Lab8-RMD

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task1

```
getwd()
```

```
## [1] "C:/Users/cglen/Documents/Stat Methods/Labs/LAB8"
```

task2

```
a=0
b=5
n=10
y=runif(n,a,b)
mu=(a+b)/2
sigma_sq=(b-a)^2/12
X_bar=sum(y/n)
S_sq=sum(y-(mu))^2/(n-1)
T=sum(y)
Y_bar=T/n
```

Mean

```
show(mu)
```

```
## [1] 2.5
```

Sample Mean

```
show(X_bar)
```

```
## [1] 2.721488
```

Variance

```
show(sigma_sq)
```

```
## [1] 2.083333
```

Sample Variance

```
show(S_sq)
```

```
## [1] 0.5450755
```

Sum T

```
show(T)
```

```
## [1] 27.21488
```

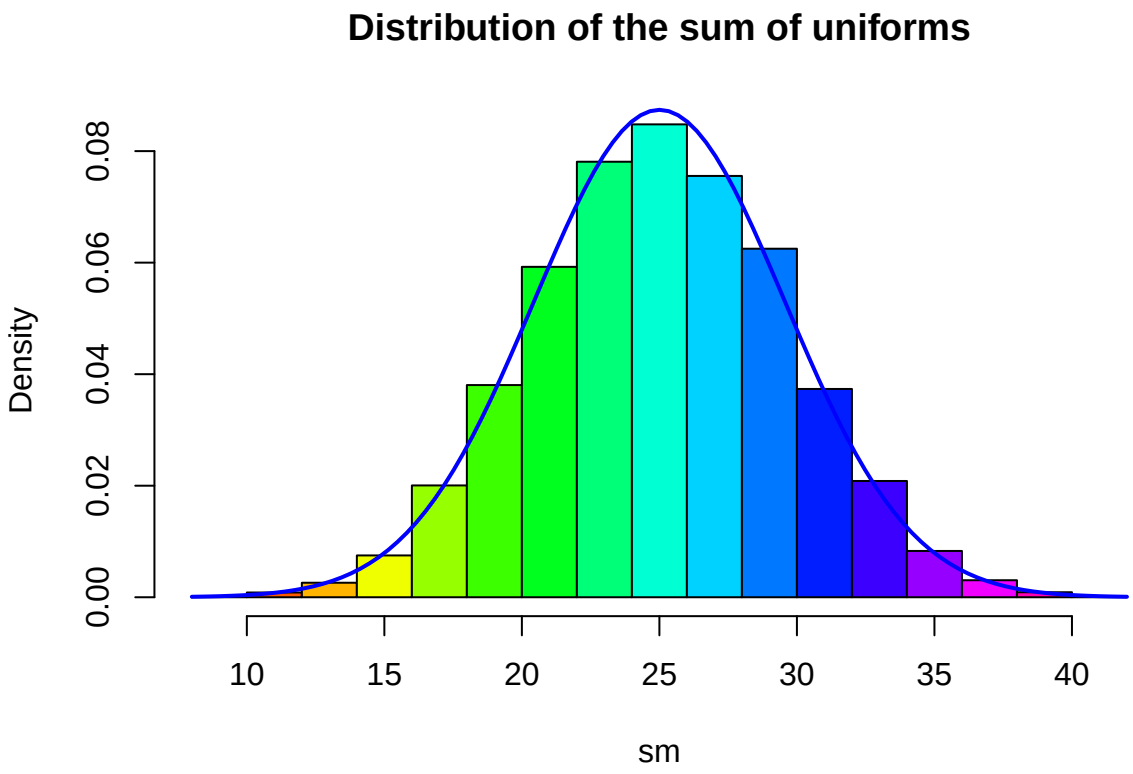
The mean Ybar

```
show(Y_bar)
```

```
## [1] 2.721488
```

Distribution of the sum of uniforms

```
myclt=function(n,iter,a=0,b=5){
  y=runif(n*iter,a,b)
  data=matrix(y,nr=n,nc=iter,byrow=TRUE)
  sm=apply(data,2,sum)
  h=hist(sm,plot=FALSE)
  hist(sm,col=rainbow(length(h$mids)),freq=FALSE,main="Distribution of the sum of uniforms")
  curve(dnorm(x,mean=n*(a+b)/2,sd=sqrt(n*(b-a)^2/12)),add=TRUE,lwd=2,col="Blue")
  sm
}
w=myclt(n=10,iter=10000,a=0,b=5)
```



Mean of W vector

```
mean(w)
```

```
## [1] 25.05282
```

Variance of W vector

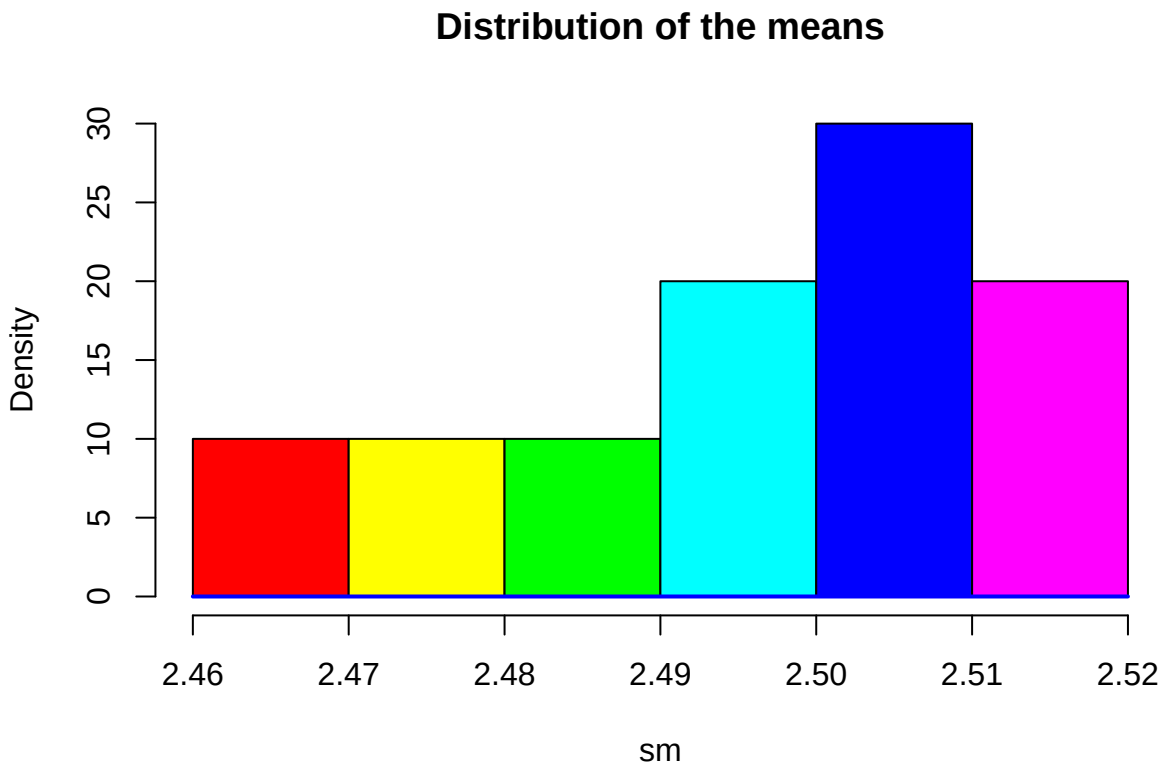
```
var(w)
```

```
## [1] 21.16026
```

myclt with sample means

```
mymean=function(n,iter,a=0,b=5){
  y=runif(n*iter,a,b)
  data=matrix(y,nr=n,nc=iter,byrow=TRUE)
  sm=apply(data,1,mean)
  h=hist(sm,plot=FALSE)
  hist(sm,col=rainbow(length(h$mids)),freq=FALSE,main="Distribution of the means")
  curve(dnorm(x,mean=n*(a+b)/2,sd=sqrt(n*(b-a)^2/12)),add=TRUE,lwd=2,col="Blue")
  sm
```

```
}
wmeans=mymean(n=10,iter=10000,a=0,b=5)
```



mean of the vector of sample means

```
mean(wmeans)
```

```
## [1] 2.496229
```

