TP 1 de probablités

IS 3

1/7/2021

Exercice 1

```
mon_vecteur <- seq(4,13,by=1) # on aurrait aussi pu faire c(4,5,6,...,13)
sum(mon_vecteur)
```

```
## [1] 85
```

```
prod(mon_vecteur)
```

```
## [1] 1037836800
```

```
mean(mon_vecteur)
```

```
## [1] 8.5
```

```
var(mon_vecteur)
```

```
## [1] 9.166667
```

```
sd(mon_vecteur)
```

```
## [1] 3.02765
```

```
max(mon_vecteur)
```

```
## [1] 13
```

```
min(mon_vecteur)
```

```
## [1] 4
```

```
length(mon_vecteur)
```

```
## [1] 10
```

```
pmax(mon_vecteur,7)
```

```
##  [1]  7  7  7  7  8  9 10 11 12 13
```

```
which.max(mon_vecteur)
```

```
## [1] 10
```

```
which.min(mon_vecteur)
```

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

```
cumsum(mon_vecteur)
```

```
##  [1]  4  9 15 22 30 39 49 60 72 85
```

```r
cumprod(mon_vecteur)
```

```
##  [1]          4         20        120        840       6720      60480
##  [7]     604800    6652800   79833600 1037836800
```

Exercice 2

```r
nb.10 <- seq(1,10,by=1)
nb.100 <- seq(1,100,by=1)
nb.1000 <- seq(1,1000,by=1)

(sum.nb.10 <-sum(1/nb.10^2))
```

```
## [1] 1.549768
```

```r
(sum.nb.100 <-sum(1/nb.100^2))
```

```
## [1] 1.634984
```

```r
(sum.nb.1000 <-sum(1/nb.1000^2))
```

```
## [1] 1.643935
```

```r
pi^2/6 #somme(1/k^2)b -> pi^2/6
```

```
## [1] 1.644934
```

```r
esperance <- (10+1)/2
variance <- (10-1)^2/12
```

Exercice 3

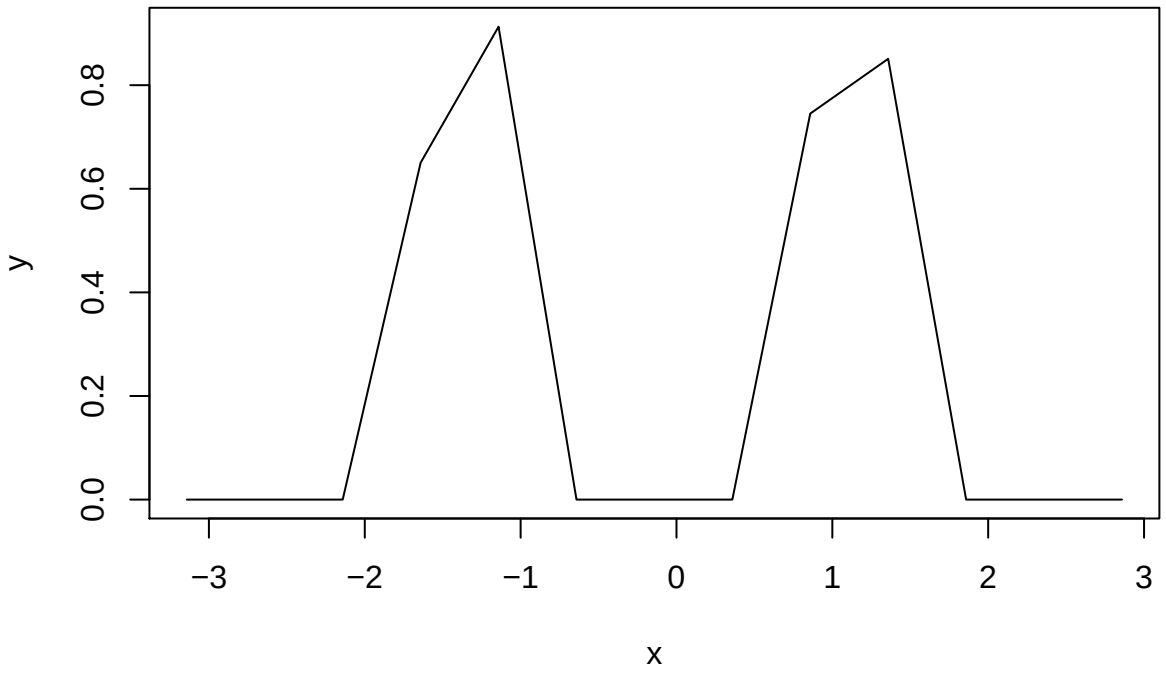
```r
A <-  matrix(c(3,2,1,2,3,1,1,2,3),byrow = TRUE,nrow=3)
b <- c(5,1,7)
solve(A,b)
```

```
## [1]  2 -2  3
```

