Lab 1

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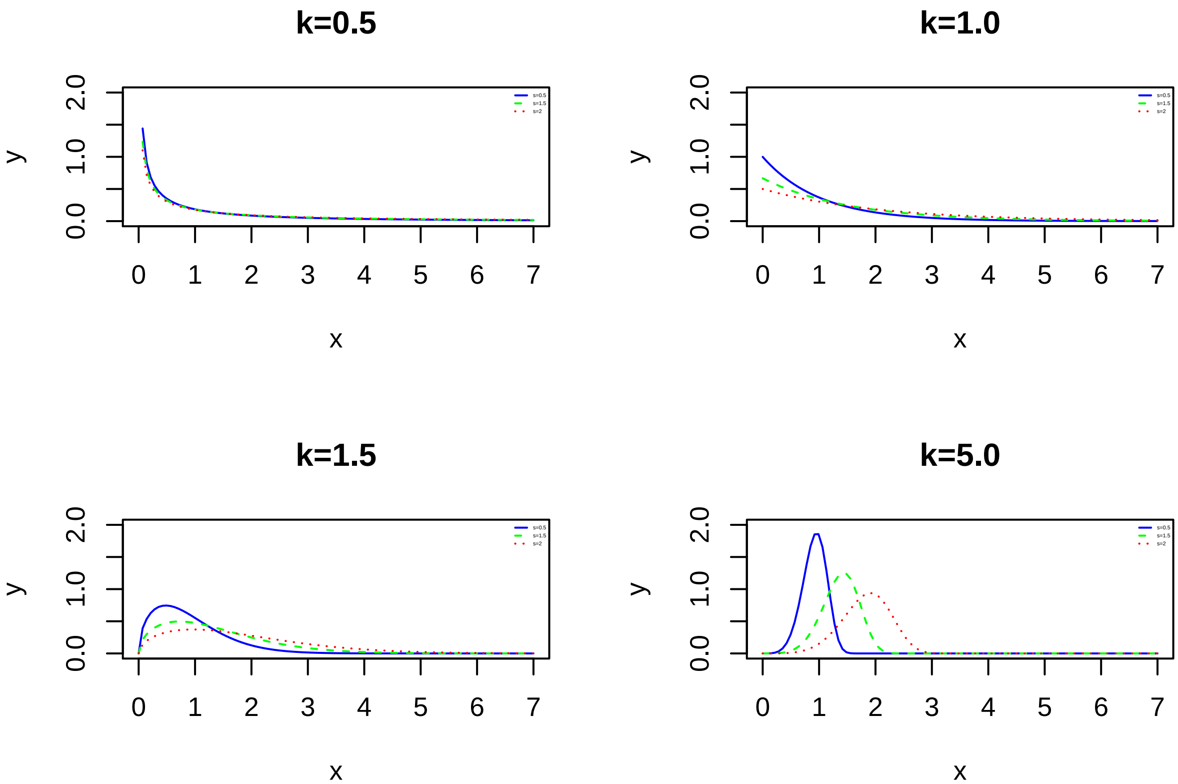
Problem 1

1a)

