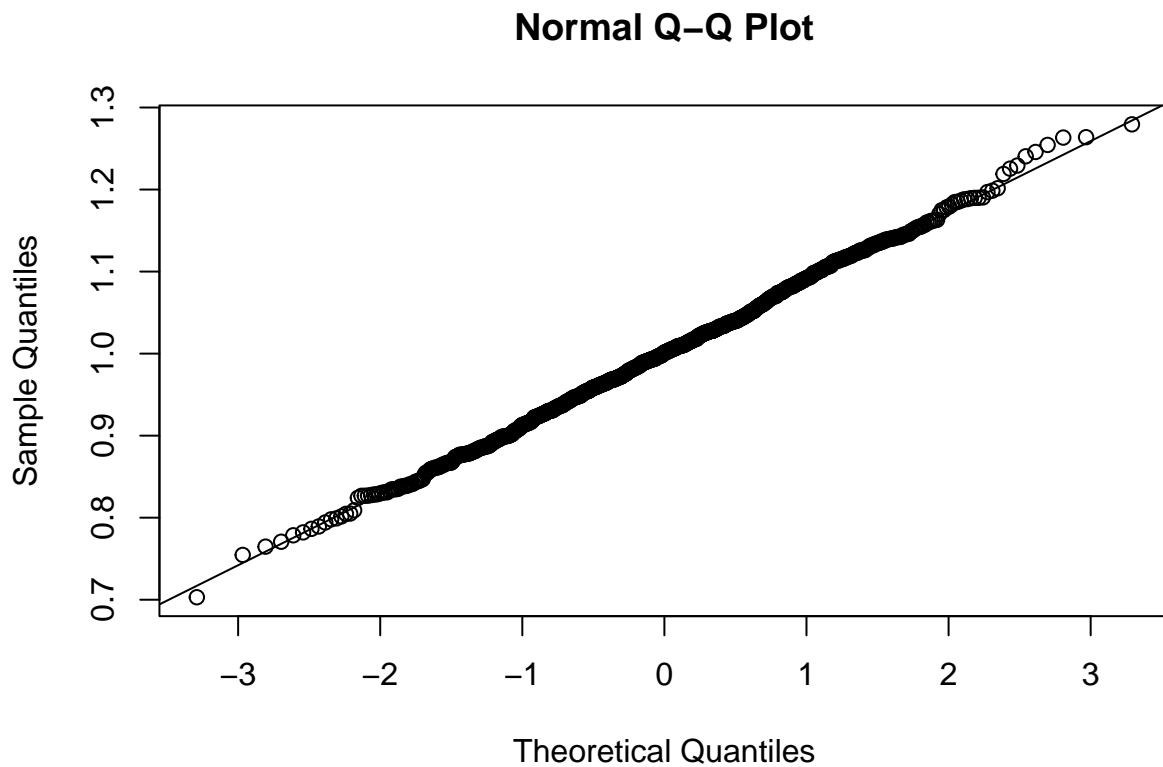
#Empirical mean
empirical_meanexp250
```