Exercice 4

```r
f <- function(x) max(sin(10*x),0)
x <- seq(-pi,pi,by=0.5)
y  <- c()
for(i in x)
  y <- c(y,f(i))

plot(x,y,type='l')
```




```
integrate(Vectorize(f),lower = -pi,upper=pi)$value
```

```
## [1] 2
```

```
n <- 1000
pas <- 2*pi/n
x <- seq(-pi,pi,by= pas)
fx <- c()
for(i in x)
  fx <- c(fx,f(i))
(integrale <- pas*sum(fx))
```

```
## [1] 1.999342
```

Exercice 5

```
 poisson <- function(n,param){
   values <- c(0:n)
   f <- c()
   for(k in values){
      f <- c(f,(exp(-param) * param^k)/factorial(k))
   }
   return(1 - sum(f))
}

poisson(10,pi)
```

```
## [1] 0.0004277368
```

```
1-ppois(10,pi)
```

```
## [1] 0.0004277368
```

Exercice 6

```
 geom <- function(n,p){
   values <- c(1:n)
   f <- c()
   for(k in values){
      f <- c(f,p * (1 - p)^(k - 1))
   }
   return(1 - sum(f))
 }
geom(10,1/pi)
```

```
## [1] 0.02167055
```

```
1-pgeom(10-1,1/pi)
```

```
## [1] 0.02167055
```

Exercice 7

```
 binom <- function(n,p,k){
   values <- c(0:k)
   f <- c()
   for(j in values){

      f <- c(f,choose(n,j) * (p^j) * (1 - p)^(n-j))
   }
   print(cbind(values,f))
   return(1 - sum(f))
 }
binom(8,1/pi,4)
```

```
##      values          f
## [1,]      0 0.04663328
## [2,]      1 0.17420037
## [3,]      2 0.28469528
## [4,]      3 0.26587248
## [5,]      4 0.15518385
```

```
## [1] 0.07341474
```

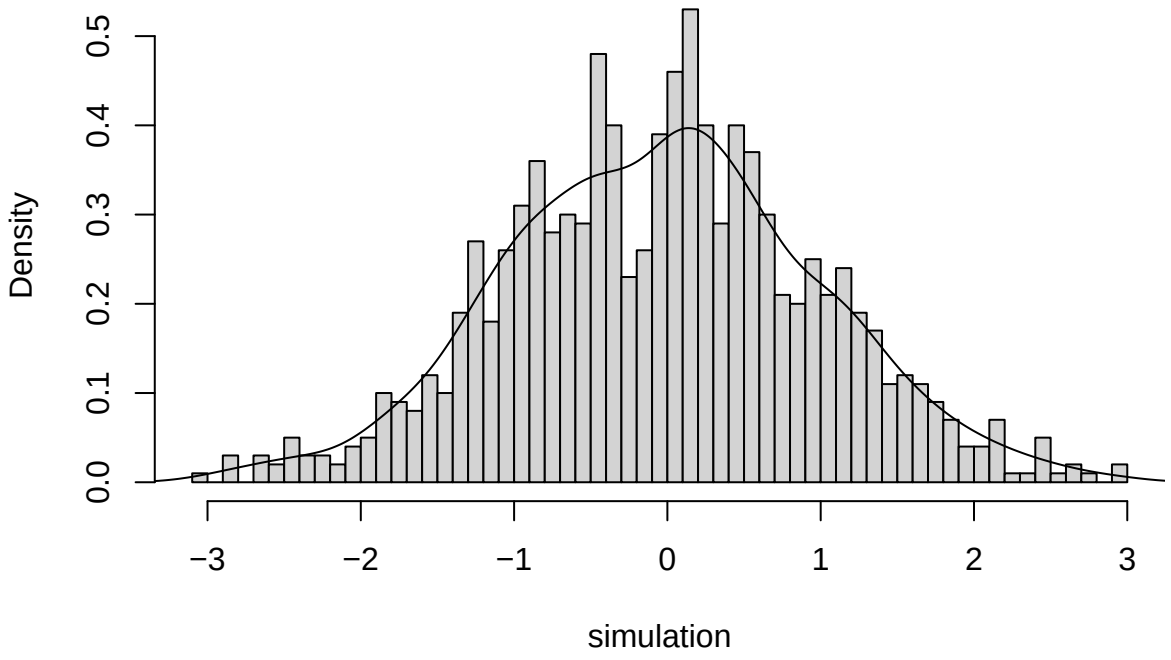
```
1 - pbinom(4,8,1/pi)
```

```
## [1] 0.07341474
```

