StatsProgram1

```r
#set seed to get the same random values
set.seed(391)
#set the sample size
n <- 10
#set our true lambda value
lambda <- 1

#Generate data from a Poisson distribution with rpois
sim_data <- rpois(n, lambda)
sim_data
```

```
 [1] 0 1 0 0 1 0 0 1 0 0
```

```r
#Now we find the value of our estimators
lambda1 <- mean(sim_data)
lambda2 <- mean(sim_data^2) - (mean(sim_data))^2
lambda1
```

```
[1] 0.3
```

```r
lambda2
```

```
[1] 0.21
```

```r
#now repeat the process!
N <- 10000 #number of estimates to find
results <- replicate(N, {
  sim_data <- rpois(n, lambda)
  list(lambda1 = mean(sim_data), lambda2 = mean(sim_data^2) - (mean(sim_data))^2)
})

#check esimates
results[, 1:6]
```

```
        [,1] [,2] [,3] [,4] [,5] [,6]
lambda1 0.9  1.3  1    1.3  0.7  0.6
lambda2 0.89 0.41 0.6  1.41 0.61 0.44
```

```r
results[1, 1:3]
```

```
[[1]]
[1] 0.9

[[2]]
[1] 1.3

[[3]]
[1] 1
```

```r
#unlist to get back in (atomic) vector form
unlist(results[1, 1:6])
```

```
[1] 0.9 1.3 1.0 1.3 0.7 0.6
```

```r
lambda1 <- unlist(results[1,])
lambda2 <- unlist(results[2,])

#quick check on the SE of lambda1
sd(lambda1)
```

```
[1] 0.3192729
```

```r
sqrt(lambda/n)
```

```
[1] 0.3162278
```

```r
#plot the values on a histogram to compare
par(mfrow = c(1, 2))
hist(lambda1,
     main = bquote(
       atop(
         ~ lambda[1] ~ " values with ", "true " ~ lambda ~ "=" ~ .(lambda) ~ " with n =
         )
       )
     )
abline(v = lambda,
       col = "blue",
       lwd = 2)
abline(v = mean(lambda1),
       col = "red",
       lwd = 2,
       lty = "dashed")
text(paste0("SE = ", round(sd(lambda1), 3)),
     x = mean(lambda1) + 3*sd(lambda1),
     y = 1500,
     cex = 0.8)
hist(lambda2, main = bquote(
  atop(
     ~ lambda[2] ~ " values with ", "true " ~ lambda ~ "=" ~ .(lambda) ~ " with n = " ~
     )
    )
  )
abline(v = lambda, col = "blue", lwd = 2)
abline(v = mean(lambda2), col = "red", lwd = 2, lty = "dashed")
text(paste0("SE = ", round(sd(lambda2), 3)), x = mean(lambda2) + 3*sd(lambda2), y = 1500
```