variance of the vector of sample means

```
var(wmeans)
```

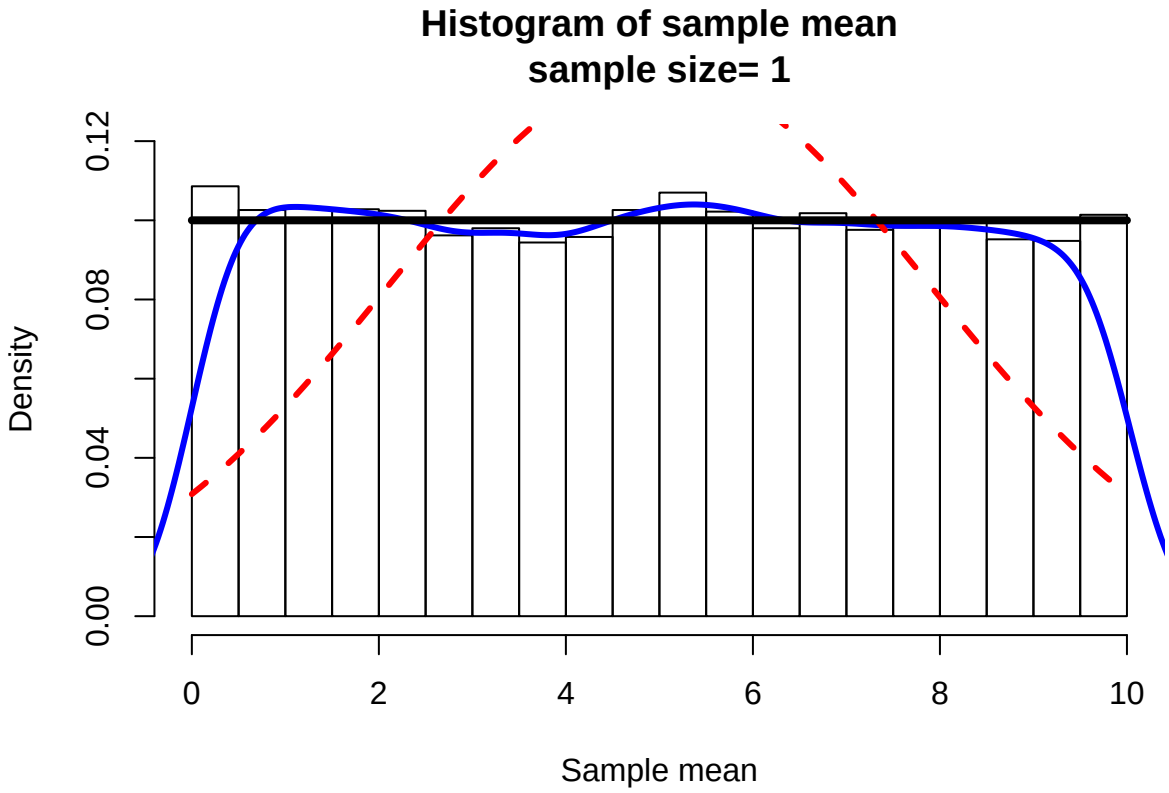
```
## [1] 0.0002475037
```

Task3

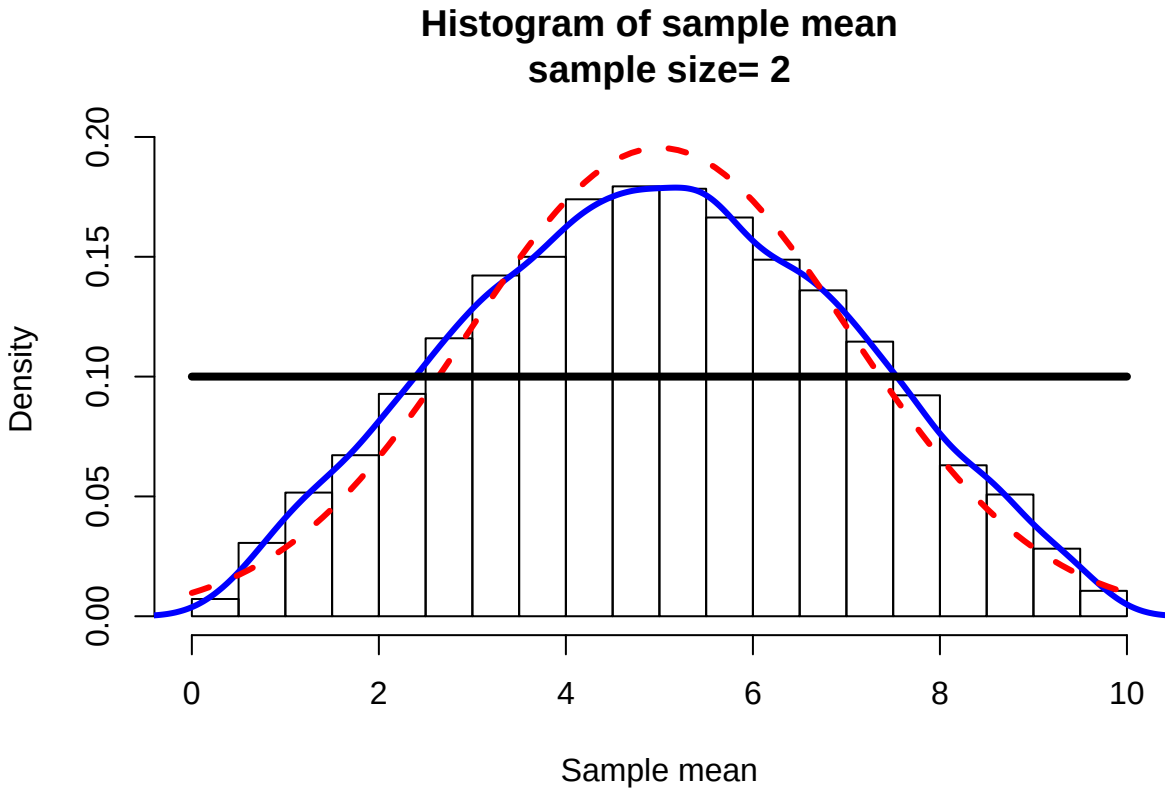
Uniform distributions

```
mycltu=function(n,iter,a=0,b=10){
  y=runif(n*iter,a,b)
  data=matrix(y,nr=n,nc=iter,byrow=TRUE)
```

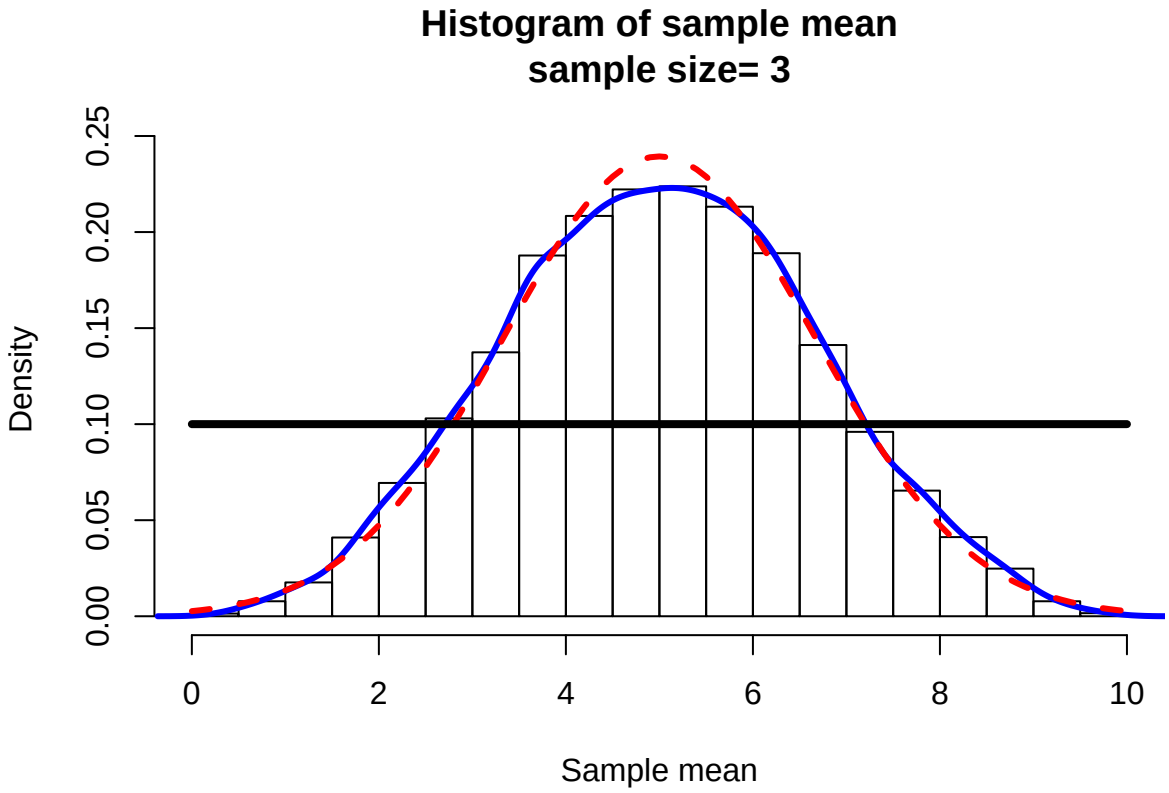
```r
  w=apply(data,2,mean)
  param=hist(w,plot=FALSE)

  ymax=max(param$density)
  ymax=1.1*ymax
  hist(w,freq=FALSE,  ylim=c(0,ymax), main=paste("Histogram of sample mean",
                          "\n", "sample size= ",n,sep=""),xlab="Sample mean")
  lines(density(w),col="Blue",lwd=3) # add a density plot
  curve(dnorm(x,mean=(a+b)/2,sd=(b-a)/(sqrt(12*n))),add=TRUE,col="Red",lty=2,lwd=3)
  curve(dunif(x,a,b),add=TRUE,lwd=4)

}
mycltu(n=1,iter=10000, a=0, b=10)
```



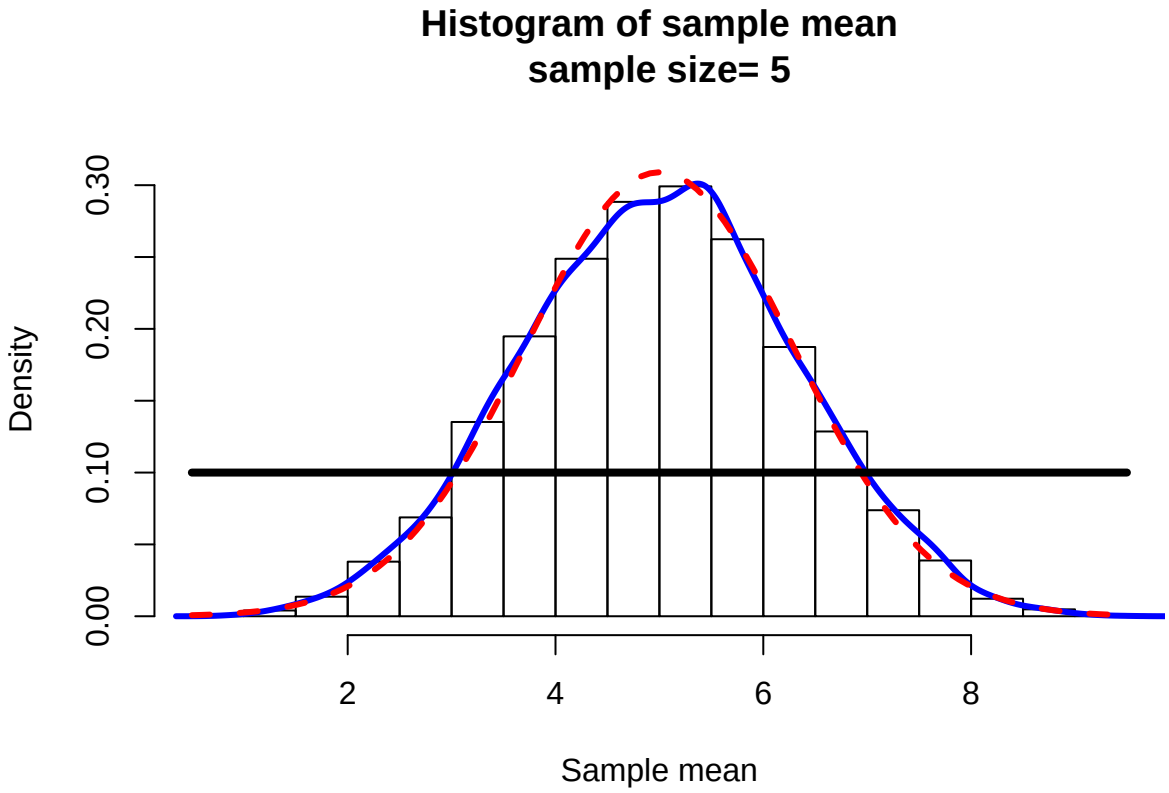

```r
mycltu(n=2,iter=10000, a=0, b=10)
```



