HYD298 - Homework #4

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3 parameter Lognormal Distribution

```
library(agricolae)
foo=read.csv("../HW1/sebou.csv")
xx=sort(foo$maxQ,decreasing=FALSE)
dlnorm3 = function (X, m, s, t) {
 (1/((X-t)*s*(2*pi)^0.5))*exp(((-(log(X-t)-m)^2)/(2*s^2)))
}
#3 PARAMETER LOGNORMAL
first=1
last=length(xx)
#stedinger lower quantile bound for threshold
chat=(xx[first]*xx[last]-(median(xx)^2))/(xx[first]+xx[last]-2*median(xx))
plot(density(xx), main="Sebou R.  Lognormal 3-parameter Dist.\nwith real and log-space mean/variance",yl
#realspace
lines(xx,dlnorm3(xx,log(mean(xx)),log(sd(xx)),chat),lwd=2,lty=2,col="BLUE")
#realspace mean (log transformed)
log(mean(xx))
```

```
## [1] 6.912233
```

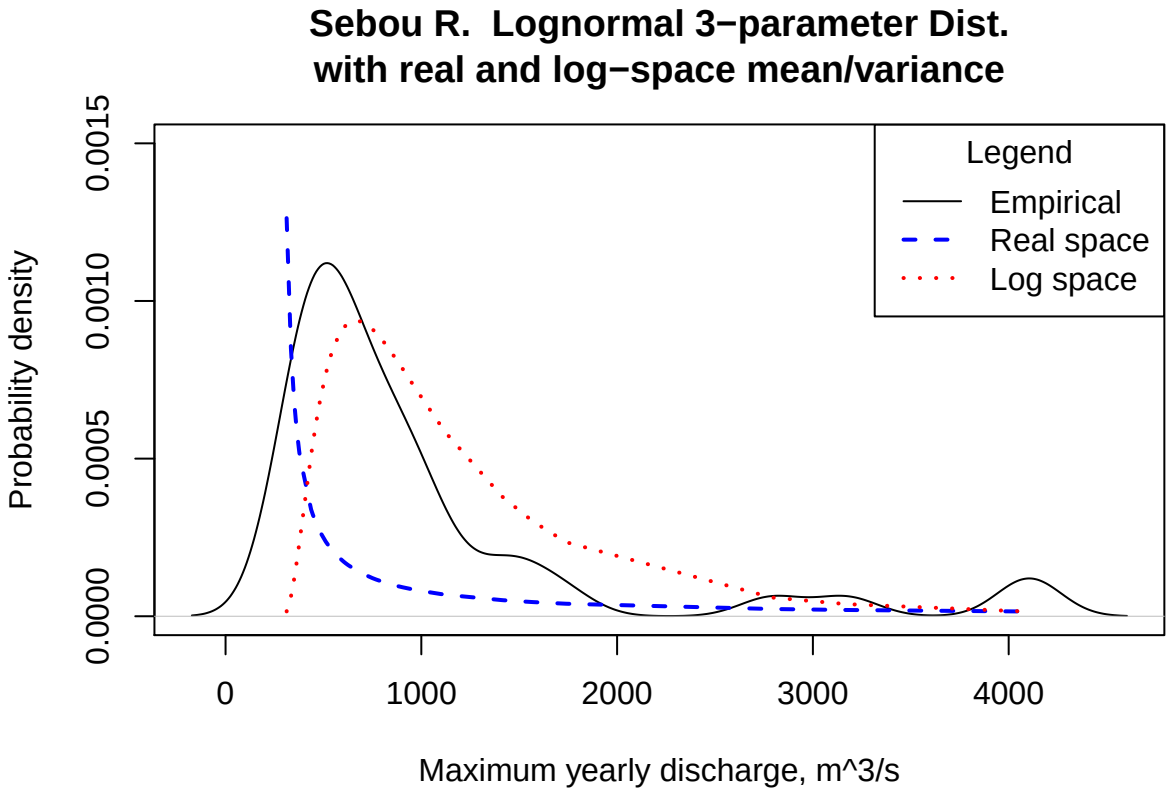
```
#realspace sd (log transformed)
log(sd(xx))
```

```
## [1] 6.836091
```

```
#quantiles
qlnorm(p=c(0.01,0.99),meanlog=mean(log(xx)),sdlog=sd(log(xx)))
```

```
## [1]  162.158 3669.217
```

```
#logspace
s_logs=sqrt(log(1+(sd(xx)/mean(xx))^2))
m_logs=(log(mean(xx))-0.5*(s_logs^2))
lines(xx,dlnorm3(xx,m_logs,s_logs,chat),lwd=2,lty=3,col="RED")
legend("topright", c("Empirical","Real space","Log space"), lty=c(1,2,3), col=c("BLACK","BLUE","RED"),lw
```




```
#log-space mean
m_logs
```

```
## [1] 6.602282
```

```
#log-space sd
s_logs
```

```
## [1] 0.787338
```

```
#quantiles
qlnorm(p=c(0.01,0.99),meanlog=m_logs,sdlog=s_logs)
```

```
## [1]  117.9971 4600.4276
```

