Exercice : Test de Kolmogorov-Smirnov

```r
install.packages("ggplot2",repos = "http://cran.us.r-project.org")
```

```
## Warning: unable to access index for repository http://cran.us.r-project.org/src/contrib:
##   cannot open URL 'http://cran.us.r-project.org/src/contrib/PACKAGES'

## Warning: package 'ggplot2' is not available (for R version 3.5.1)

## Warning: unable to access index for repository http://cran.us.r-project.org/bin/macosx/el-capitan/co
##   cannot open URL 'http://cran.us.r-project.org/bin/macosx/el-capitan/contrib/3.5/PACKAGES'
```

```r
library(ggplot2)
set.seed(254)
k=1:100
l=1:100
for (i in 1:100)
{
  u=rexp(1,1)
  l[i]=u
}

so=l[order(l)]
so
```

```
##   [1] 0.005143292 0.007998401 0.035032275 0.038825120 0.053518175
##   [6] 0.079166044 0.107159502 0.131127127 0.136118233 0.158363834
##  [11] 0.160438983 0.181117203 0.205961673 0.214485342 0.218351417
##  [16] 0.223184937 0.224276716 0.228771869 0.232283868 0.233438427
##  [21] 0.236372354 0.245644187 0.248222437 0.260990661 0.261556915
##  [26] 0.267238777 0.272209368 0.272860450 0.276354577 0.278804836
##  [31] 0.294241696 0.310352448 0.322630604 0.340961270 0.366683055
##  [36] 0.368288236 0.397390094 0.413780637 0.418461236 0.420138591
##  [41] 0.450135275 0.450721797 0.463897370 0.539803244 0.576316005
##  [46] 0.605506711 0.621298573 0.639958588 0.643892045 0.667425530
##  [51] 0.668248098 