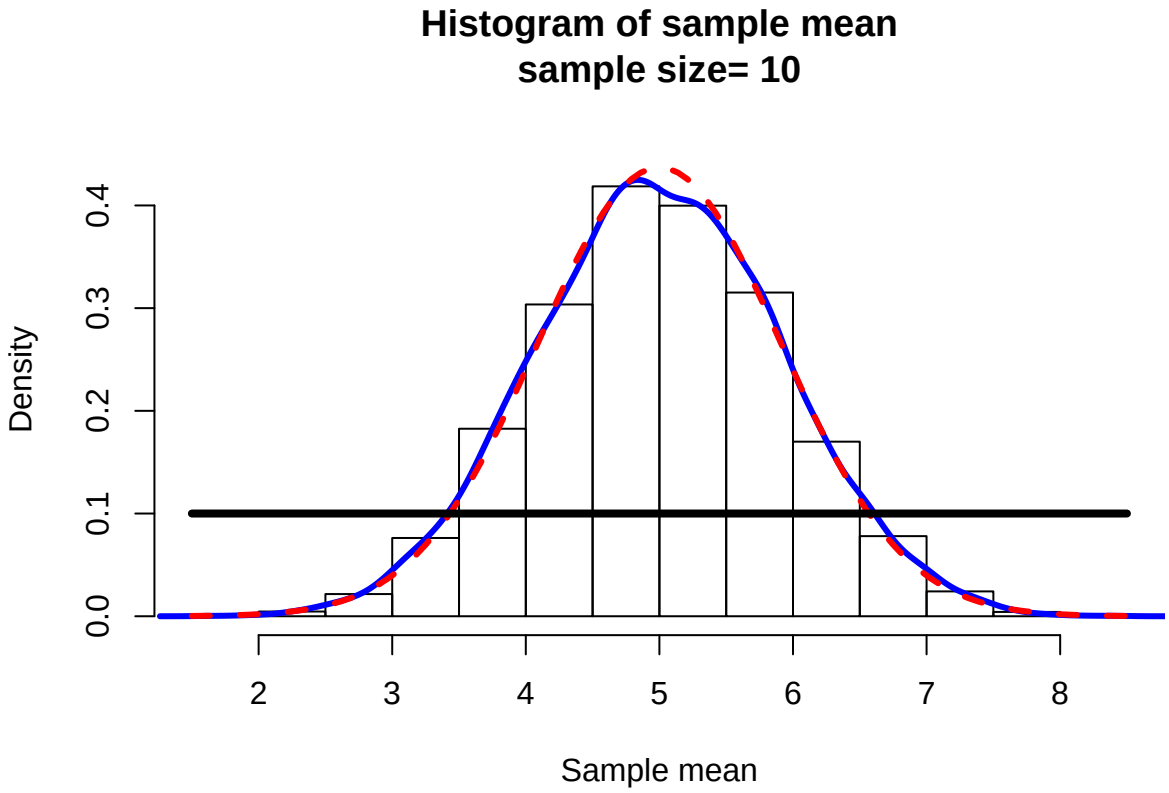

```
mycltu(n=3,iter=10000, a=0, b=10)
```



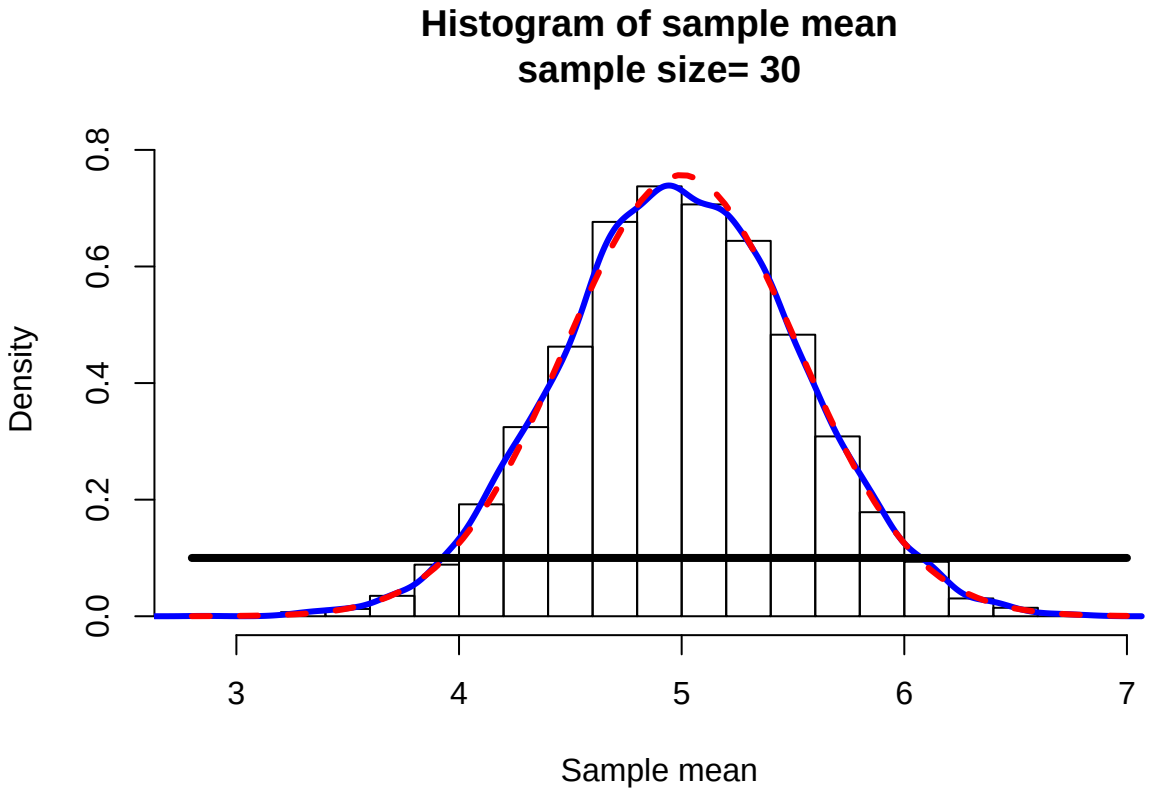

```
mycltu(n=5,iter=10000, a=0, b=10)
```




```
mycltu(n=10,iter=10000, a=0, b=10)
```



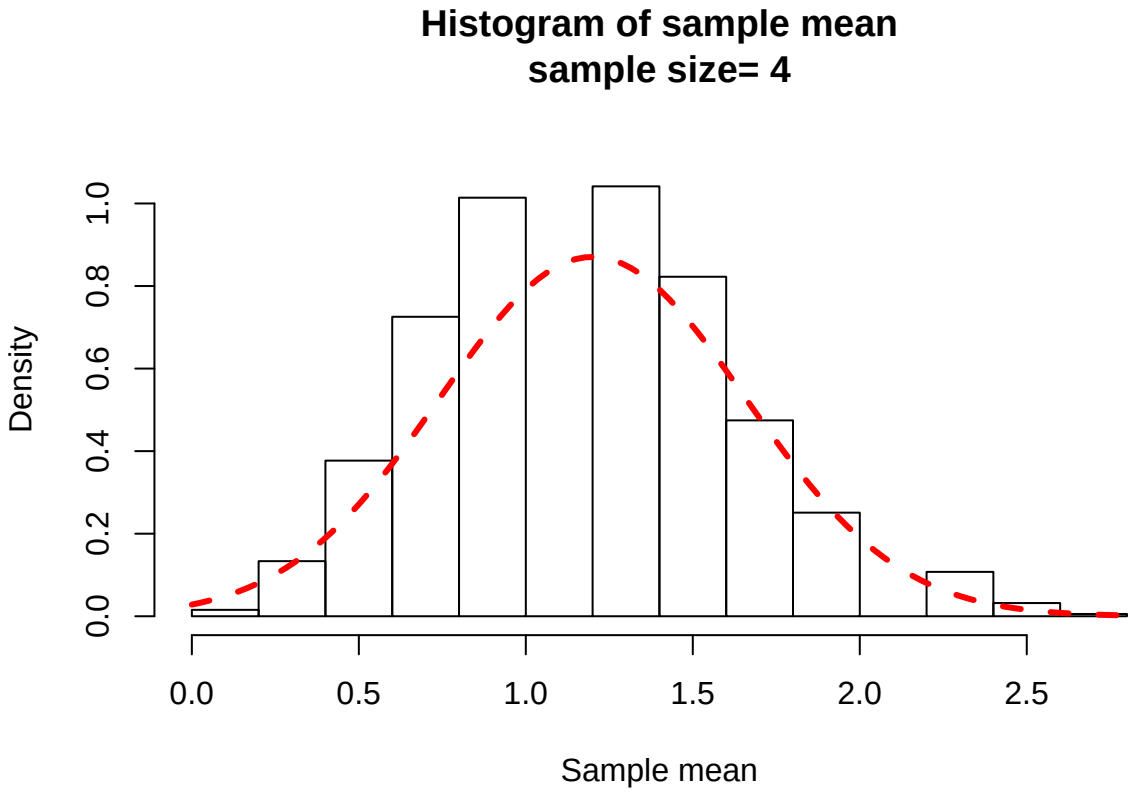

```
mycltu(n=30,iter=10000, a=0, b=10)
```



