Stat 3202 Lab 8

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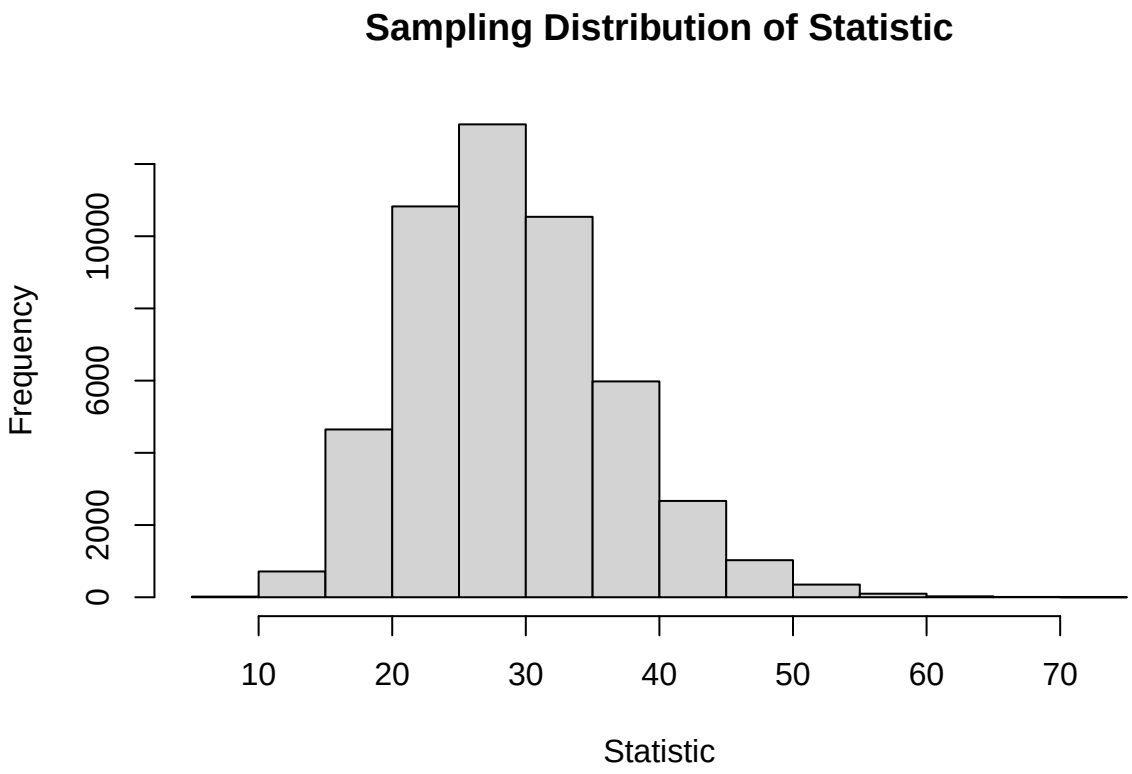
1a.

```
set.seed(515)
num_samples <- 50000
n <- 30
mu <- 0
sigma2 <- 1

stat_storage <- c()

for (i in 1:num_samples) {
  sample <- rnorm(n, mu, sigma2)
  stat_storage[i] <- ((n-1)*var(sample))/sigma2
}

hist(stat_storage, main="Sampling Distribution of Statistic", xlab="Statistic")
```



1b.

