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)
 {
```

[1] Στην R η Αρνητική Διωνυμική με παραμέτρους n και p έχει σ.μ.π

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

```
Sn<-rep(NA,k)
for(i in 1:k)
{
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)
mean(run)
var(run)
```

5. [2]

```
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))
          }
```

[2] Στην R η Γεωμετρική κατανομή με παραμέτρους n και p έχει σ.μ.π.

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

```
        return(results)
        }
results<-uniform_likelihood(x, theta)
plot(theta, results, xlab="theta", ylab="likelihood", type="l")
```