```r
#==================2. TLC ===========

# ------- 1 ----------
tclbernoulli <- function(N,p){
  nb.echant <- 1000
  res <- rep(0,nb.echant)
  for (i in 1:nb.echant){
    data <- rbinom(N,1,p)
    moy.emp <- mean(data)
    res[i] <- sqrt(N/(p*(1-p)))*(moy.emp-p)
  }
  return(res)
}

# ------- 2 ----------

s<-tclbernoulli(10,0.2)
mean(abs(s)<1.96)
# Do the same for N=100 and N=1000
#...

# ------- 3 ----------
par(mfrow=c(1,3))

res <- tclbernoulli(10,.2)
fdr10 <- ecdf(res)
plot.ecdf(res,main="FdR, N=10",cex=0.5)
lines(sort(res),pnorm(sort(res)),col='red')

# Do the same for N=100 and N=1000

#==================3. LLN ===========

#---------------1----------
par(mfrow=c(1,1))
Nfin <- 5000
X <- rexp(Nfin,2)
Y <- cumsum(X)/1:Nfin
plot(1:Nfin, Y, type='l', ylim=c(0,1), xlab='n', ylab='moyenne empirique')
for (i in 2:50){
  X <- rexp(Nfin,2)
  Y <- cumsum(X)/1:Nfin
  lines(1:Nfin, Y, col=i)
}

#--------------- 2 ---------------

lgnexpo <- function(N){
  moy=rep(0,100)
  for (i in 1:100){
    moy[i]=mean(rexp(N,2))
  }
  return(moy)
}


boxplot(lgnexpo(100),lgnexpo(1000),lgnexpo(10000), names=c("100","1000","10000"),xlab='N: taille
de l echantillon')


#--------------- 3 ---------------

Nfin <- 5000
X <- rcauchy(Nfin)
Y <- cumsum(X)/1:Nfin
plot(1:Nfin, Y, ylim=c(-50,50),type='l', xlab='n', ylab='moyenne empirique')
for (i in 2:10){
  X <- rcauchy(Nfin)
  Y <- cumsum(X)/1:Nfin
```

```r
    lines(1:Nfin, Y, col=i)
  }

  lgncauchy <- function(N){
    moy <- rep(0,100)
    for (i in 1:100){
      moy[i] <- mean(rcauchy(N))
    }
    return(moy)
  }

  boxplot(lgncauchy(100),lgncauchy(1000),lgncauchy(10000),outline=T,names=c("100","1000","10000"),xl
  ab='N: taille de l echantillon')

  boxplot(lgncauchy(100),lgncauchy(1000),lgncauchy(10000),outline=F,names=c("100","1000","10000"),xl
  ab='N: taille de l echantillon')


  #=================3. Poisson law toward binomial law ===========

  #----1-----
  lambda=8
  Bin10=rbinom(1000,10,lambda/10)
  # Do the same for N=10,20, 30 and 100

  #----2-----

  M=max(Bin10,Bin20,Bin30,Bin100)
  k=seq(0,M,by=1)
  dpois(k,lambda)

  #----3-----

  par(mfrow=c(2,2))

  plot(table(Bin10)/1000,main='N=10')
  points(k,dpois(k,lambda),col='red')
  # Do the same for N=10,20, 30 and 100

  #----4-----

  plot(ecdf(Bin10),main='N=10')
  lines(k,ppois(k,lambda),type='s',col='red')
  # Do the same for N=10,20, 30 and 100
```