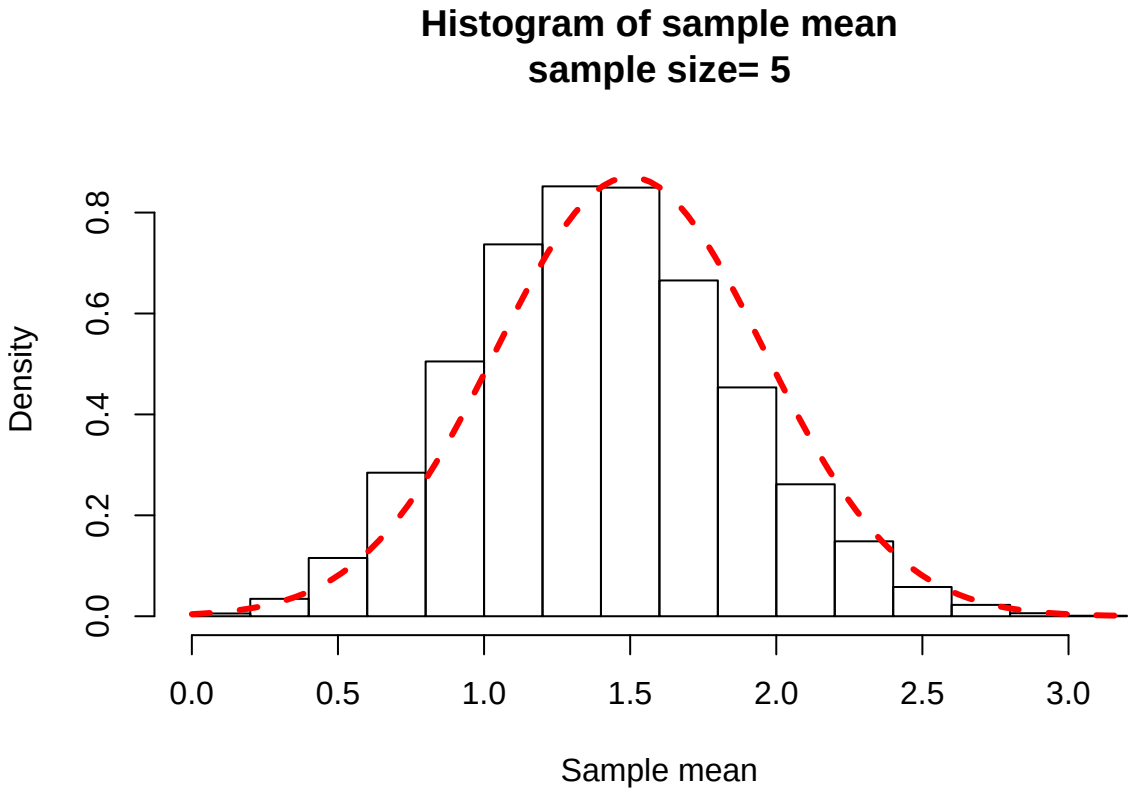
Task 4

Binomial Distributions

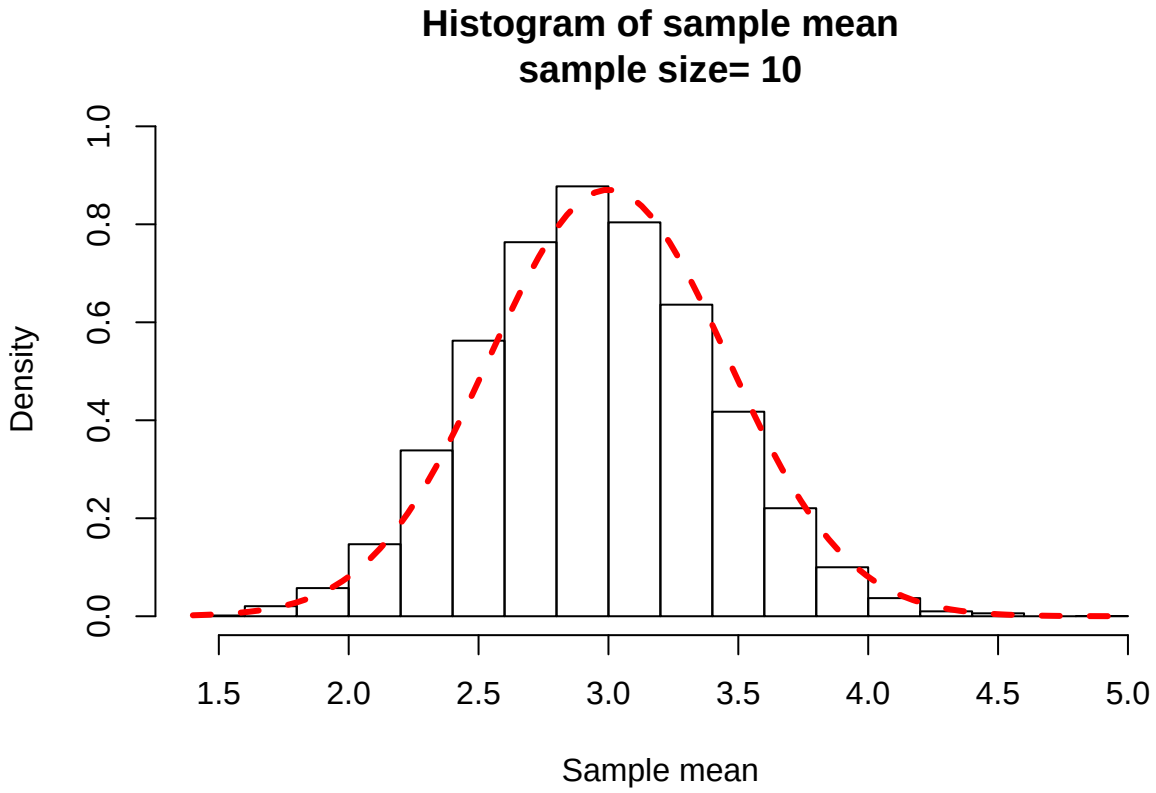
```
mycltb=function(n,iter,p=0.5){
  y=rbinom(n*iter,size=n,prob=p)
  data=matrix(y,nr=n,nc=iter,byrow=TRUE)
  w=apply(data,2,mean)
  param=hist(w,plot=FALSE)

  ymax=max(param$density)
  ymax=1.1*ymax
  hist(w,freq=FALSE,  ylim=c(0,ymax),
       main=paste("Histogram of sample mean","\n", "sample size= ",n,sep=""),
       xlab="Sample mean")
  curve(dnorm(x,mean=n*p,sd=sqrt(p*(1-p))),add=TRUE,col="Red",lty=2,lwd=3)

}

mycltb(n=4,iter=10000,p=0.3)
```