```
## [1] 1.002426
```

```
#Empirical SD
empirical_sdexp250
```

```
## [1] 0.06514611
```

```
qqnorm(sample.mean250)
qqline(sample.mean250)
```

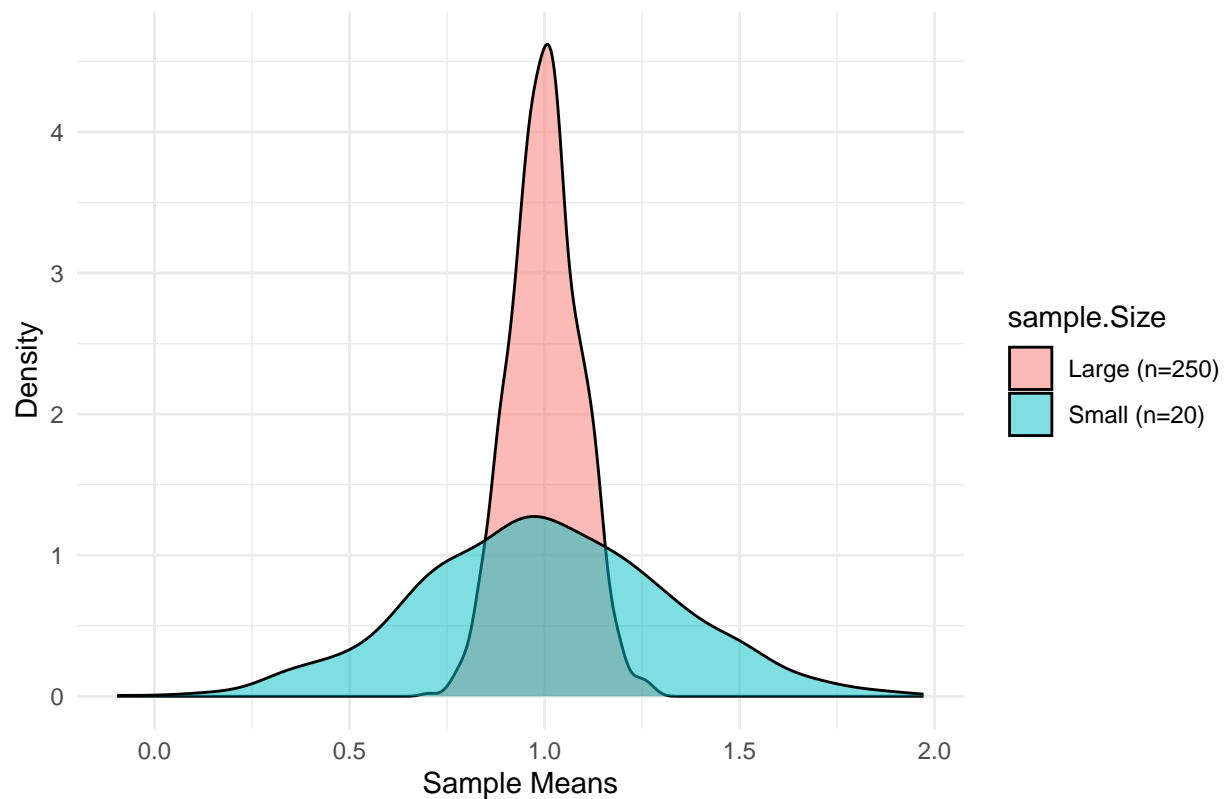


```
# Load ggplot package for visualization
library(ggplot2)

# Combining the laplace sample means into a data frame
laplace_means = data.frame(
  sample.Mean = c(sample.mean20, sample.mean250),
  sample.Size = rep(c("Small (n=20)", "Large (n=250)"), each = 1000))

# Plot density for laplace distribution sample means
ggplot(laplace_means, aes(x = sample.Mean, fill = sample.Size)) +
  geom_density(alpha = 0.5) +
  labs(title = "Density of LaPlace Sample Means (Small and Large Samples)",
       x = "Sample Means", y = "Density") +
  theme_minimal() +
  theme(legend.position = "right")
```

Density of LaPlace Sample Means (Small and Large Samples)



```
# Combining the exponential sample means into a data frame
exponential_means = data.frame(
  sample.Mean = c(sample.meanexp20, sample.meanexp250),
  sample.Size = rep(c("Small (n=20)", "Large (n=250)"), each = 1000))

# Plot density for exponential distribution sample means
ggplot(exponential_means, aes(x = sample.Mean, fill = sample.Size)) +
  geom_density(alpha = 0.5) +
  labs(title = "Density of Exponential Sample Means (Small and Large Samples)",
       x = "Sample Means", y = "Density") +
  theme_minimal() +
  theme(legend.position = "right")
```