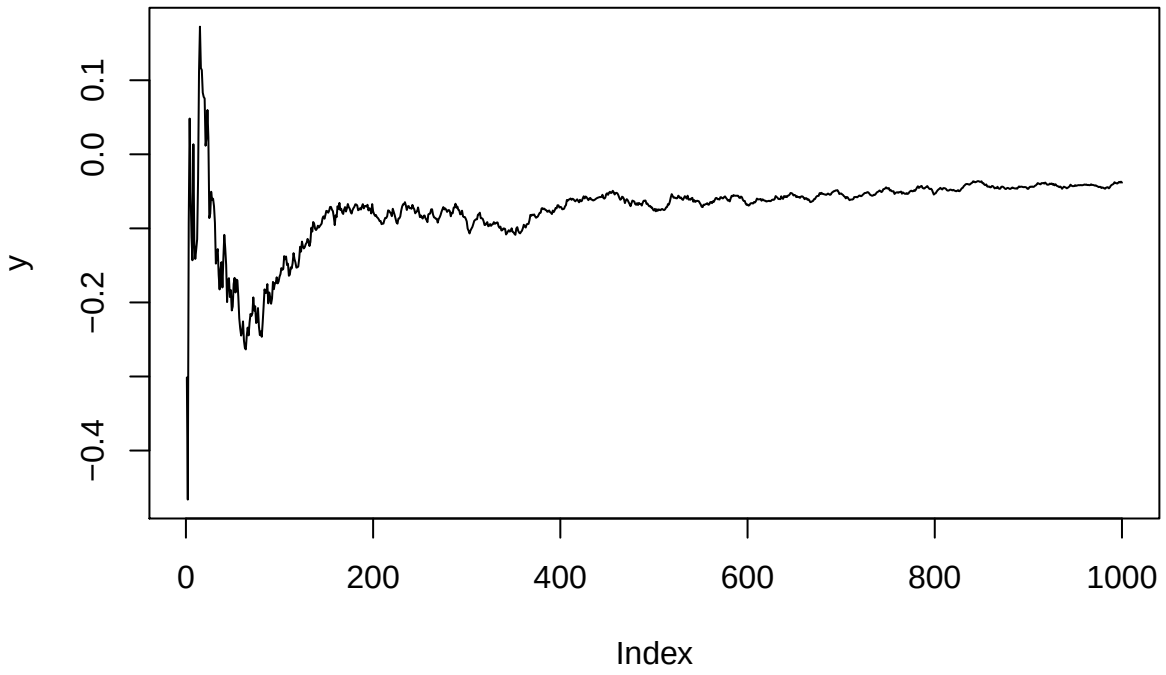
Exercice 8

```
#1. Simulation de 1000 V.A de loi N(0,1)
simulation <- rnorm(1000)

#2. Histogramme à 50 classes
hist(simulation,breaks = 50,freq=FALSE)
lines(density(simulation))
```