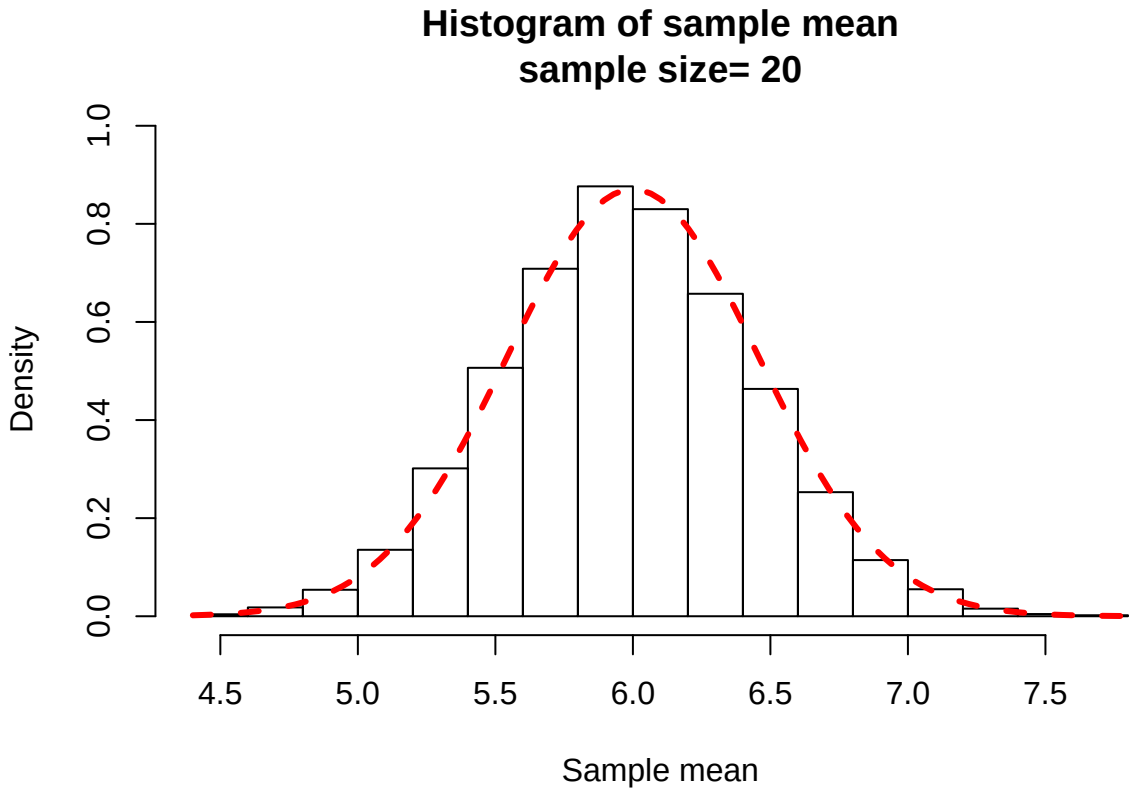

```
mycltb(n=5,iter=10000,p=0.3)
```



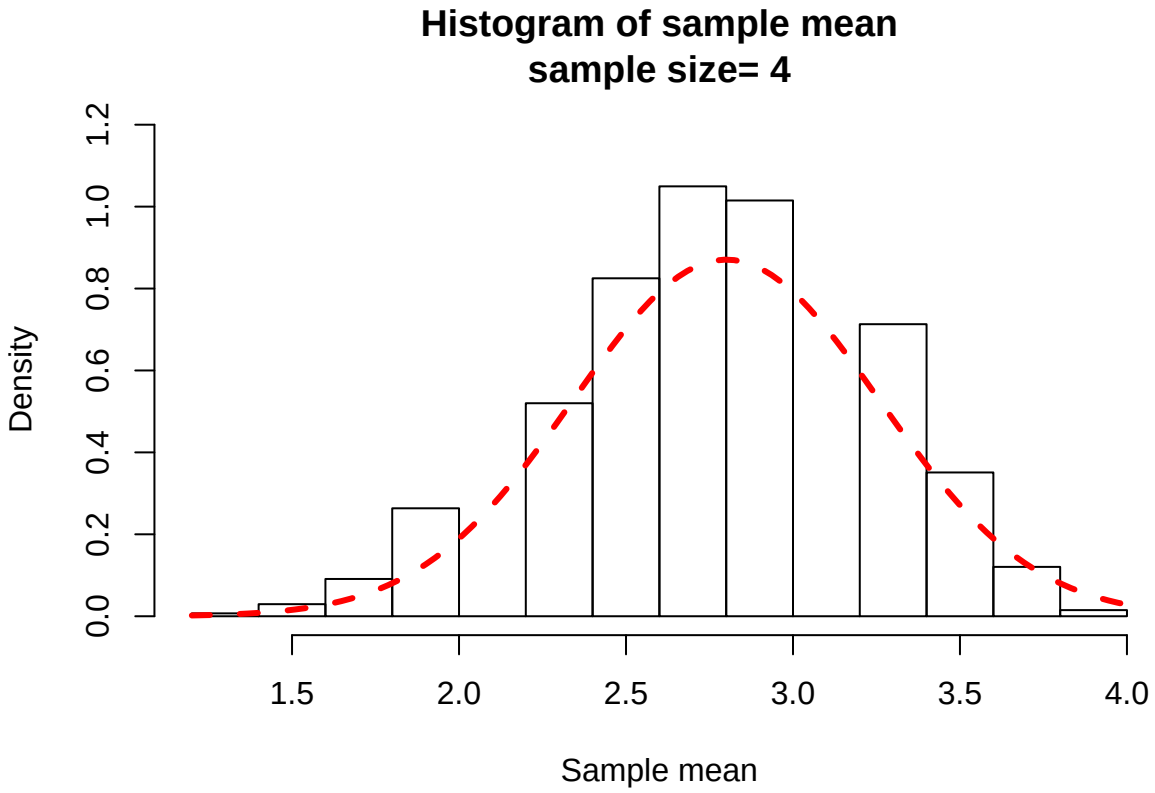

```
mycltb(n=10,iter=10000,p=0.3)
```



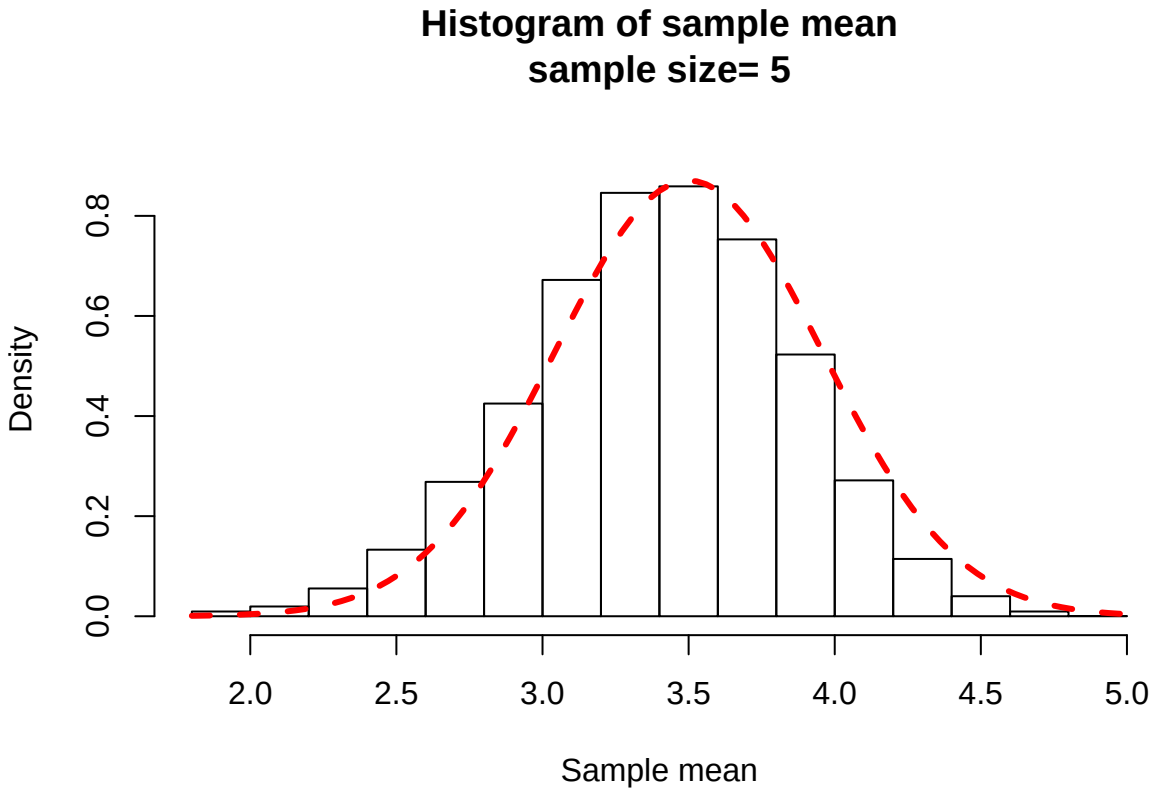

```
mycltb(n=20,iter=10000,p=0.3)
```



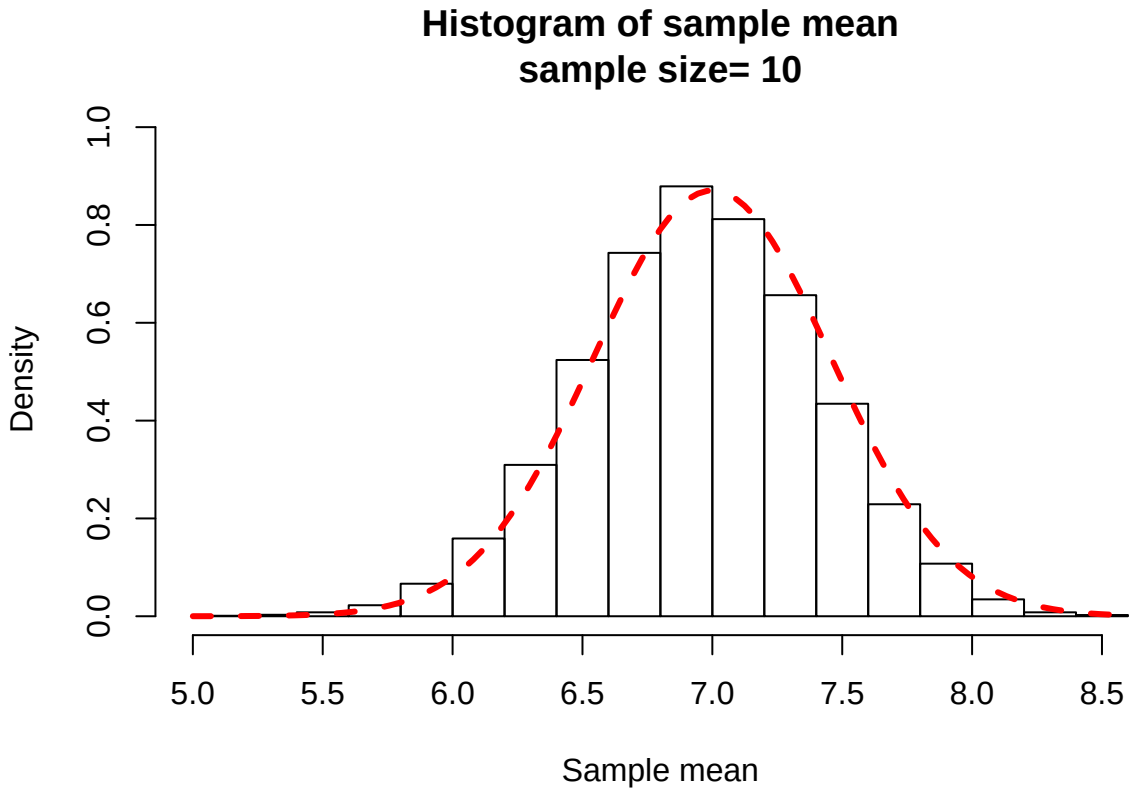

```
mycltb(n=4,iter=10000,p=0.7)
```



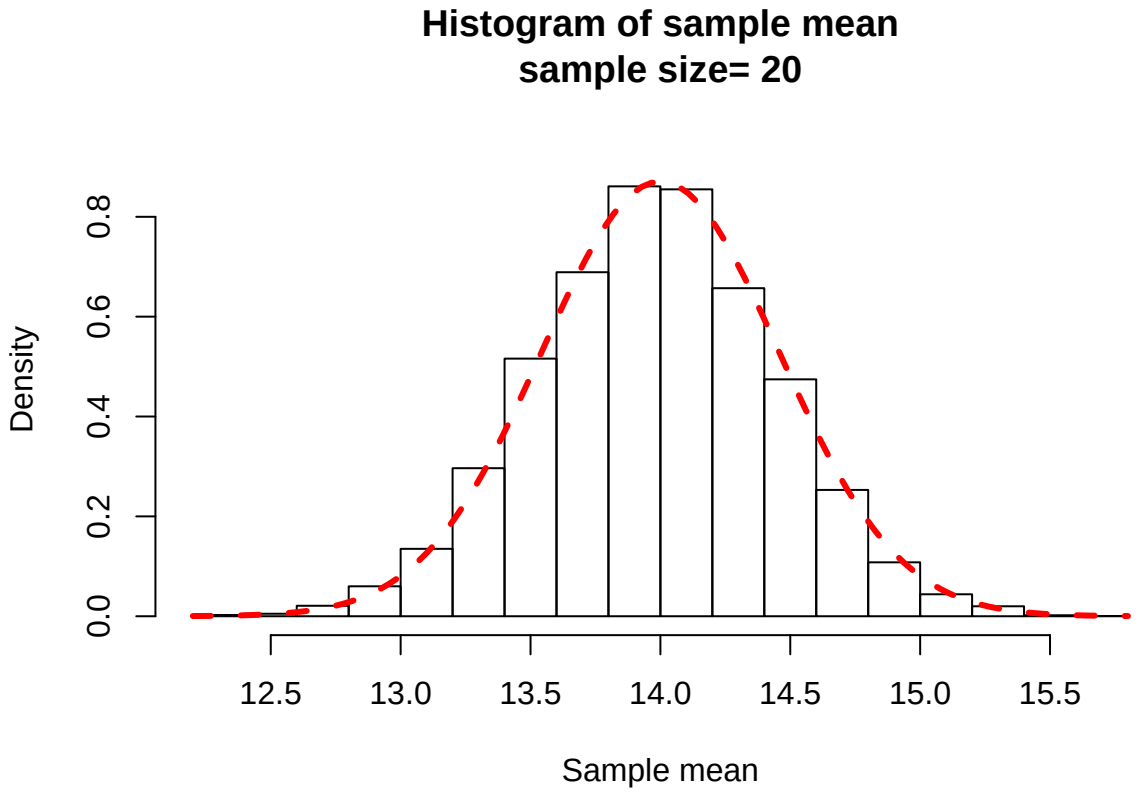

```
mycltb(n=5,iter=10000,p=0.7)
