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### exo 5 loi des grands nombres
# correction "codeS2.pdf"
### exo 6 theoreme central limite
# correction "codeS2.pdf"
### exo 7 tcl generalise
n = 1000; R = 5000; m = 1:R;
for(i in 1:R){
  x = rcauchy(n); m[i] = mean(x)
}
hist(m, probability = T)
y = seq(min(m), max(m), 0.01)
lines(y, dcauchy(y), col = "red")

c = 10;
hist(m[(m>-c)&(m<c)], probability = T, br =
50)
tcl <- function(R, n){
  a=matrix(1,nrow=R,ncol=n)
  for( i in 1 : R)
  {
    temp=rcauchy(n)
    a[i,]=temp
  }
  x = apply(a, 1, mean)
}
R = 5000; n = 1000
y = tcl(R, n)
hist(y[(y>-10)&(y<10)], breaks = 50)
#b) Calculer ...
#c) Tracer (1) un histogramme ...
hist(y,proba=T,col="grey",breaks = 50)
z=seq(min(y),max(y),0.01)
lines(z,dnorm(z,0,1),lty=1,col="red",lwd =
2)
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lines(z,dcauchy(z,0,1),lty=1,col="blue",lwd
= 2)

c = 10
hist(y[(y > -c)&(y <
c)],proba=T,col="grey",breaks = 50)
z=seq(-c,c,0.01); t = length(y[(y > -c)&(y <
c)])/R
lines(z,dnorm(z,0,1)/t,lty=1,col="red",lwd =
2)
lines(z,dcauchy(z,0,1)/t,lty=1,col="blue",lwd
 = 2)

lines(z,dnorm(z,0,1),lty=1,col="red",lwd =
2)
lines(z,dcauchy(z,0,1),lty=1,col="blue",lwd
= 2)
# d) fonction de repartition
Fn=ecdf(y)
plot(Fn,verticals=T,do.p=F, col = 1, lty= 1,
xlim = c(-10,10))
lines(z,pnorm(z,0,1),col=5)
lines(z,pcauchy(z,0,1),col=6)
R = c(50, 100, 500)
for(i in 1:3){
  y = tcl(R[i], n);Fn = ecdf(y)
  lines(Fn,verticals=T, do.p=F, col = (i+1))
}
legend("bottomright", col = 1:6, lty =
rep(1,6), c(as.character(c(5000, R)),
"norm", "cauchy"))
### pareto
qpareto <- function(y, p){(1/(1-y))^(1/p)}
rpareto <- function(n, p){qpareto(runif(n),
p)}
```

```
library(evd)

n = 1000; R = 5000; m = 1:R; p = 1
for(i in 1:R){
  x = rpareto(n, p); m[i] = max(x)/n
}
hist(m[m<10], br = 50, probability = T)
y = seq(0, 10, 0.01)
lines(y, dfrechet(y), col = "red")

tcl <- function(R, n, p){
  a = matrix(1, nrow = R, ncol = n)
  n1 = floor(n/2)
  for( i in 1 : R)
  {
    temp = rpareto(n, p)
    a[i,] = c(temp[1:n1]-1, 1-
temp[(n1+1):n])
  }
  x = apply(a, 1, sum)/(n^(1/p))
}
R = 5000; n = 1000; p = 1
y = tcl(R, n, p); hist(y)
hist(y[(y>-10)&(y<10)], breaks = 50)
#b) Calculer ...
#c) Tracer (1) un histogramme ...
hist(y,proba=T,col="grey",breaks = 50)
z=seq(min(y),max(y),0.01)
lines(z,dnorm(z,0,1),lty=1,col="red",lwd =
2)
lines(z,dcauchy(z,0,1),lty=1,col="blue",lwd
= 2)

c = 10
hist(y[(y > -c)&(y <
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c)],proba=T,col="grey",breaks = 50)
z=seq(-c,c,0.01); t = length(y[(y > -c)&(y <
c)])/R
lines(z,dstable(z,p,0)/t,lty=1,col="red",lwd
= 1)

lines(z,dcauchy(z,0,1),lty=1,col="blue",lwd
= 2)


plot (z,dcauchy(z,0,1),lty=1,col="blue",lwd
= 2)

# d) fonction de repartition
Fn=ecdf(y)
plot(Fn,verticals=T,do.p=F, col = 1, lty= 1,
xlim = c(-10,10))
lines(z,pnorm(z,0,1),col=5)
lines(z,pcauchy(z,0,1),col=6)
R = c(50, 100, 500)
for(i in 1:3){
  y = tcl(R[i], n);Fn = ecdf(y)
  lines(Fn,verticals=T, do.p=F, col = (i+1))
}
legend("bottomright", col = 1:6, lty =
rep(1,6), c(as.character(c(5000, R)),
"norm", "cauchy"))
### exo 8 loi des valeurs extremes
#############
# 1. pareto #
#############
p = 1
ext <- function(R, n){
  a = matrix(1,nrow = R, ncol = n)
  for( i in 1 : R)
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```
  {
    temp = rpareto(n, p)
    a[i,] = temp
  }
  x = apply(a,1,max)
}
R = 5000; n = 1000
y = ext(R, n)

#b) Calculer ...
#c) Tracer (1) un histogramme ...
m = 0; s = n
y = (y-m)/s
# hist(y,proba=T,col="blue")
c = 10
hist(y[y < c],proba=T,col="grey",breaks =
50)
z=seq(0,c,0.01)
library(evd)
lines(z,dfrechet(z),lty=1,col="red",lwd = 2)

#
Fn=ecdf(y)
plot(Fn,verticals=T,do.p=F, col = 1, xlim =
c(0,10))
lines(z,pnorm(z,0,1),lty=1,col=5)
lines(z,pfrechet(z),lty=1,col=6)
R = c(50, 100, 500)
for(i in 1:3){
  y = ext(R[i], n); y = (y-m)/s; Fn =
ecdf(y)
  lines(Fn,verticals=T, do.p=F, col = i+1)
}
legend("bottomright", col = 1:6, lty =
rep(1,6), c(as.character(c(5000,
```

```
R)),"norm","frechet"))
```