0.678926278 0.692402035 0.711499895 0.742813652
##  [56] 0.767528851 0.769268951 0.778684772 0.860676320 0.863709202
##  [61] 0.939297402 1.004607570 1.030692153 1.053208095 1.090745795
##  [66] 1.104893157 1.248641727 1.254266503 1.277752831 1.285727725
##  [71] 1.349126834 1.373063784 1.407445110 1.411408625 1.427030606
##  [76] 1.451181516 1.456112422 1.463243833 1.476518646 1.482341621
##  [81] 1.501251490 1.673895370 1.720761325 1.771965988 1.784164976
##  [86] 1.795787865 1.878004692 2.016635647 2.145343950 2.356171688
##  [91] 2.417059082 2.491645159 2.650724599 2.750335669 2.918883867
##  [96] 3.131893150 3.420829050 4.086011892 4.841131080 5.591181144
```

```r
#les statistiques d'ordre
l2=1:100
for (i in 1:100)
{
    l2[i]=i/100
}

#le zalpha du theoreme de Massart
alph=0.05
```

```r
zalpha=sqrt(1/2*log(2/alph))
zalpha/10
```

```
## [1] 0.1358102
```

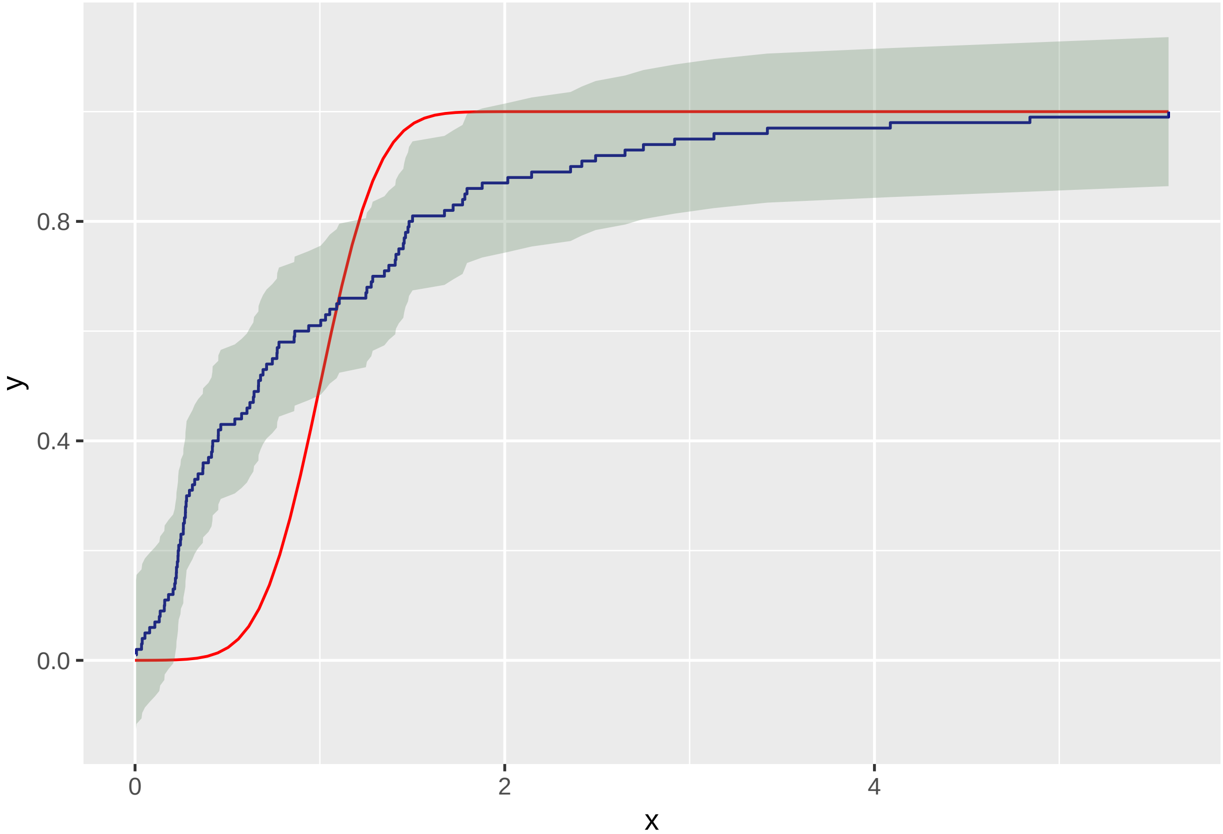
```r
plotdata <- data.frame(x=so, y=l2, lower = (l2-zalpha/10), upper = (l2+zalpha/10), qdown=qnorm((l2-zalph
```

```
## Warning in qnorm((l2 - zalpha/10)): NaNs produced
```

```
## Warning in qnorm((l2 + zalpha/10)): NaNs produced
```

```r
test <- function(x) {pnorm(x,1,1/4)}


p4 <- ggplot(data.frame(x = c(0, 4)), aes(x = x)) +
  stat_function(fun =test, colour="red") +geom_step(data=plotdata,aes(so,l2),colour="darkblue")+geom_ri
p4
```

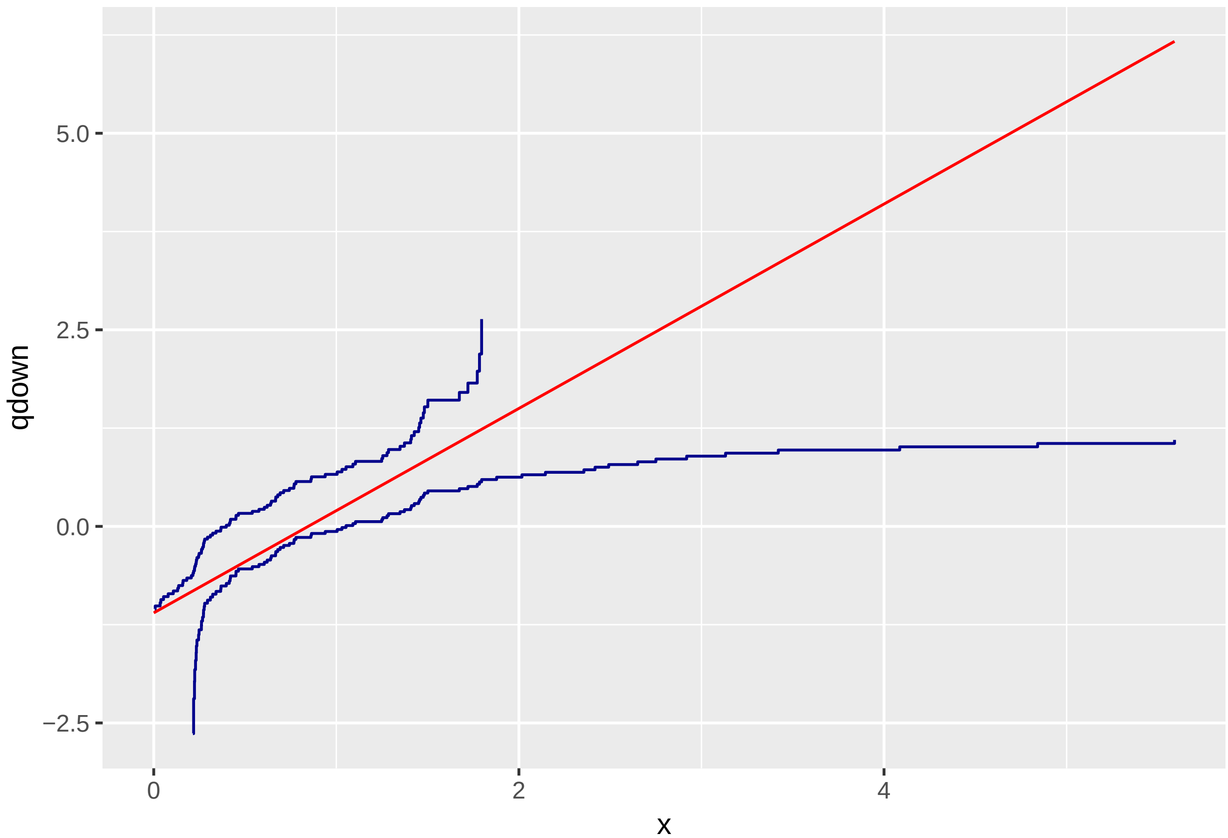