```



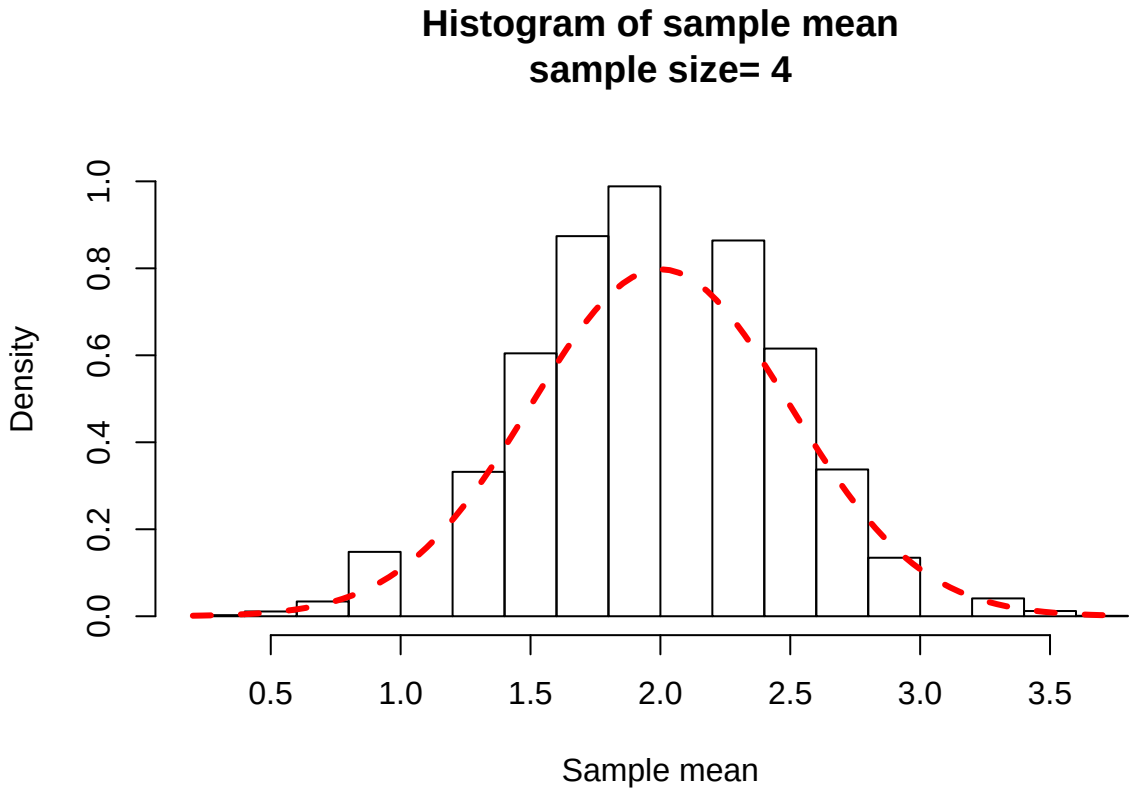

```
mycltb(n=10,iter=10000,p=0.7)
```



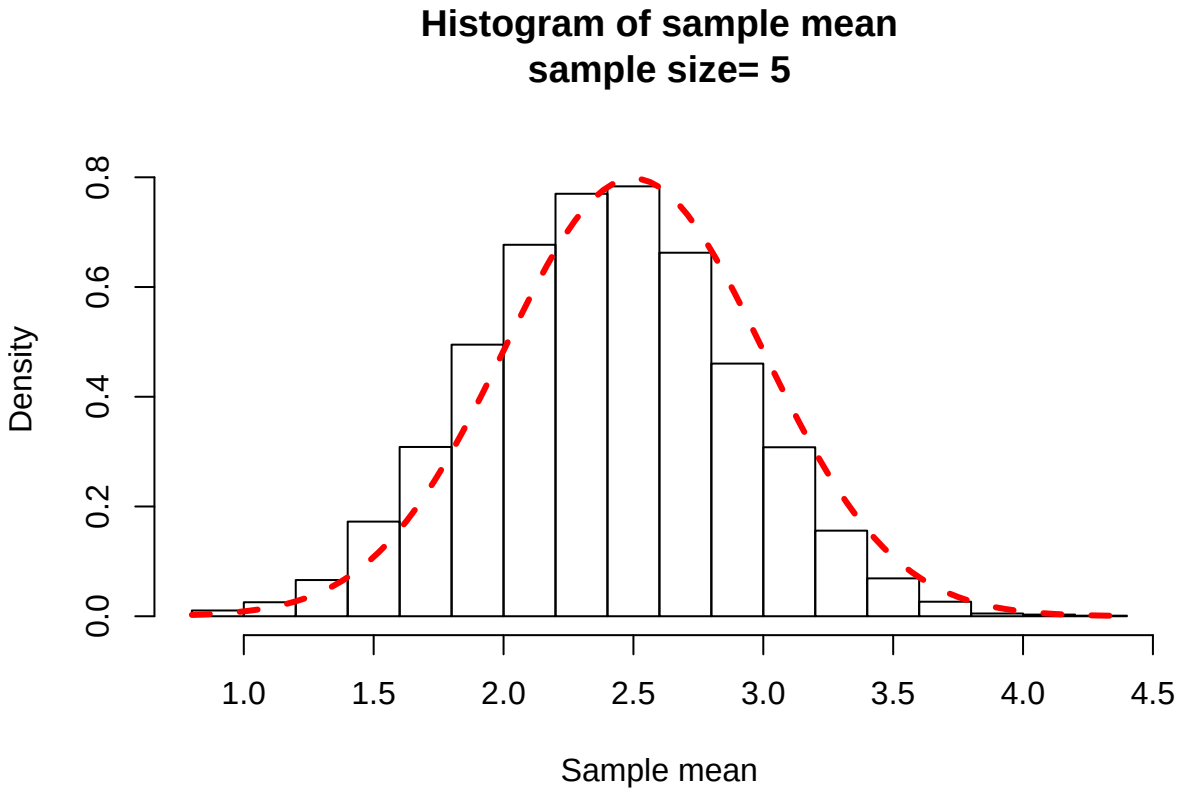

```
mycltb(n=20,iter=10000,p=0.7)
```



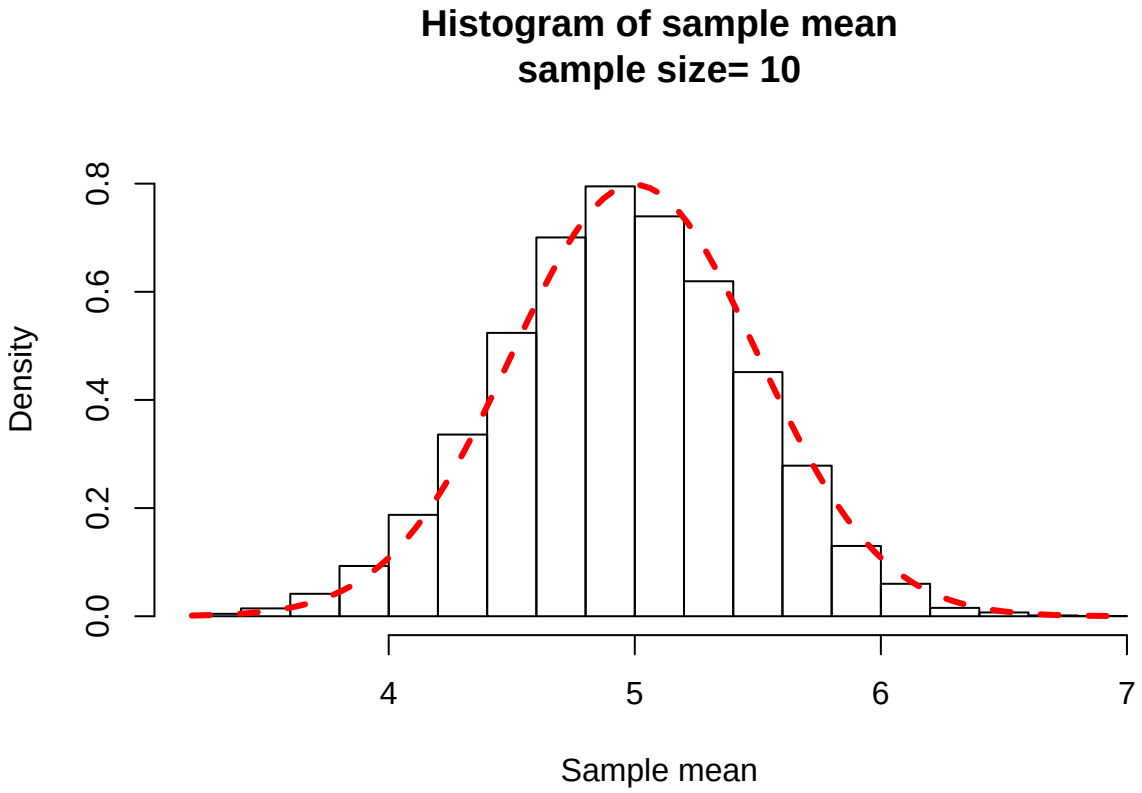

```
mycltb(n=4,iter=10000,p=0.5)
```



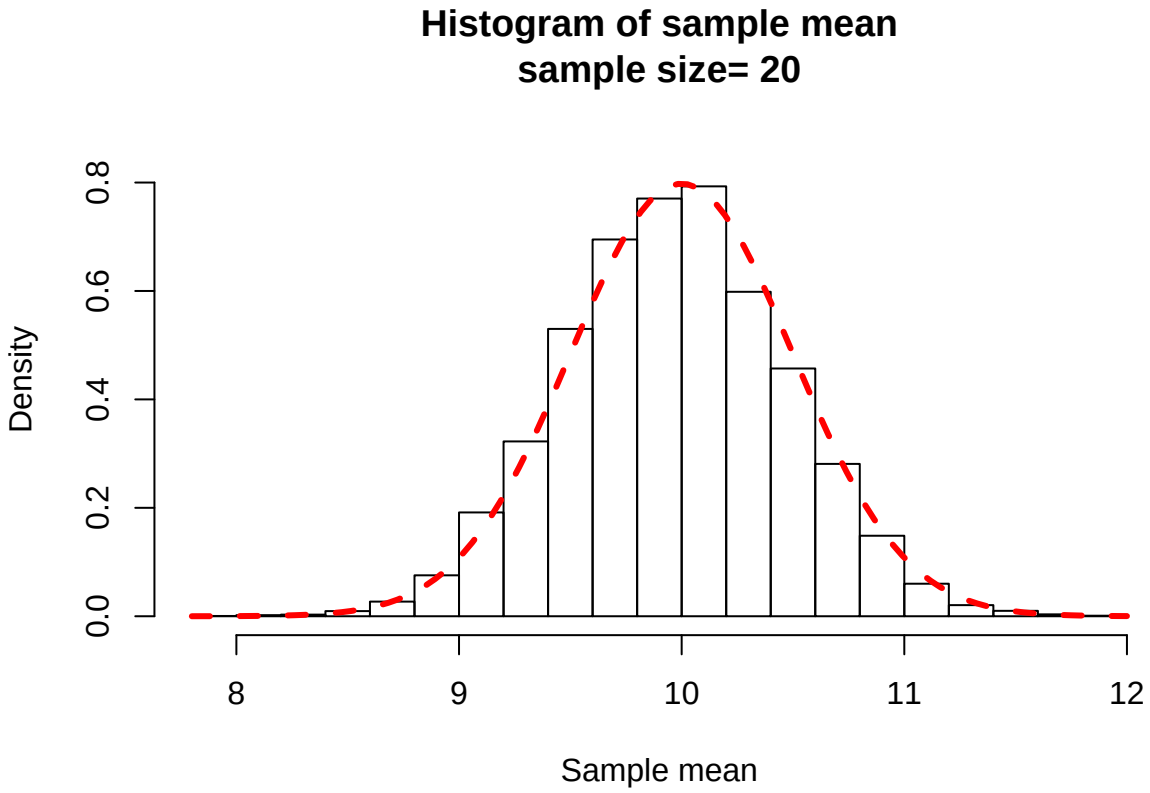

```
mycltb(n=5,iter=10000,p=0.5)
```




```
mycltb(n=10,iter=10000,p=0.5)
```



