MA 750: HW1

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September 26, 2017

Exercise 1

(d)

```
#set seed
set.seed(1665)

#set up tunning variables
n = 100
num_samp = 1000
mu = 5

#Get num_samp estimates of exp(-xbar) where -xbar from Pois(mu) with n samples
sim = replicate(num_samp, exp(-mean(rpois(n,mu))))

#compute empircal bias for each point
estimated_bias = sim - exp(-mu)

#find the mean bias
mean_bias = mean(estimated_bias)

#display estimated bias
paste("The estiamted bias of the MLE estimator:", round(mean_bias, 6))
```

```
## [1] "The estiamted bias of the MLE estimator: 0.000218"
```

```
#estimate the variance of the estimator
estimated_var = var(sim)

#display estimated variance
paste("The estiamted variance of the MLE estimator:", round(estimated_var, 6))
```

```
## [1] "The estiamted variance of the MLE estimator: 2e-06"
```

Compare estimates to the part approximated in part b

(e)

```
#set up tunning variables
n = 50
num_samp = 1000
mu = 5

#Get num_samp estimates of exp(-xbar) where -xbar from Pois(mu) with n samples
sim = replicate(num_samp, exp(-mean(rpois(n,mu))))

#compute empircal bias for each point
estimated_bias = sim - exp(-mu)
```

```r
#find the mean bias
mean_bias = mean(estimated_bias)

#display estimated bias
paste("The estiamted bias of the MLE estimator:", round(mean_bias, 6))
```

```
## [1] "The estiamted bias of the MLE estimator: 0.000539"
```

```r
#estimate the variance of the estimator
estimated_var = var(sim)

#display estimated variance
paste("The estiamted variance of the MLE estimator:", round(estimated_var, 6))
```

```
## [1] "The estiamted variance of the MLE estimator: 5e-06"
```

Compare estimates here

```r
#set up tunning variables
n = 20
num_samp = 1000
mu = 5

#Get num_samp estimates of exp(-xbar) where -xbar from Pois(mu) with n samples
sim = replicate(num_samp, exp(-mean(rpois(n,mu))))

#compute empircal bias for each point
estimated_bias = sim - exp(-mu)

#find the mean bias
mean_bias = mean(estimated_bias)

#display estimated bias
paste("The estiamted bias of the MLE estimator:", round(mean_bias, 6))
```

```
## [1] "The estiamted bias of the MLE estimator: 0.000879"
```

```r
#estimate the variance of the estimator
estimated_var = var(sim)

#display estimated variance
paste("The estiamted variance of the MLE estimator:", round(estimated_var, 6))
```

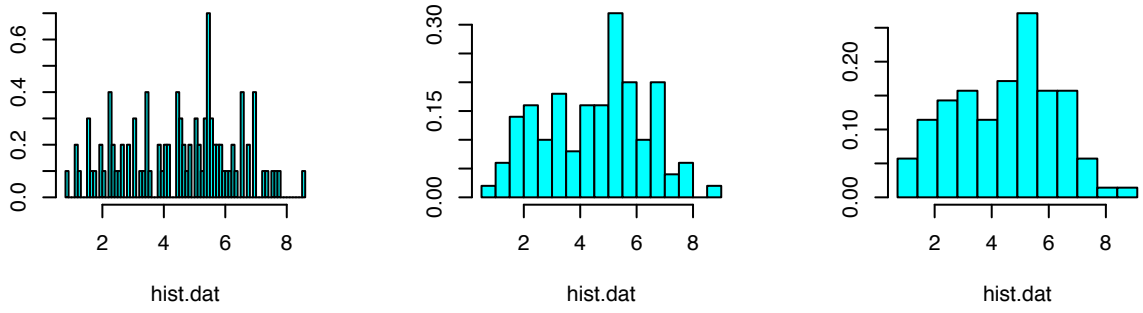
```
## [1] "The estiamted variance of the MLE estimator: 1.6e-05"
```

