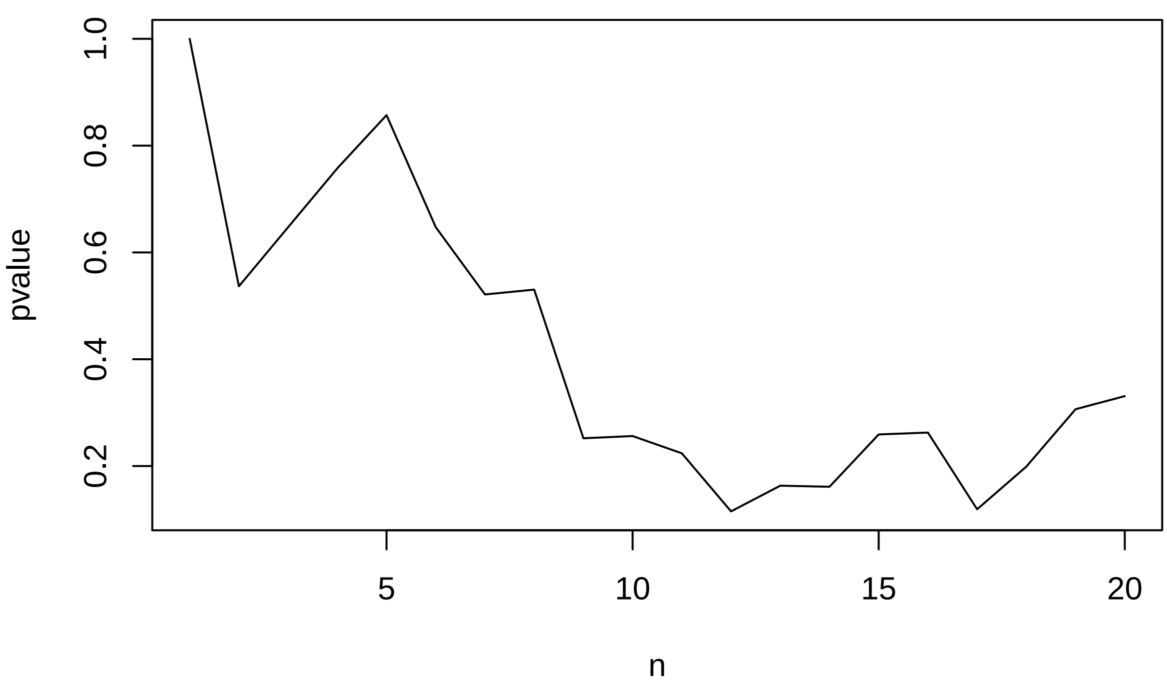
Solution lab 18

May 11, 2016

The sample was in fact generated with a Poisson distribution with parameter $\lambda = 10$. We will estimate the p-value according to the size of the sample n. In the exercises, only the computation for $n = 20$ was asked but it is always interesting to see the behavior evolution of the estimators as n raised.

Exercise 1

```
chi <- c()
pvalue <- c()
obs <- c(16,8,13,14,11,13,11,19,11,5,14,13,4,8,12,4,13,9,7,9)
n <- length(obs)
for(c in 1:n){
  sample <- obs[1:c]

# Computation of the N_i's
  counts <- hist(sample,plot=FALSE,breaks=seq(min(sample)-0.5,max(sample)+0.5,1))$counts
  k <- max(sample)-min(sample)+1

# Computation of the statistic T
  T <- sum((counts - c/k)^2/(c/k))
  chi <- append(chi, T )

# Computation of the p-value;
  pvalue <- append(pvalue, 1-pchisq(T,k-1))
}
plot(1:n,pvalue,type='l',xlab='n')
```