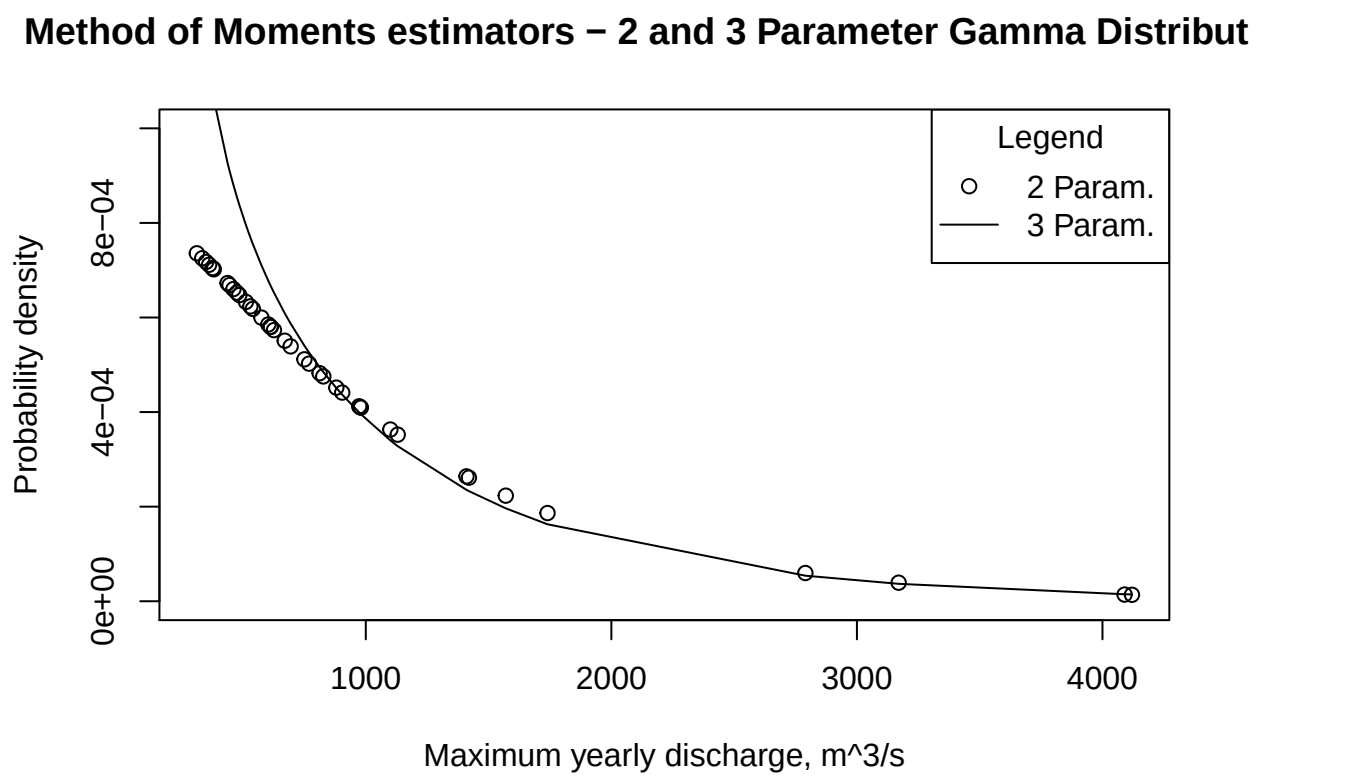
```
#2-parameter Gamma
alpha_hat=(mean(xx)^2)/(sd(xx)^2)
beta_hat=(mean(xx)/(sd(xx)^2))
plot(xx,dgamma(xx,alpha_hat,beta_hat),ylim=c(0,1E-3),ylab="Probability density",xlab="Maximum yearly dis
qgam2=qgamma(shape=alpha_hat,scale=beta_hat,p=c(0.01,0.99))
data.frame(shape=alpha_hat,scale=beta_hat)
```

```
##      shape       scale
## 1 1.164491 0.001159288
```

```r
qgamma(p=c(0.01,0.99),alpha_hat,beta_hat)
```

```
## [1]   17.84633 4288.62572
```

```r
#3-parameter Gamma
dgamma3 = function (x, aa = 1, bb = 2, tt = 0) {
  (bb^aa)*(x-tt)^(aa-1)*exp(-(x-tt)*bb)/gamma(aa)
}
qgamma3=function(x,mu,sigma,gam) {
  #Uses Wilson-Hilferty transformation
  mu+sigma*((2/gam*(1+(gam*x/6)-((gam^2)/36))^3)-(2/gam))
}
tau_hat=mean(xx)-2*(sd(xx)/skewness(xx))
alpha_hat=4/(skewness(xx)^2)
beta_hat=(2/(sd(xx)*skewness(xx)))
lines(xx,dgamma3(xx,alpha_hat,beta_hat,tau_hat))
legend("topright", c("2 Param.","3 Param."), pch=c(1,-1),lty=c(0,1), lwd=c(1,1), title = "Legend")
```




```r
#parameters
data.frame(shape=alpha_hat,scale=beta_hat,location=tau_hat)
```

```
##       shape        scale location
## 1 0.7126882 0.0009069288 218.6618
```

```r
#quantiles
qgamma3(qnorm(p=c(0.01,0.99)),mean(xx),sd(xx),skewness(xx))
```

```
## [1]  218.3375 4522.1713
```