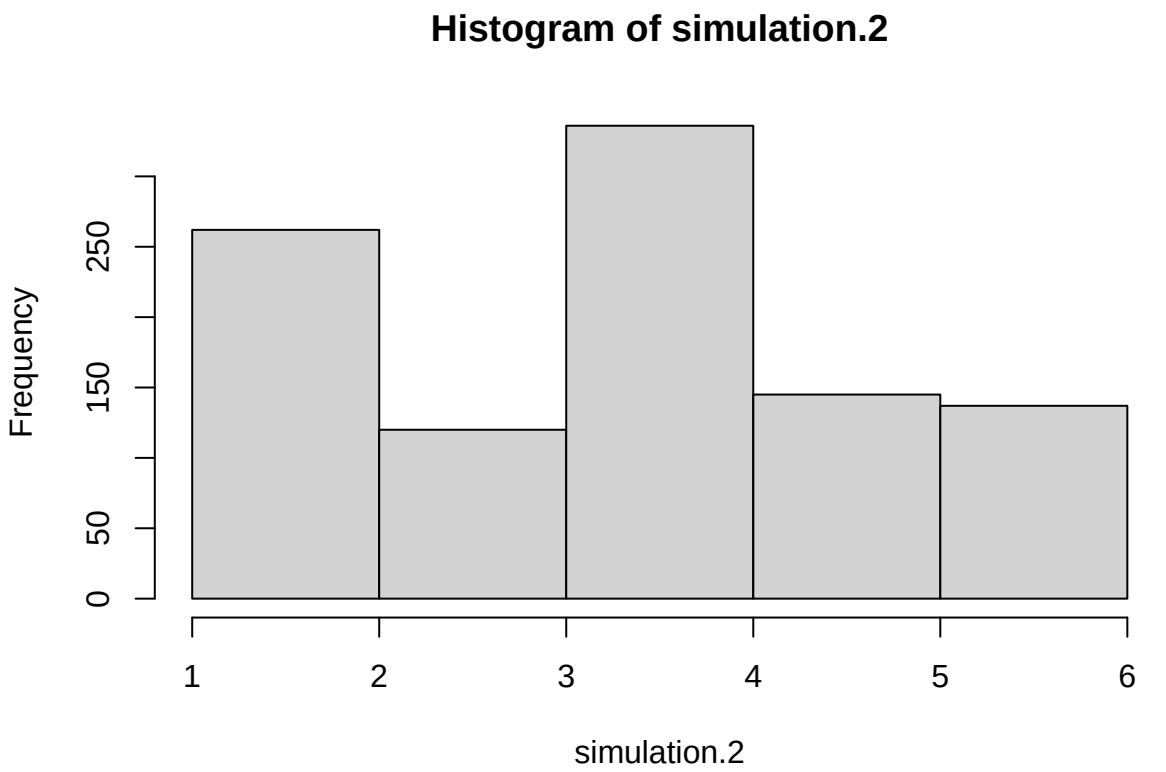



```r
extrapolation <- function(n,X){
  return(sum(X[1:n])/n)
}
x<-1:1000
y<-c()
for(j in x){
  y <- c(y,extrapolation(j,simulation))
}
plot(y,type='l')
```



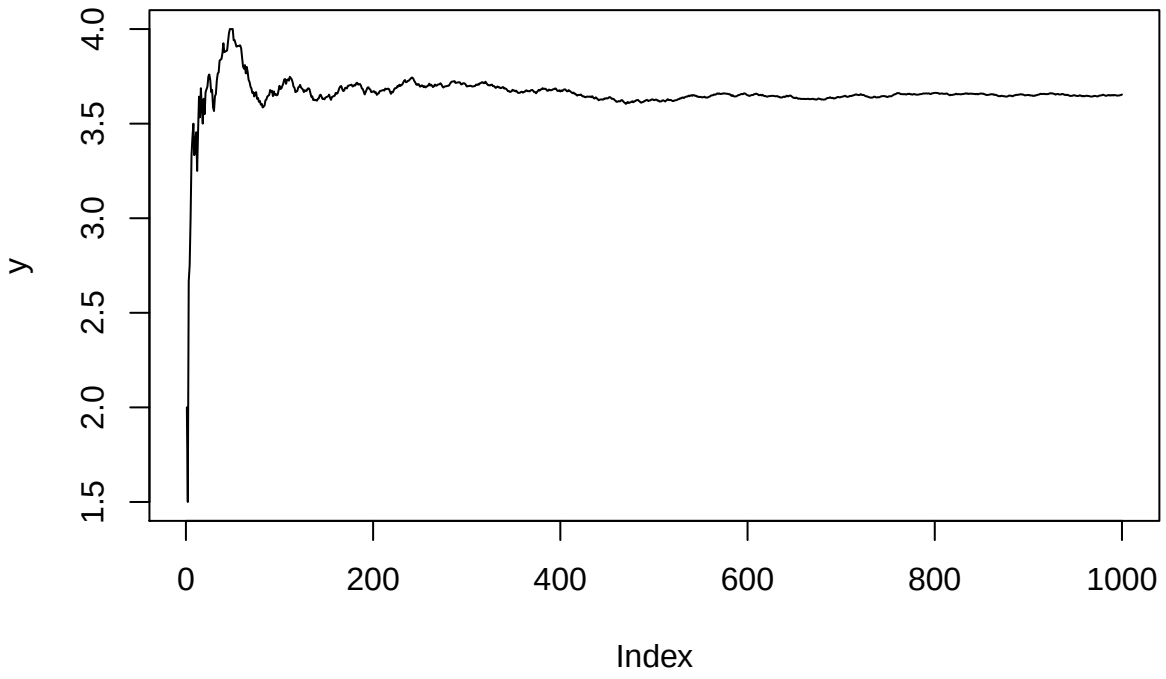
Exercice 9

```
simulation.2 <- sample(c(1,2,3,4,5,6),1000,replace=TRUE,prob=c(2/15,2/15,2/15,1/3,2/15,2/15))
hist(simulation.2,breaks = 6)
```




```
extrapolation <- function(n,X){
  return(sum(X[1:n])/n)
}
```

```r
x<-1:1000
y<-c()
for(j in x){
  y <- c(y,extrapolation(j,simulation.2))
}
plot(y,type ='l')
```