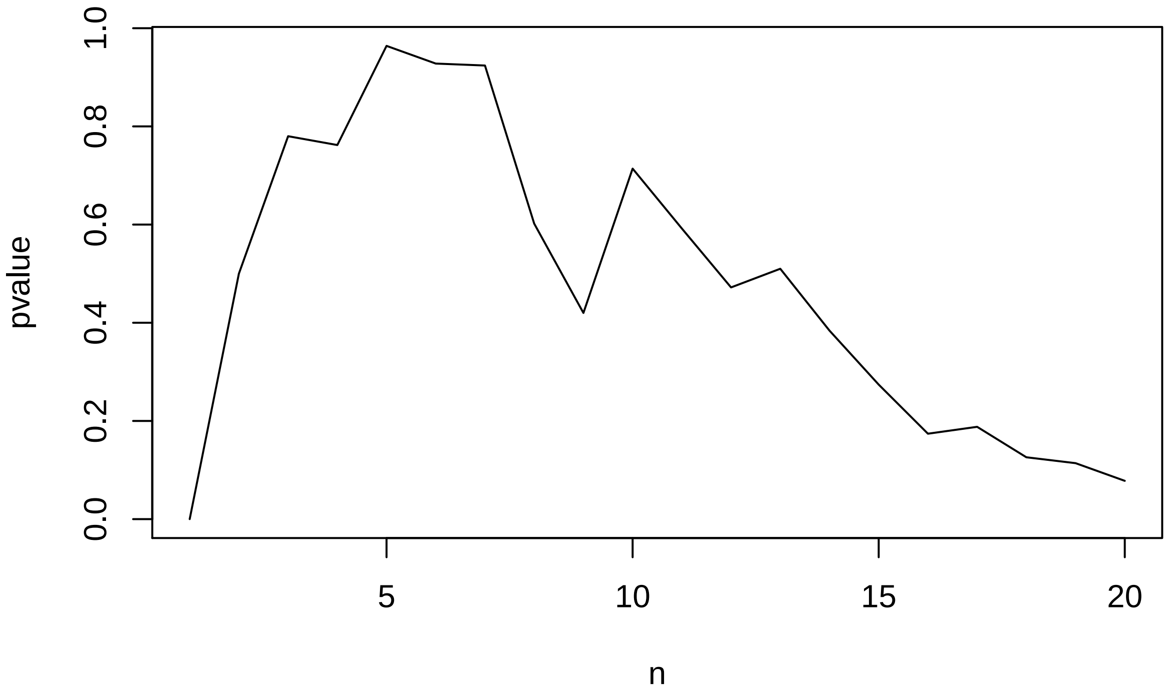


```r
pvalue[n]
```

```
## [1] 0.3309604
```

Exercise 2

```r
pvalue <- c()

for(c in 1:n){
 sample <- obs[1:c]
 k <- max(sample)-min(sample)+1

# Computation of the c.d.f F
 cdf<-function(y){
   return( min(max(sample),max(floor(y)-min(sample),0))/k )
 }
 sortsample <- sort(sample)
 Fy <- sapply(sortsample,cdf)

# Computation of the statistic D
 d <- max( c(1:c/c-Fy, Fy-0:(c-1)/c) )

# Estimation of the p-value function
  # We generate a matrix with n*500 uniform random variables
 U <- sapply(1:500,function(x) runif(c))

  # Computation of the statistic D under H_0
 if(c==1){
   U <- max( c(1:c/c-U, U-0:(c-1)/c) )
 }else{
   U <- apply(U,2,sort)
   U <- apply(U,2, function(x) max( c(1:c/c-x, x-0:(c-1)/c) ) )
 }

# Estimation of the p-value by mean estimator
 pvalue <- append(pvalue,mean(U>d))
}
plot(1:n,pvalue,type='l',xlab='n')
```




```
pvalue[n]
```

```
## [1] 0.078
```

```
x <- (min(obs)-1):(max(obs)+1)
k <- length(x)
plot(x,0:(k-1)/(k-2),type='s',ylab='F')
Fe<-ecdf(obs)
lines(x,Fe(x),type='s',col='red')
```