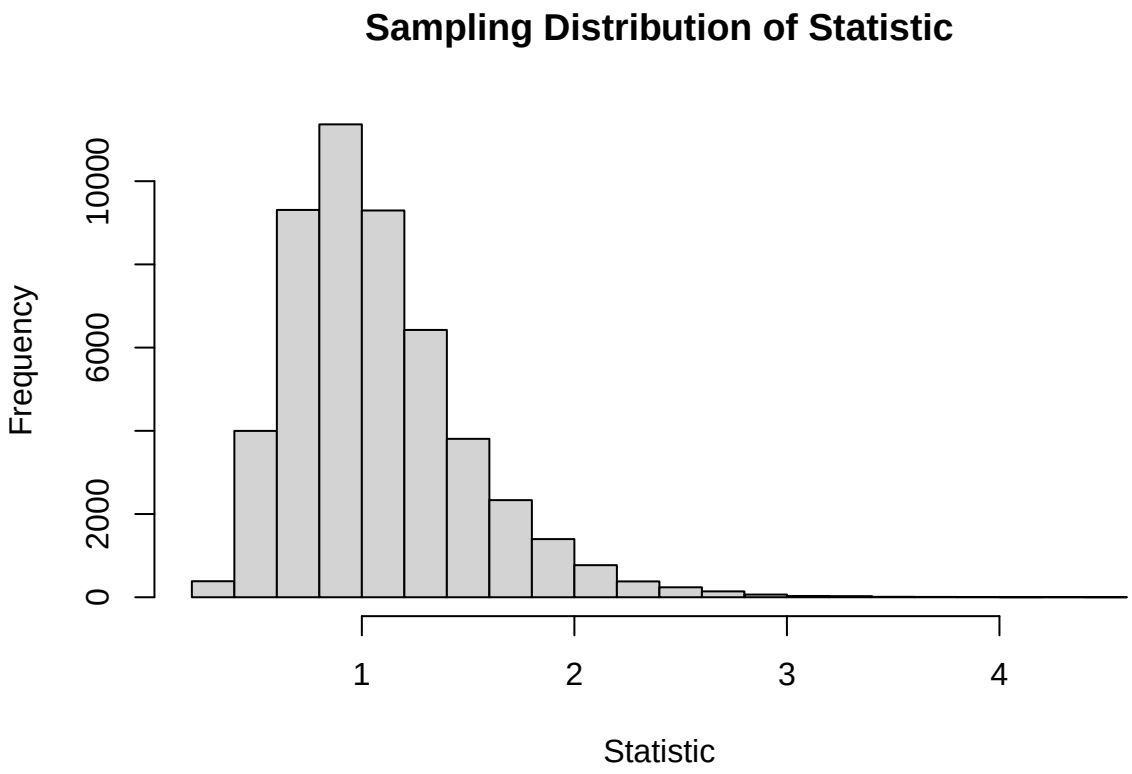
```
set.seed(515)
num_samples <- 50000
nA <- 30
muA <- 0
sigma2A <- 1

nB <- 30
muB <- 0
sigma2B <- 1

stat_storage <- c()

for (i in 1:num_samples) {
  sampleA <- rnorm(nA, muA, sigma2A)
  sampleB <- rnorm(nB, muB, sigma2B)
  stat_storage[i] <- (var(sampleA)/sigma2A)/(var(sampleB)/sigma2B)
}

hist(stat_storage, main="Sampling Distribution of Statistic", xlab="Statistic")
```



2a.

```
library(DescTools)

set.seed(515)
n <- 30
mu <- 0
sigma2 <- 1
alpha <- 0.05
num_samples <- 50000

success_count <- 0

for (i in 1:num_samples) {
  sample <- rnorm(n, mu, sigma2)
  results <- VarTest(sample, sigma.squared=sigma2, conf.level=1-alpha)
  ci <- results$conf.int
  if (sigma2 >= ci[1] && sigma2 <= ci[2]) {
    success_count <- success_count + 1
  }
}

coverage_rate <- success_count/num_samples
coverage_rate
```

```
## [1] 0.95028
```

The interval achieves the desired coverage. The coverage rate comes out to 0.95028, which is above our desired coverage of 0.95.

2b.

```
library(DescTools)

set.seed(515)
nA <- 30
muA <- 0
sigma2A <- 1

nB <- 30
muB <- 0
sigma2B <- 2

true_ratio <- sigma2A / sigma2B

alpha <- 0.05
num_samples <- 50000

success_count <- 0

for (i in 1:num_samples) {
  sampleA <- rnorm(nA, muA, sd=sqrt(sigma2A))
  sampleB <- rnorm(nB, muB, sd=sqrt(sigma2B))
  results <- VarTest(sampleA, sampleB, conf.level=1-alpha)
  ci <- results$conf.int
  if (true_ratio >= ci[1] && true_ratio <= ci[2]) {
    success_count <- success_count + 1
  }
}

coverage_rate <- success_count/num_samples
coverage_rate
```

```
## [1] 0.95056
```

The interval achieves the desired coverage. The coverage rate comes out to 0.95056, which is above our desired coverage of 0.95.

2c.

```
library(DescTools)

set.seed(515)
nA <- 30
muA <- 0
sigma2A <- 3

nB <- 30
muB <- 0
sigma2B <- 2/25
```

```r
true_ratio <- sigma2A / sigma2B

alpha <- 0.05
num_samples <- 50000

success_count <- 0

for (i in 1:num_samples) {
  sampleA <- rpois(nA, lambda=3)
  sampleB <- rgamma(nB, 2, 5)
  results <- VarTest(sampleA, sampleB, conf.level=1-alpha)
  ci <- results$conf.int
  if (true_ratio >= ci[1] && true_ratio <= ci[2]) {
    success_count <- success_count + 1
  }
}

coverage_rate <- success_count/num_samples
coverage_rate
```

```
## [1] 0.87336
```

The interval does not achieve the desired coverage. The coverage rate comes out to 0.87336, which is below our desired coverage of 0.95. Non-normality causes the coverage rate to be insufficient.