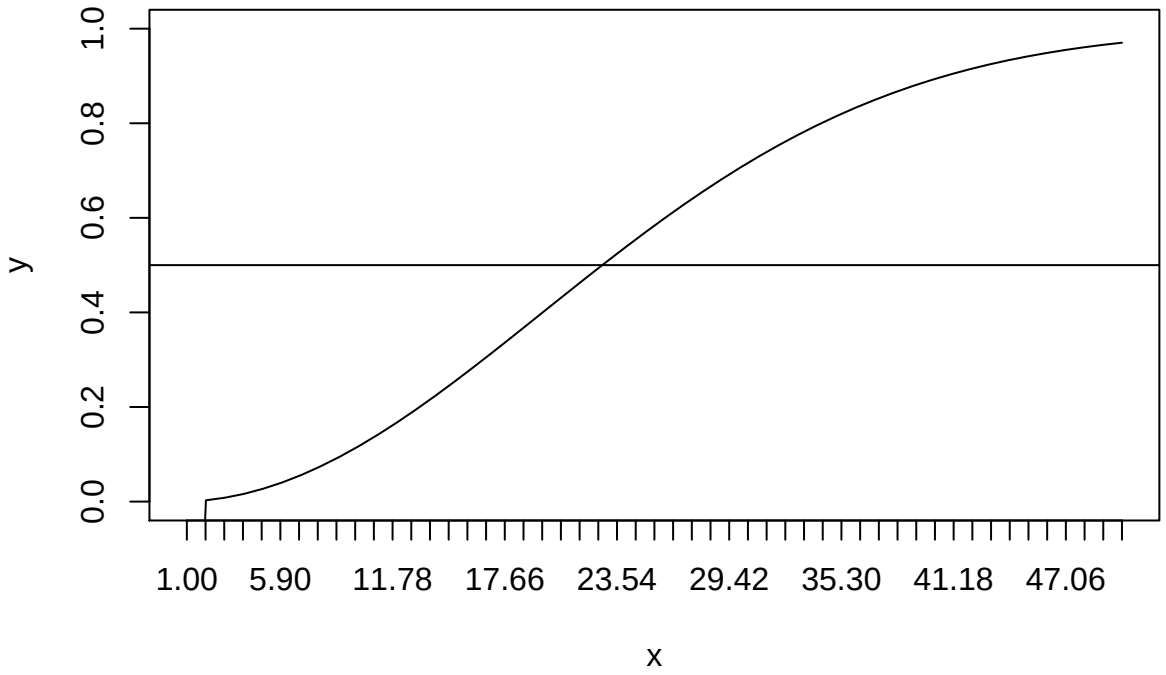


Exercice 10

```r
paradoxe <- function(n){
  if(n>=2 & n<=365)
  {
    p <- 1 - prod(c((365-n+1):365))/365^n
    return(p)
  }
  else
  {
    return(-1)
  }
}
paradoxe(30)
```

```
## [1] 0.7063162
```

```r
x<-1:50
y <- numeric(length(x))
for (i in 1:length(x)) {
  y[i]<-paradoxe(i)
}
plot(x,y,ylim = c(0,1),type = 'l',xaxp=c(1,50,50))
abline(h=0.5)
```




```
which(y>=0.5)
```

```
##  [1] 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
## [26] 48 49 50
```

```
paradoxe2 <- function(n){
  ifelse(n>=2 & n<=365,p <- 1 - prod(c((365-n+1):365))/365^n,0)
}
paradoxe2(30)
```

```
## [1] 0.7063162
```