TP1 ~ Mathématique actuarielles IARD I

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2018-10-05

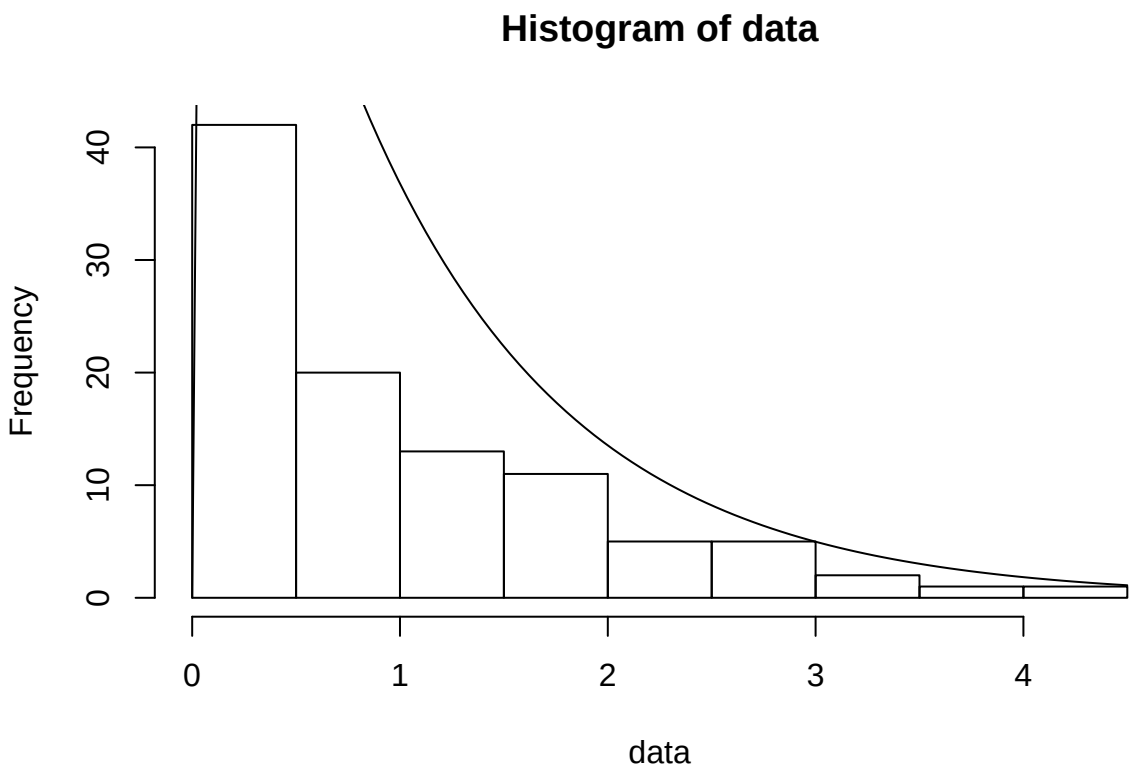
a) Le coéficient d'asymétrie estimé:

```
n <- 100
data <-  rexp(n, 1)


mu <- mean(data)
sd <- sd(data)
mu_2 <- mean(data^2)
mu_3 <- mean(data^3)
cof_asymetrie <- (mu_3 - 3 * mu_2 * mu + 2 * mu^3)/sd^3



hist(data);curve(dexp(x,1) * n, add = TRUE)
```



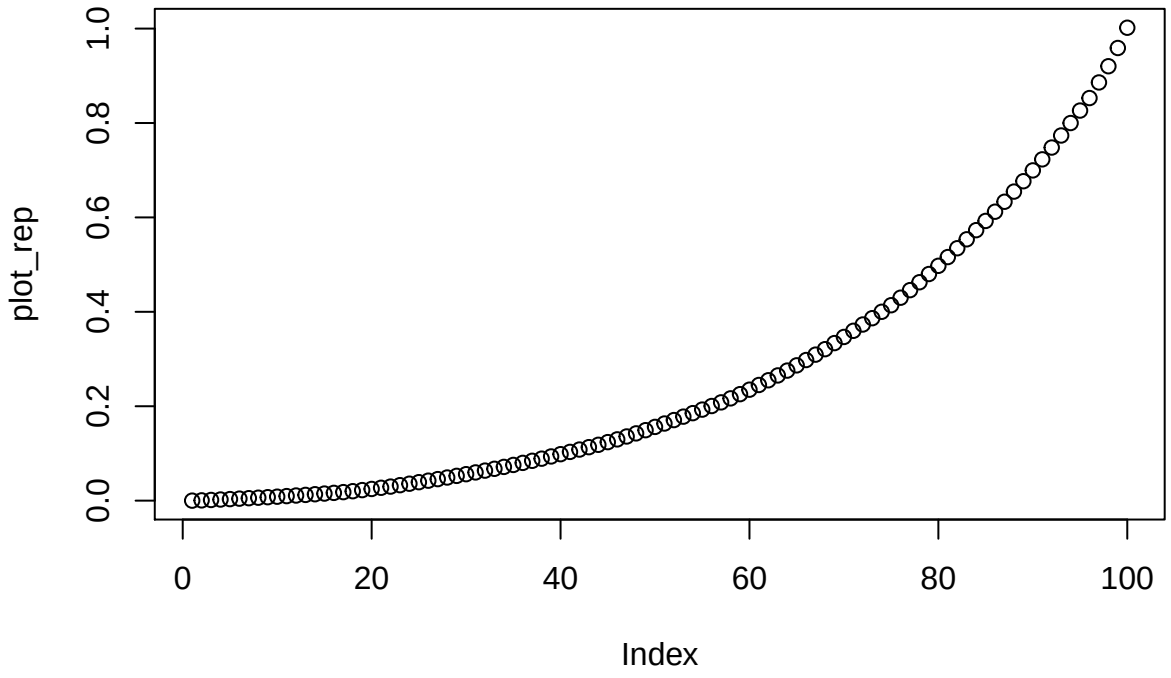
c)Coeficient d'asymétrie théorique Les moments de la loi expodentiel sont donnés par:

$$
\begin{aligned}
E[x] &= \frac{1}{\theta} \\
E[x^2] &= var(x) + E^2[x] \\
&= \frac{1}{\theta^2} + \left(\frac{1}{\theta}\right)^2 \\
&= \frac{2}{\theta^2} E[x^3] && = M_x^{(3)}(0) \\
&= \frac{d^3}{dt^3}\left(\frac{\theta}{\theta - t}\right) \\
&= \frac{d^2}{dt^2}\left(\frac{\theta}{(\theta - t)^2}\right)
\end{aligned}
$$

$$
\begin{aligned}
\gamma &= E\left[\frac{(x-\mu)^3}{\sigma^3}\right] \\
&= \frac{1}{\sigma^3} E\left[x^3 - 3x^2\mu + 3x\mu 2\mu^3\right] \\
&= \frac{1}{\sigma^3}\left(E[x^3] + 3\mu E[x^2] + 3\mu^2 E[x] + \mu^3\right)
\end{aligned}
$$

Question 2

```
rep_emp <- function(t){
    sum(data * (data <= t)) / n
}
plot_rep <- sapply(sort(data), rep_emp)
plot(plot_rep)
```



```r
plot(ecdf(data))
```