Test

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```r
Q <- t(matrix(data =c(0.2,0.1,0.5,0.2,0.1,0.6,0.1,0.2,0.3,0.1,0.2,0.4,0.1,0.1,0.1,0.7),nrow = 4,ncol= 4)

pi = Q
for(i in 1:500)
{
  pi <- pi%*%Q
}
pi <- pi[1,]


#Step 2 , set X0
X0 <-1

#Step 3 , built Xn
n = 100000
Xn <- rep(1,n)

Xn[1]<-X0
#la fonction pour generer Yn
rYn <- function(X)
{
  Yn <- 1
  u <- runif(1)
  c <- Q[X,]

  if(u <= c[1])
    Yn=1
  else if(u<=c[2]+c[1])
    Yn=2
  else if(u<=c[2]+c[1]+c[3])
    Yn=3
  else
    Yn=4

  return(Yn)
}

for(i in 2:n)
{
  u <- runif(1)
  x <- Xn[i-1]
  Yn <- rYn(x)
  h = min(1,(pi[Yn]*Q[Yn,Xn[i-1]])/(pi[Xn[i-1]]*Q[Xn[i-1],Yn]))
  if(u < h)
    Xn[i]=Yn
  else
    Xn[i]=Xn[i-1]
```

```
}

#step 4, we have now Markov chain Xn ,using the ergodic theorem now

Approx <- mean(Xn^2)

#Donc , notre estimation est :
Approx
```

```
## [1] 10.11487
```