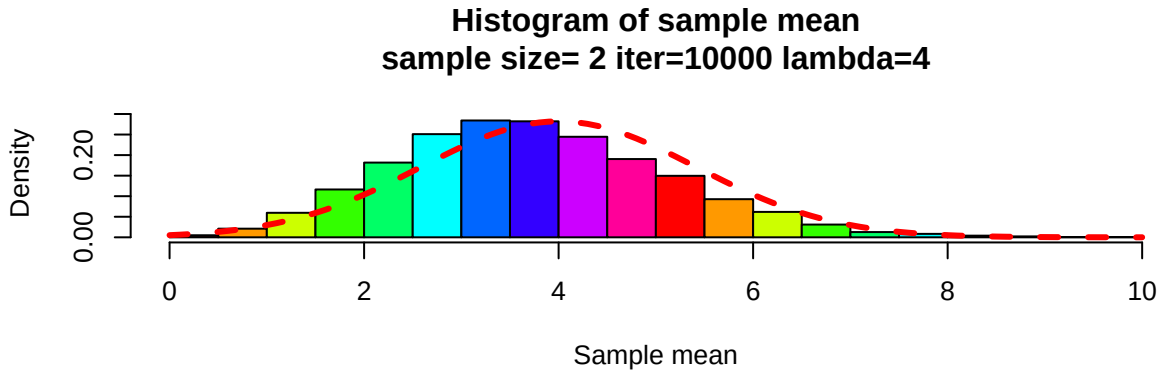

```
mycltb(n=20,iter=10000,p=0.5)
```

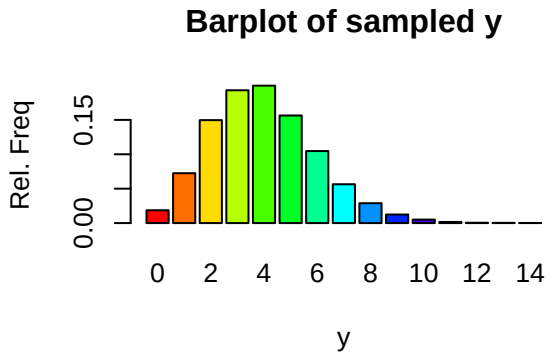


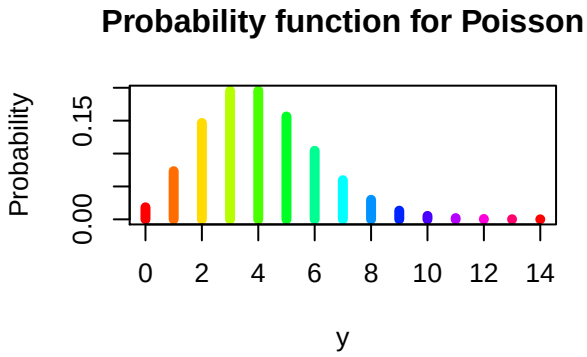
Task 5

Poisson Distributions

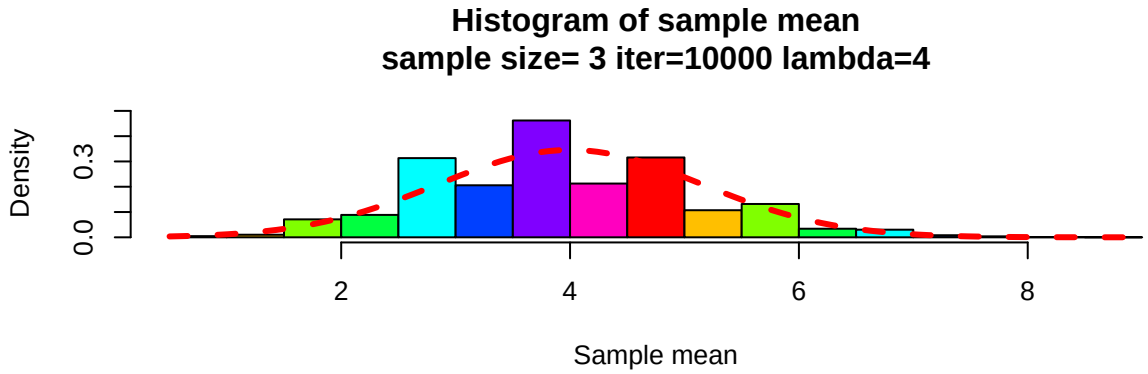
```
mycltp=function(n,iter,lambda=10){
  y=rpois(n*iter,lambda=lambda)
  data=matrix(y,nr=n,nc=iter,byrow=TRUE)
  w=apply(data,2,mean)
  param=hist(w,plot=FALSE)
  ymax=max(param$density)
  ymax=1.1*ymax
  layout(matrix(c(1,1,2,3),nr=2,nc=2, byrow=TRUE))
  hist(w,freq=FALSE,  ylim=c(0,ymax), col=rainbow(max(w)),
       main=paste("Histogram of sample mean","\n", "sample size= ",n," iter=",iter," lambda=",lambda,sep
  curve(dnorm(x,mean=lambda,sd=sqrt(lambda/n)),add=TRUE,col="Red",lty=2,lwd=3)
  barplot(table(y)/(n*iter),col=rainbow(max(y)), main="Barplot of sampled y", ylab ="Rel. Freq",xlab="y
  x=0:max(y)
  plot(x,dpois(x,lambda=lambda),type="h",lwd=5,col=rainbow(max(y)),
       main="Probability function for Poisson", ylab="Probability",xlab="y")
}
mycltp(n=2,iter=10000, lambda = 4)
```

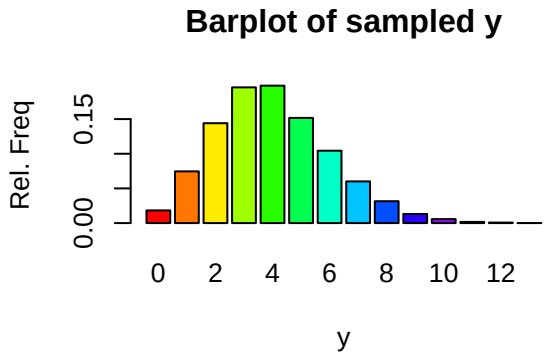


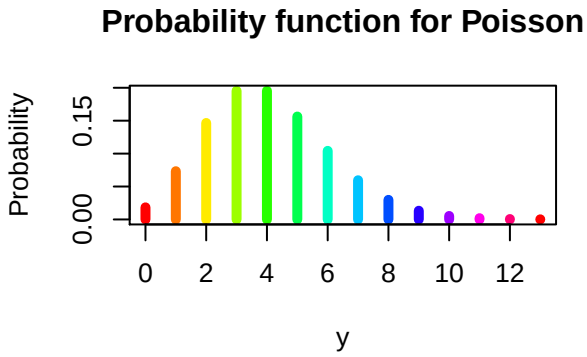




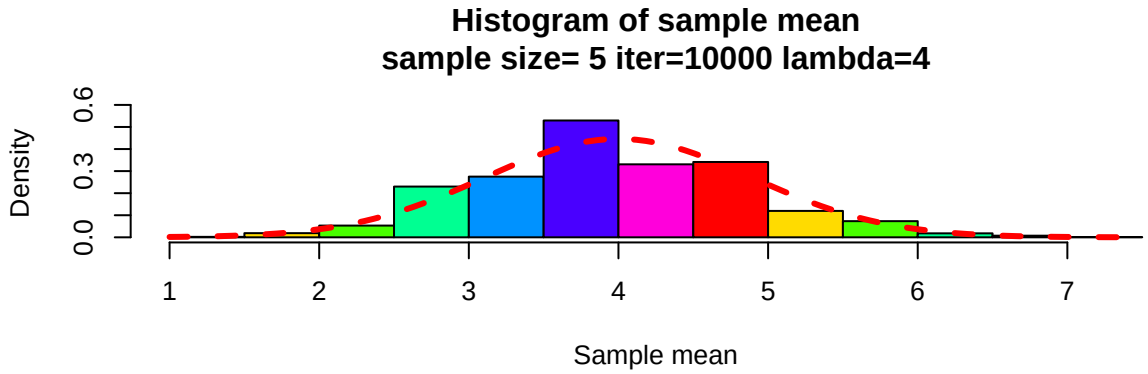

```
mycltp(n=3,iter=10000, lambda = 4)
```

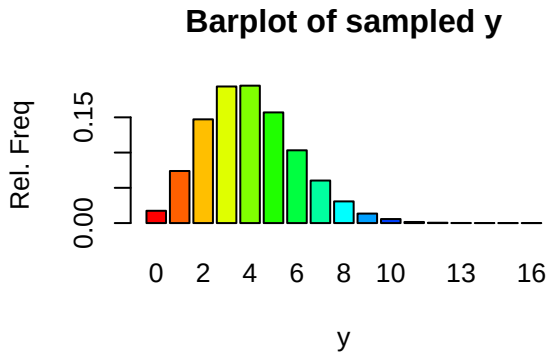


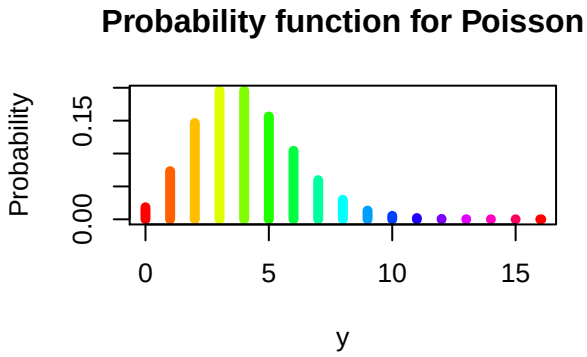




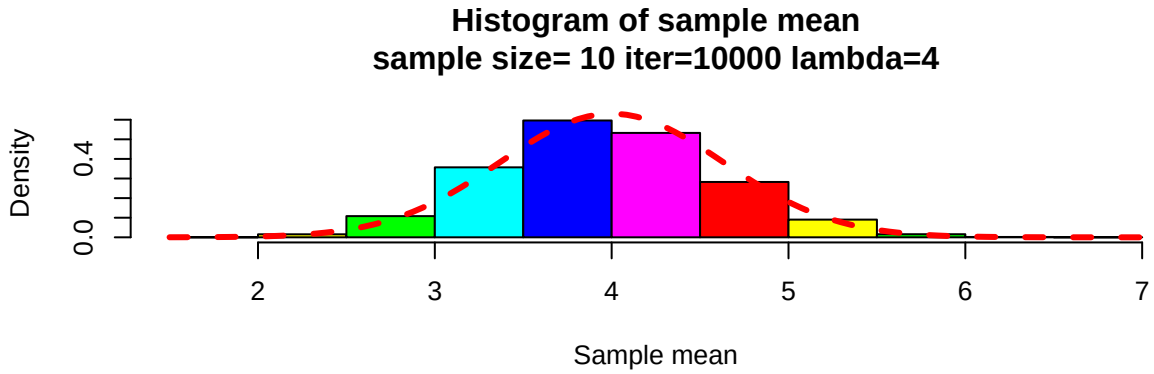

```
mycltp(n=5,iter=10000, lambda = 4)
```

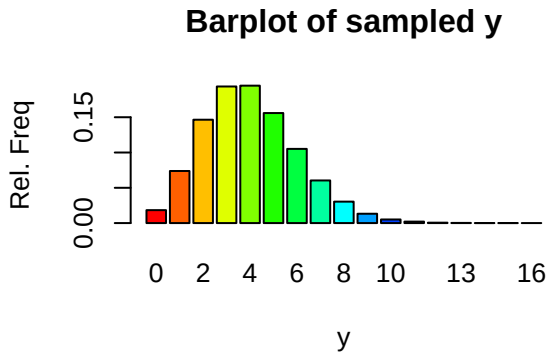


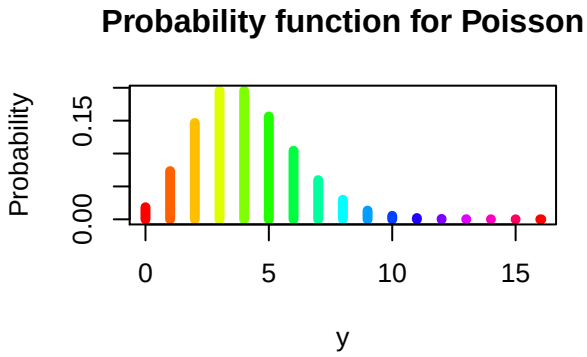




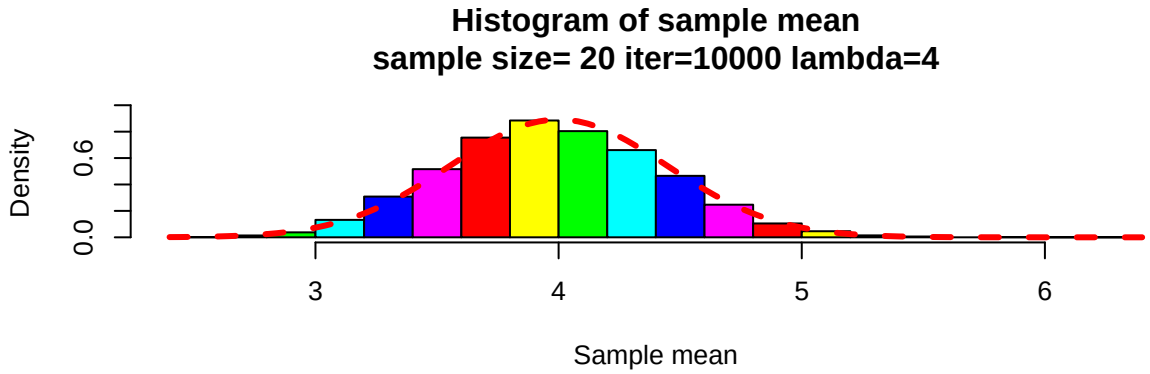

```
mycltp(n=10,iter=10000, lambda = 4)
```