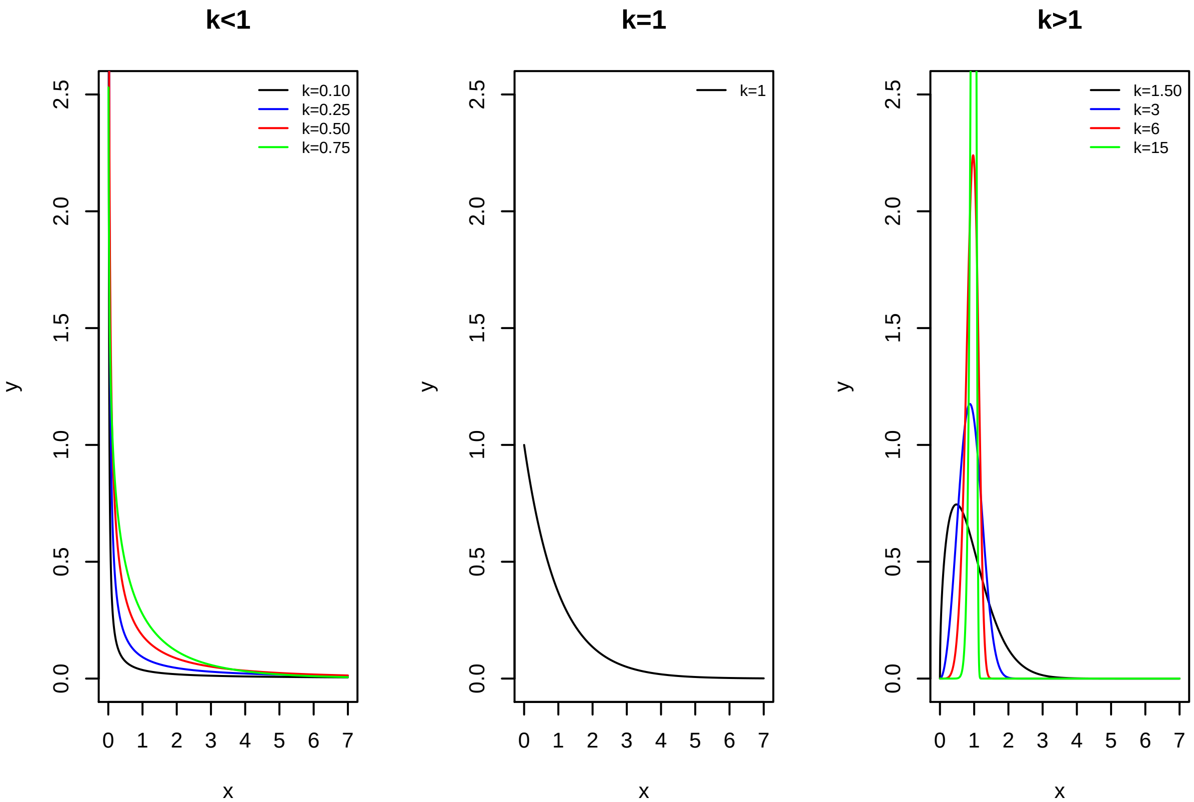
```r
dwei <- Vectorize(function(x,k,s){

  if (x < 0)
    0
  else
    k/s*(x/s)^(k-1)*exp(-(x/s)^k)

})
x <- seq(0,7,length = 100)
k = c(0.5,1.0,1.5,5.0)
kStr = c("k=0.5","k=1.0","k=1.5","k=5.0")
s = c(1,1.5,2)

par(mfrow = c(2,2))
for(i in 1:4){
  plot(x,dwei(x,k[i],s[1]),col="blue",lty=1,ylim=c(0,2),type="l",ylab="y")
  title(kStr[i])
  lines(x,dwei(x,k[i],s[2]),col="green",lty=2,ylim=c(0,2),type="l",ylab="y")
  lines(x,dwei(x,k[i],s[3]),col="red",lty=3,ylim=c(0,2),type="l",ylab="y")
  legend("topright",legend=c("s=0.5","s=1.5","s=2"),col=c("blue","green","red")
         ,lty=1:3,bty="n",cex=0.25)
}
```



1b)

```
dwei <- Vectorize(function(x,k,s){

  if (x < 0)
    0
  else
    k/s*(x/s)^(k-1)*exp(-(x/s)^k)

})
x <- seq(0,7,length = 1000)
strings = c("k<1","k=1","k>1")
kLessThan1 = c(0.1,0.25,0.5,0.75)
kIs1 = c(1)
kLargerThan1 = c(1.5,3,6,15)
colours = c("black","blue","red","green")
values = list(kLessThan1,kIs1,kLargerThan1)
par(mfrow = c(1,3))

for(i in 1:3){

  vec = unlist(values[i])
  ks = c()
  for(j in 1:length(vec)){

    if((vec[j])%%1 == 0)
      ks = append(ks,paste("k=",sprintf("%d",vec[j]),sep=""))
    else
      ks = append(ks,paste("k=",sprintf("%1.2f",vec[j]),sep=""))
```

```r
    if (j ==1){
      plot(x,dwei(x,vec[j],1),col=colours[j],ylim=c(0,2.5),ylab="y",type="l",lty=1)
      title(strings[i])
    }
    else
      lines(x,dwei(x,vec[j],1),col=colours[j],ylim=c(0,2.5),ylab="y",type="l",lty=1)
  }
  legend("topright",legend=ks,col=colours[1:length(vec)],lty=rep(1,length(vec)),
         bty="n",cex=0.75)
}
```

