Problems Sheet 2

Statistics 1

Dom Hutchinson

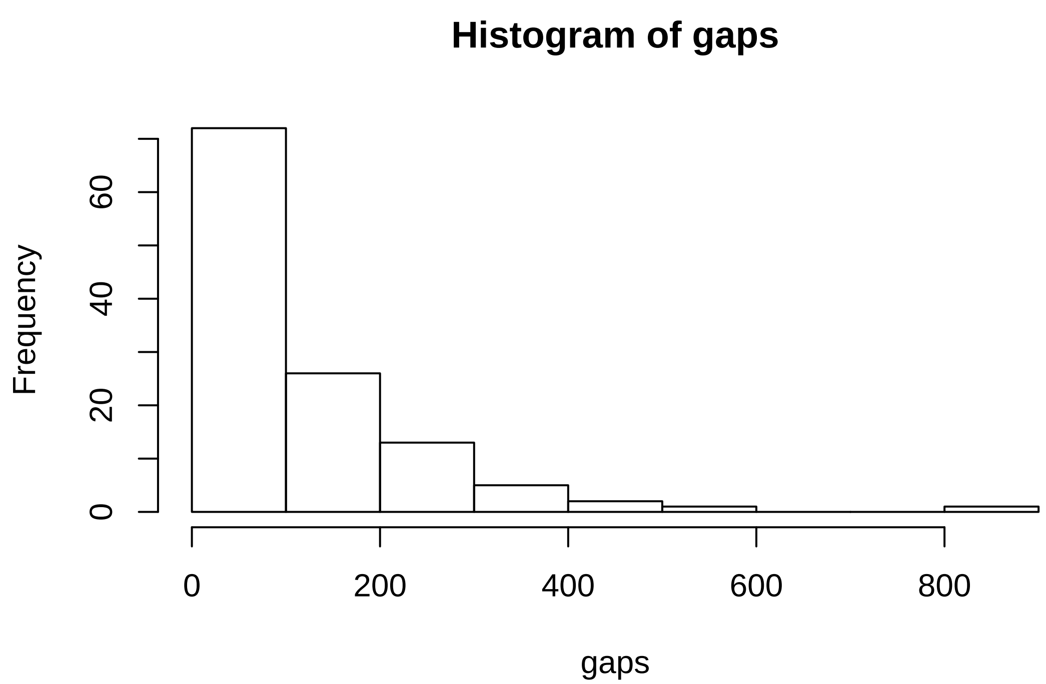
Part A

Question 2

```
source("https://people.maths.bris.ac.uk/~maxca/stats1/downloads/disasters.R")
gaps<-disasters$gap[2:121]
```

Part a)

```
p1<-hist(gaps)
```



This histogram fits the general shape of an exponential distribution. This suggests an exponential distribution would be a suitable model. This makes sense since we can expect each disaster to occur independently.

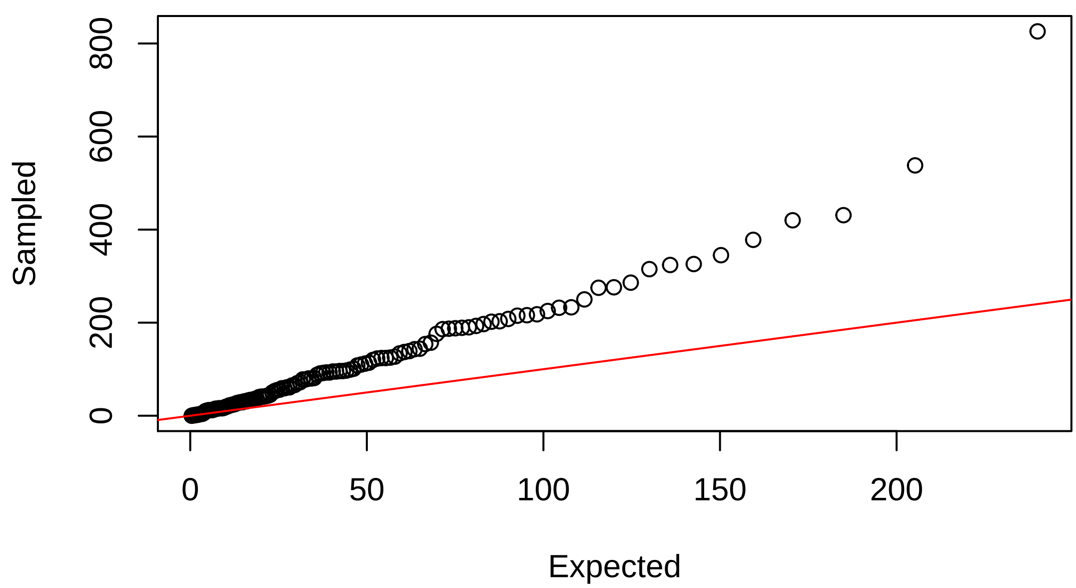
Part b)

$$\begin{aligned}
\mu(gaps) &= 115.2 \\
m &= \mathbb{E}(X;\theta) \\
&= \frac{1}{\theta} \\
\implies \qquad \hat{\theta} &= \frac{1}{\mu} \\
&= \frac{1}{115.2} \\
&= 0.008681
\end{aligned}$$

Part c)

```
inverseDistribution <- function(y,theta) {
  val <- -log10(1-y)
  val <- val/theta
  return(val)
}

order<-sort(gaps)
k<-seq(1,120,1)
plot(inverseDistribution(k/121,0.008681),order,xlab="Expected",ylab="Sampled")
abline(0,1,col="red")
```



Question 5

$$\begin{array}{lrcl}
 & \mathbb{E}(X;\alpha,\lambda) & = & \frac{\alpha}{\lambda} \\
 & \mathbb{E}(X^2;\alpha,\lambda) & = & \frac{\alpha(\alpha+1)}{\lambda^2} \\
\text{Set} & m_1 & = & \frac{\alpha}{\lambda} \\
 & \&\ m_2 & = & \frac{\alpha(\alpha+1)}{\lambda^2} \\
\implies & \alpha & = & \lambda m_1 \\
\implies & m_2 & = & \dfrac{\lambda m_1(\lambda m_1+1)}{\lambda^2} \\
\implies & \lambda^2 m_2 & = & \lambda^2 m_1^2 + \lambda m_1 \\
\implies & \hat{\lambda} & = & \dfrac{m_1}{m_2 - m_1^2} \\
\implies & \hat{\alpha} & = & \dfrac{m_1^2}{m_2 = m_1^2}
\end{array}$$

Part B

Question 2