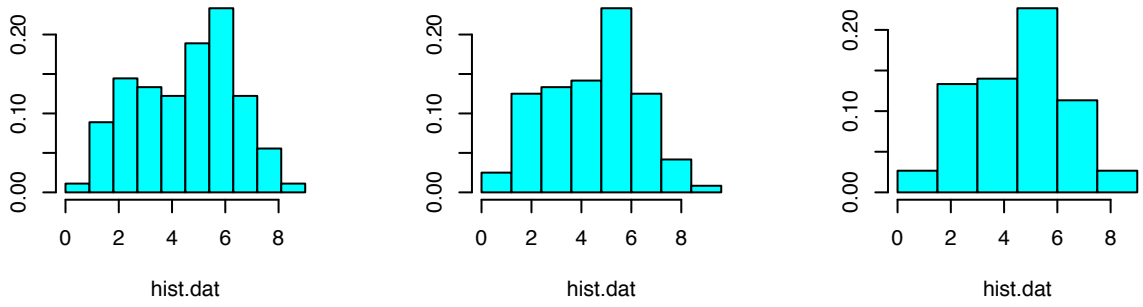
Compare estimates here

Exericse 5

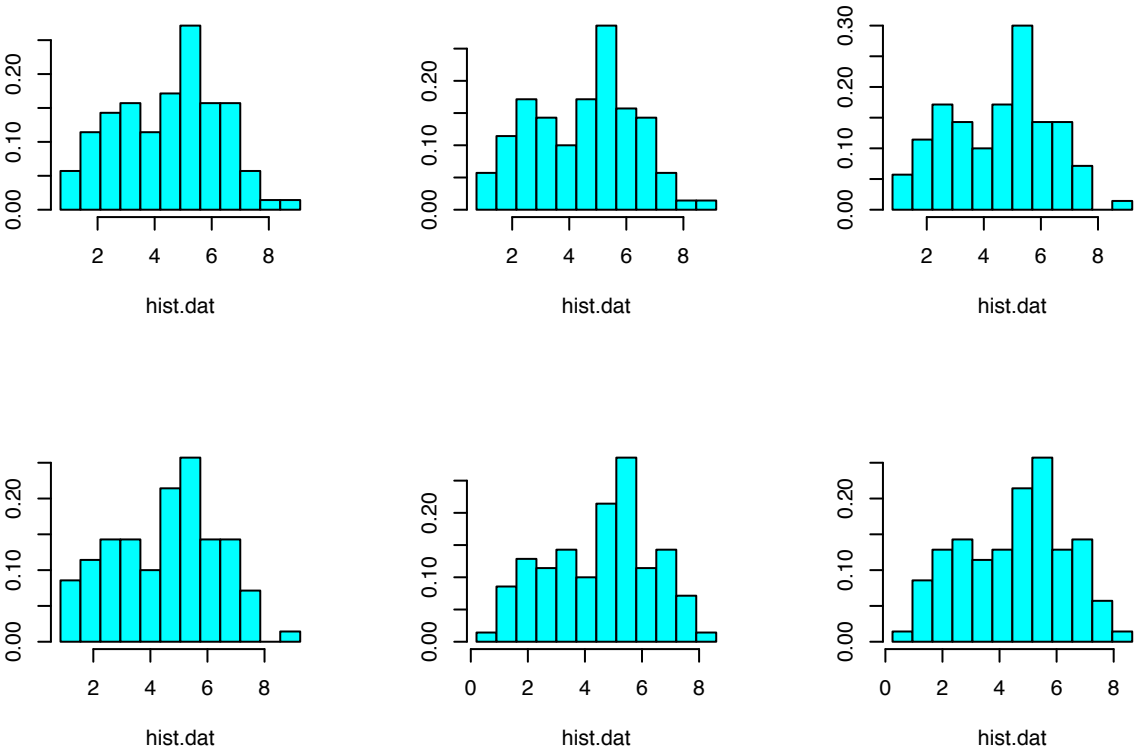
```r
#get sample
dat = matrix(0,nrow = 100, ncol = 2)
dat[,1] = rnorm(100, mean = 3, sd = 1)
dat[,2] = rnorm(100, mean = 6, sd = 1)

#get indicator
mixture1 = rbinom(n = 100, size = 1, p = .4)
```

```r
indicator = matrix(0, nrow = 100, ncol = 2)
indicator[,1] = mixture1
indicator[,2] = ifelse(indicator[,1] == 0, 1, 0)

#get histogram data
hist.dat = rowSums(dat*indicator)

#load necessary packages
library(MASS)

#Check out histograms
par(mfrow = c(2.,3))
truehist(hist.dat, h = 0.1, x0 = 0)
truehist(hist.dat, h = 0.5, x0 = 0)
truehist(hist.dat, h = 0.7, x0 = 0)
truehist(hist.dat, h = 0.9, x0 = 0)
truehist(hist.dat, h = 1.2, x0 = 0)
truehist(hist.dat, h = 1.5, x0 = 0)
```






```r
#Check out histograms
par(mfrow = c(2.,3))
truehist(hist.dat, h = 0.7, x0 = 0)
truehist(hist.dat, h = 0.7, x0 = 0.05)
truehist(hist.dat, h = 0.7, x0 = 0.1)
truehist(hist.dat, h = 0.7, x0 = 0.15)
truehist(hist.dat, h = 0.7, x0 = 0.2)
truehist(hist.dat, h = 0.7, x0 = 0.25)
```


0.00
0.10
0.20
0.30
2
4
6
8
0
hist.dat