```r
#Apres plusieurs essais on otient une droite comprise entre les deux courbes
a=1.3
b=-1.1
droite<-function(x){a*x+b}

ptest<- ggplot(data.frame(x = c(0, 4)), aes(x = x)) +geom_step(data=plotdata,aes(so,qdown),colour="dark
ptest
```

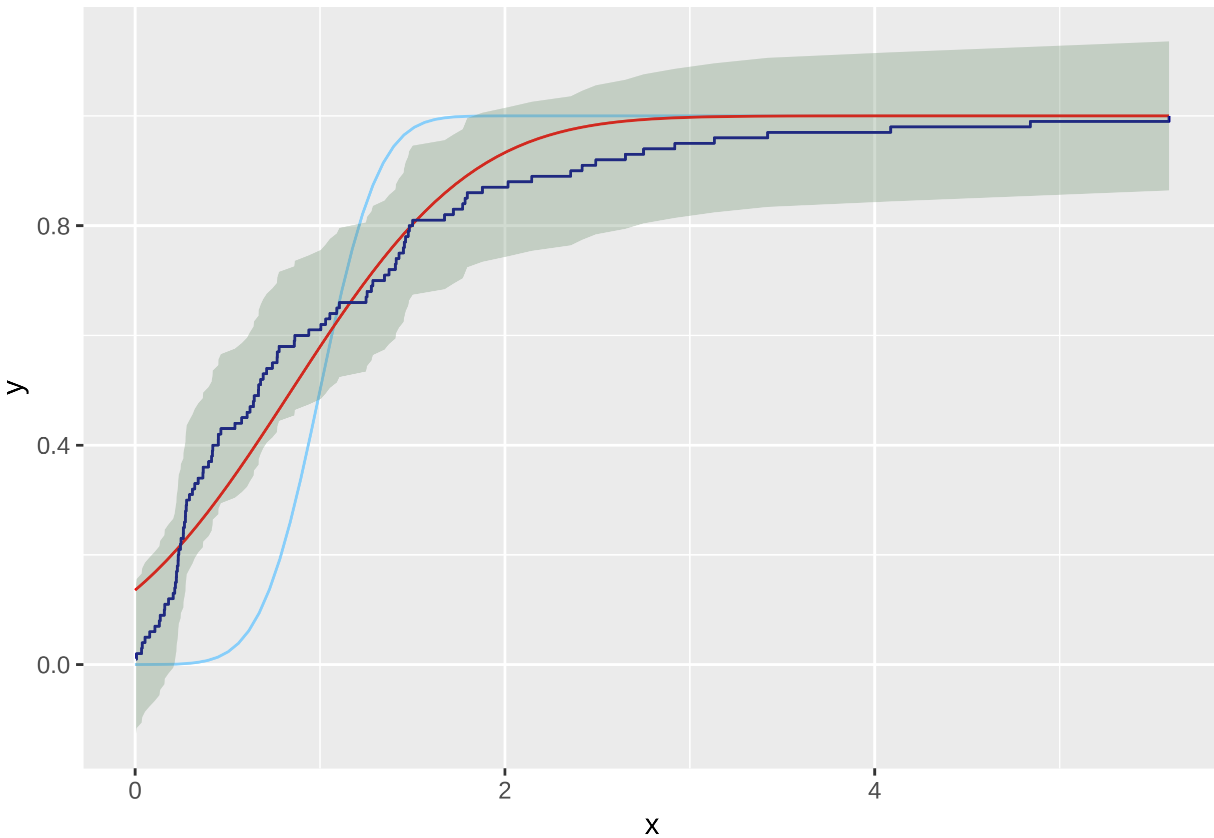
```
## Warning: Removed 13 rows containing missing values (geom_path).
```

```
## Warning: Removed 14 rows containing missing values (geom_path).
```




```
test_norm<-function(x){pnorm(x,-b/a,1/a)}

#On superpose la loi normale correspondante sur le graphe des fonctions de repartition
ppp<- ggplot(data.frame(x = c(0, 4)), aes(x = x)) + stat_function(fun =test, colour="lightskyblue")+
  stat_function(fun =test_norm, colour="red") +geom_step(data=plotdata,aes(so,l2),colour="darkblue")+geo
ppp
```



La fonction de repartition de la N(1,1/2) n est pas dans la bande de confiance de la fonction de repartition empirique basee sur les X1,. . . Xn iid~Exp(1). On rejette donc l hypothese nulle. Cela est coherent car on sait que les observations sont des observations d une Exp(1). Pour le modele general avec un test portant sur la famille des loi normales, on trouve qu il existe une loi qui appartient a l intervalle et ne pouvont donc pas rejeter l hypothese nulle. Comme on sait qu en realite la loi des Xi est une Exp(1), on effectue en fait une erreur de 2eme espece (H1 est vraie mais on decide H0).