

## Εργαστηριακή Άσκηση 3

### Θέμα: Προσομοίωση και Στατιστική Συμπερασματολογία

1.
  - a. `pnorm(1,lower.tail=FALSE)`
  - b. `qnorm(0.8)`
  - c. `pnorm(11,10,2)`
  - d. `qnorm(0.6,10,2,lower.tail=F)`
  - e. `pbeta(3,2,2)`
  - f. `pgamma(2,4,2)-pgamma(1,4,2)`
  - g. `x<-0:10; dbinom(x,10,0.7)`
  - h. `x<-3:10; dnbinom(x,3,0.5)`
  - i. `qf(0.5,3,5)`
  - j. `x<-c(1,3,5); dchisq(x,10)`
  - k. `rhyper(100,10,7,8)`
  
2.
  - a. `x<-seq(0,10, 0.001); plot(x, df(x,10,15), type='l')`
  - b. `x<-seq(0,15, 0.001); plot(x, dweibull(x,2,4), type='l')`
  - c. `x<-0:10`  
`pr<-dnbinom(x,2,0.7)`  
`plot(x,pr,type="h",xlim=c(0,10),ylim=c(0,1), col="blue",ylab="p")`  
`points(x,pr,pch=20,col="dark red")1.`
  
3.
 

```
par(mfrow=c(2,2))
for(i in 1:4)
{
x<-rexp(150,0.5)
xbar<-cumsum(x)/(1:150)
plot(xbar)
abline(h=2)
}
```
  
4.
 

```
geom.clt<-function(k,n,p)
{
Sn<-rep(NA,k)
for(i in 1:k)
```

<sup>1</sup> Στην R η Αρνητική Διωνυμική με παραμέτρους n και p έχει σ.μ.π

$$\binom{n+x-1}{x} p^n (1-p)^x, \quad x = 0, 1, 2, \dots$$

```

{
x<-rgeom(n,p)
Sn[i]<-sum(x)
}
return(Sn)
}
run<-geom.clt(150,200,0.4)
par(mfrow=c(1,2))
hist(run)
qqnorm(run)
qqline(run)

```

5. <sup>2</sup>

```

x<- c(3, 1, 2, 3, 1, 1, 1, 1, 4, 1, 1, 7, 1, 1, 1, 2, 1, 2, 1, 1, 1, 2, 2, 2, 1, 1,
3, 1, 2, 4)
y<-x-1
p<-seq(0.001, 0.999, length=10000)
geom_loglikelihood<-function(data, p){
results<-rep(NA,10000)
for(i in 1:10000){
results[i]<-sum(dgeom(data,p[i],log=T))
}
return(results)
}
results<-geom_loglikelihood(y, p)
plot(p, results, xlab="p ", ylab="loglikelihood", type="l")
actual_mle<- (1+mean(y))(-1)
actual_mle
p[order(results)[10000]]

```

6.

```

x<-c(9.92, 9.35, 7.81, 8.82, 9.34, 7.01, 8.80, 6.97, 5.87, 9.71, 5.26,
9.30, 8.17, 9.67, 9.23, 7.41, 6.80, 9.06, 9.96, 5.36, 8.88, 6.89, 8.23,
6.00, 9.00, 5.85, 9.71, 9.79, 8.22, 8.91)
min(x)
theta<-seq(0.1, 9.9, length=10000)
uniform_likelihood<-function(data, theta){
results<-rep(NA,10000)
for(i in 1:10000){
results[i]<-prod(dunif(data, theta[i], 10))
}
return(results)
}
results<-uniform_likelihood(x, theta)
plot(theta, results, xlab="theta", ylab="likelihood", type="l")

```

<sup>2</sup> Στην R η Αρνητική Διωνυμική με παραμέτρους  $n$  και  $p$  έχει σ.μ.π.

$$\binom{n+x-1}{x} p^n (1-p)^x, \quad x = 0, 1, 2, \dots$$