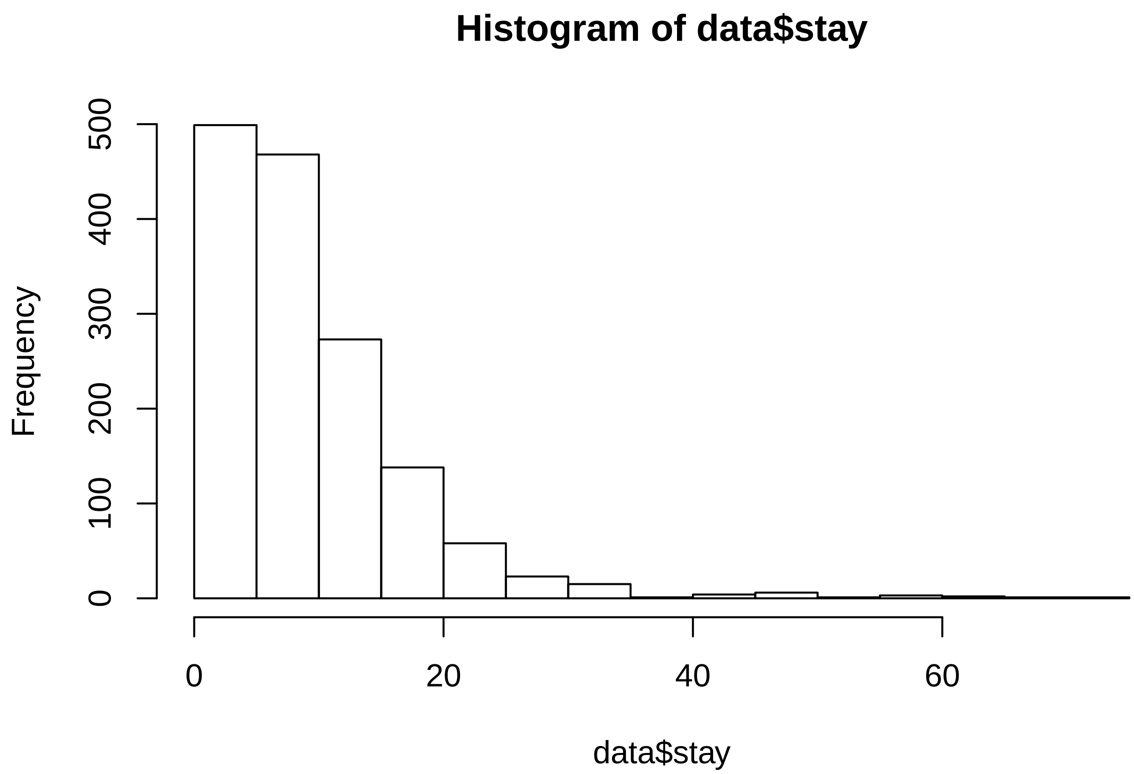


For $0 < k < 1$ the density function approaches infinity when $x \to 0^+$ and is decreasing. When $k = 1$ the density function converges to some number (in this case the number is around 1) when $x \to 0+$, and the function is also decreasing. When $k > 1$ the density function approaches 0 when $x \to 0^+$ and is increasing until some number and after that decreasing. In all three cases the function goes to 0 when $x \to \infty$.

Problem 2

2a) and 2b)

```r
data <- read.csv("/Users/andreas/Documents/workspace/R/hospital.csv")
hist(data$stay)
```




```
any(data$stay == 0)
```

```
## [1] FALSE
```

The variable "stay" could be Poisson distributed since it only takes integer values ≥ 0 and usually small values and not so often large values, which characterises the Poisson distribution.

The problem is that in our data "stay" is never 0. If it really is Poisson distributed then it should take the value 0 with probability $e^{-\lambda}$. It is therefore more likely that "stay" is zero-truncated poisson distributed.