Statistical Inference Course Project

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1.2.) Simulations

```
## Check for missing dependencies
library(ggplot2)
library(lemon)
```

```
##
## Attaching package: 'lemon'
```

```
## The following objects are masked from 'package:ggplot2':
##
##     CoordCartesian, element_render
```

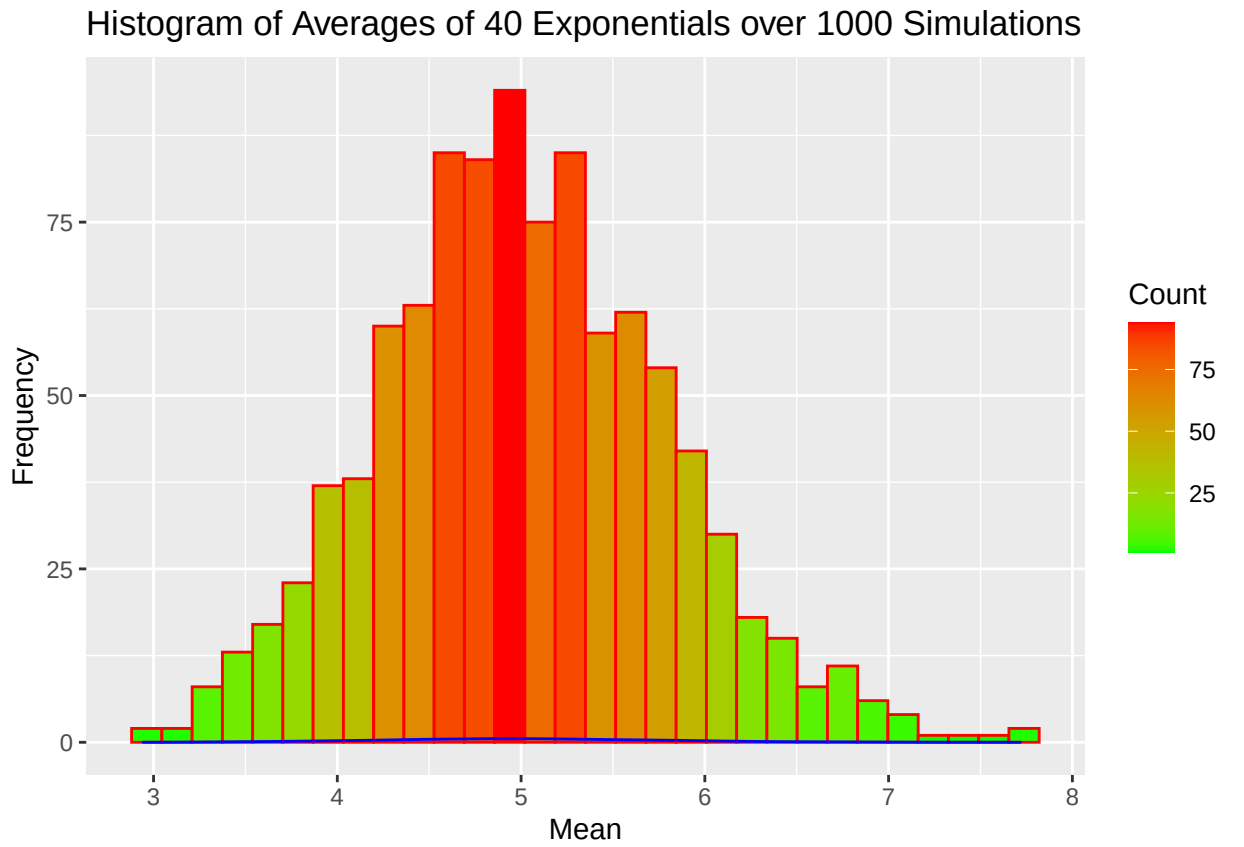
```
#install.packages("lemon")
knit_print.data.frame <- lemon_print
## init
lambda <- 0.2
n <- 40
sims <- 1:1000
set.seed(123)

# Simulate the draws
draws <- data.frame(x=sapply(sims, function(x) {mean(rexp(n, lambda))}))
#?rexp
# Plot



hist.of.pop <- ggplot(draws, aes(x=x)) +
  geom_histogram(
    col="red",
    aes(y=..count.., fill=..count..)) +
    scale_fill_gradient("Count", low="green", high="red")+
  geom_density(col="blue") +
  labs(title="Histogram of Averages of 40 Exponentials over 1000 Simulations", y="Frequency", x="Mean")
hist.of.pop
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



1.3.) Sample mean vs theoretical mean

```
# Tabulating the Sample Mean & Theoretical Mean
sample.mean <- mean(draws$x)
theo.mean <- 1/lambda
mean.df1<-cbind(sample.mean, theo.mean)
knitr::kable(mean.df1)
```

sample.mean	theo.mean
5.011911	5

```
t.test(draws$x)[4]
```

```
## $conf.int
## [1] 4.963824 5.059998
## attr(,"conf.level")
## [1] 0.95
```

From previous block, it can be noticed that sample mean and the theoretical mean approximately close. Plus, after computing the confidence interval on the mean, it observed that the sample mean is between *[4.963824 5.059998]* at 95% confidence interval interval,

1.4.) Sample Variance vs theoretical Variance

```
# Tabulating the Sample Mean & Theoretical Mean
sample.var <- var(draws$x)
```

```r
theo.var <- (1/(lambda^2))/n
var.df<-cbind(sample.var, theo.var)
knitr::kable(var.df)
```

sample.var	theo.var
0.6004928	0.625

From previous block, it can be noticed that sample variance and the theoretical variance approximately close. Plus, after computing the confidence interval on the variance, it observed that the sample variance is between *[0.6004928 0.625]* at 95% confidence interval interval,

1.5.) Distribution

```r
# Plotting Sample Mean & Varience vs Theoretical Mean & Varience
gg <- ggplot(draws, aes(x=x)) +
  geom_histogram(aes(y=..density.., fill=..density..)) +
  labs(title="Histogram of Averages of 40 Exponentials over 1000 Simulations", y="Density", x="Mean") +
  geom_density(colour="blue") +
  geom_vline(xintercept=sample.mean, colour="blue", linetype="dashed") +
  stat_function(fun=dnorm,args=list( mean=1/lambda, sd=sqrt(theo.var)),color = "red") +
  geom_vline(xintercept=theo.mean, colour="red", linetype="dashed")
gg
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```