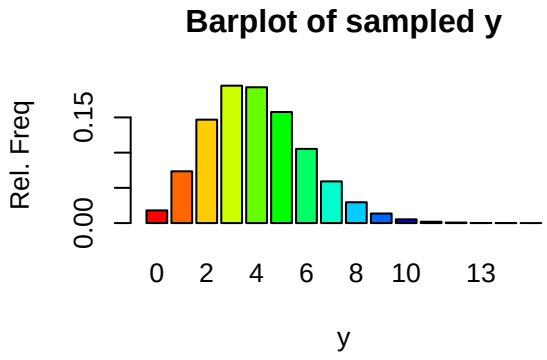


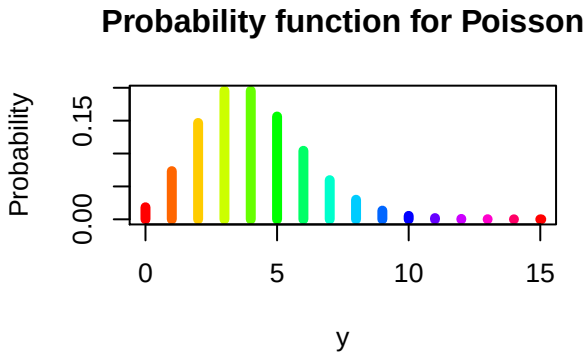




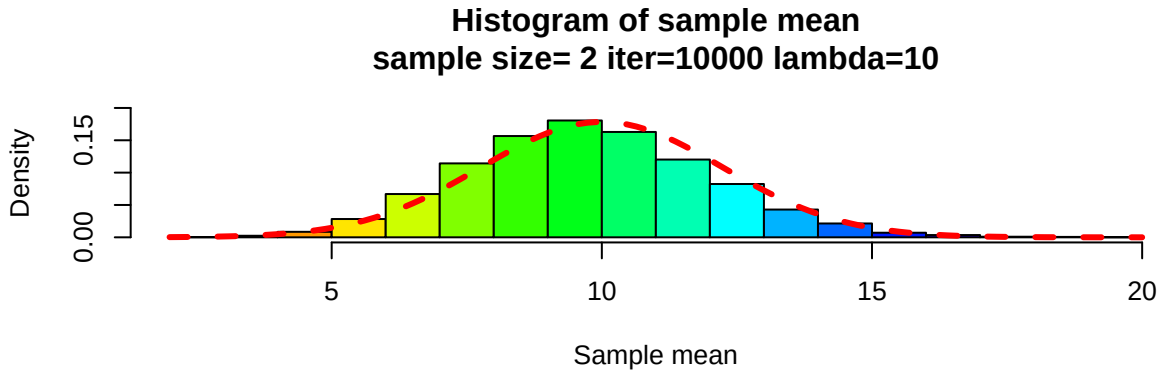

```
mycltp(n=20,iter=10000, lambda = 4)
```

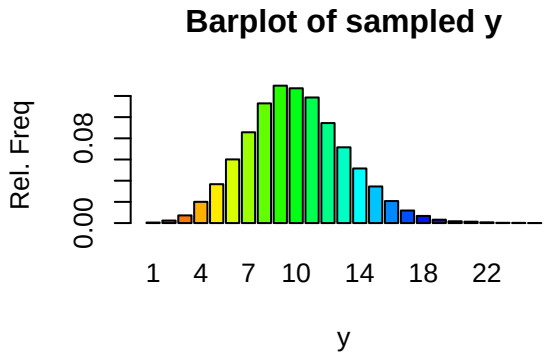


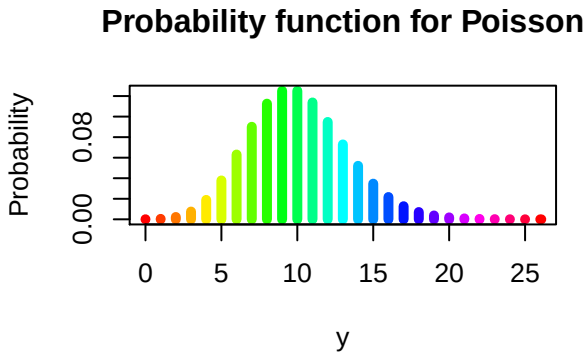




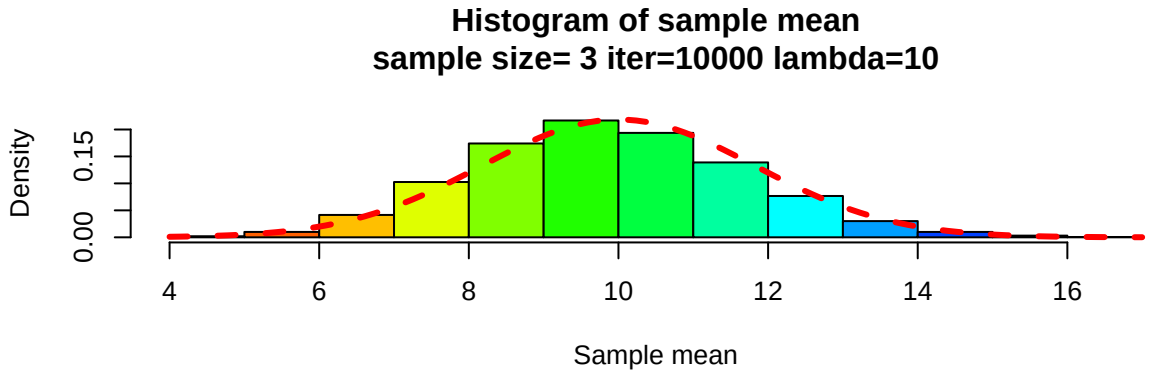

```
mycltp(n=2,iter=10000, lambda = 10)
```

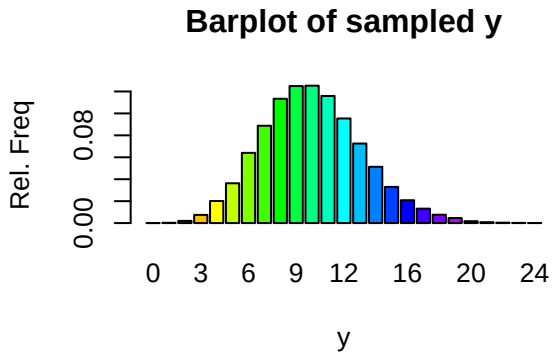


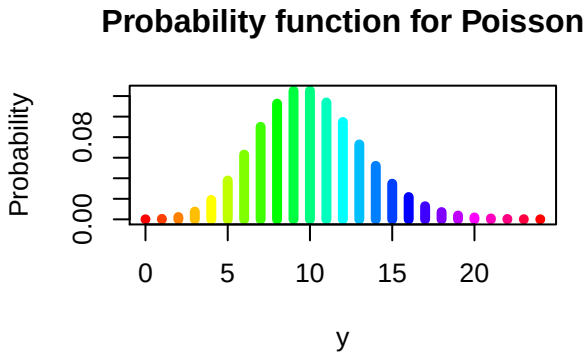




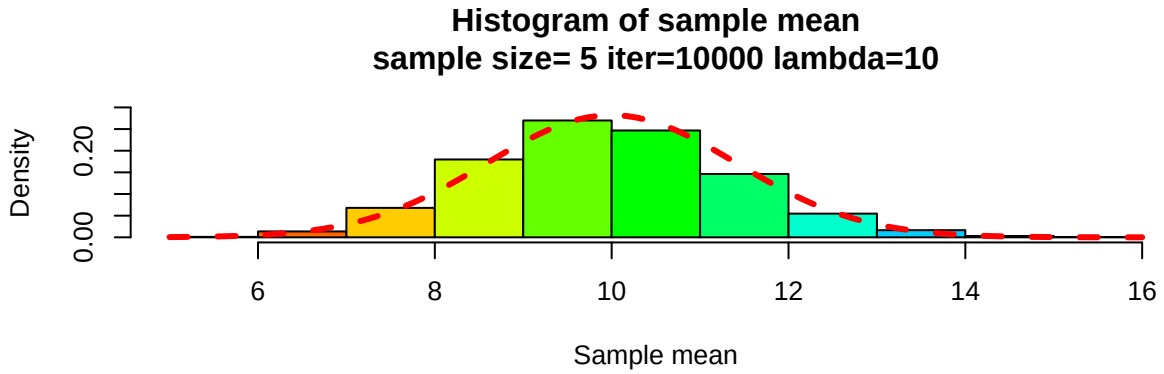

```
mycltp(n=3,iter=10000, lambda = 10)
```

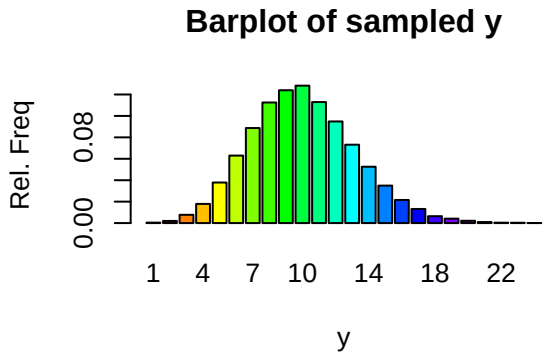


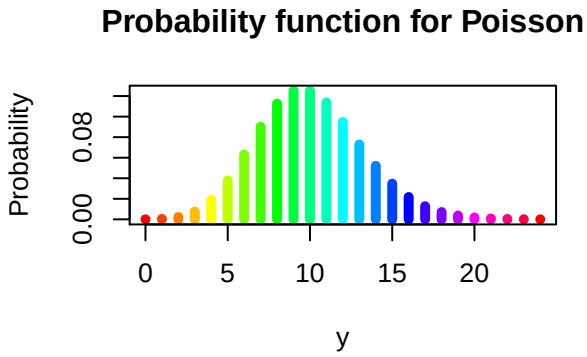




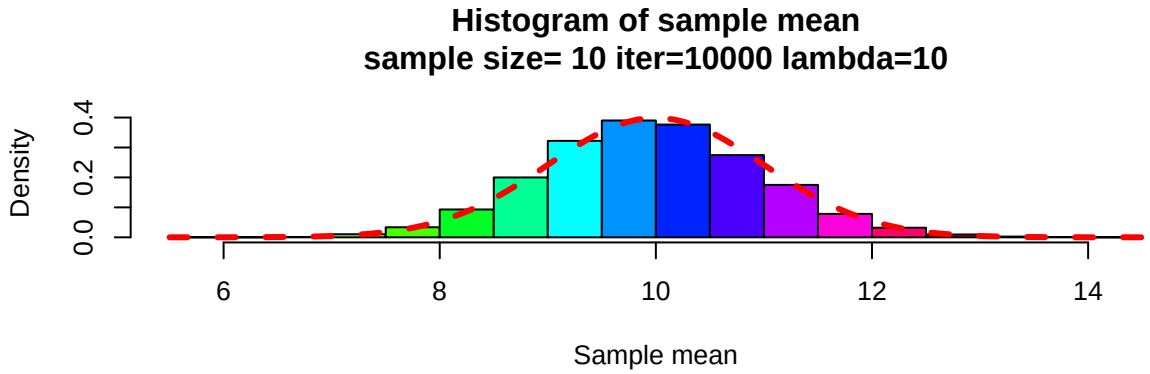

```
mycltp(n=5,iter=10000, lambda = 10)
```

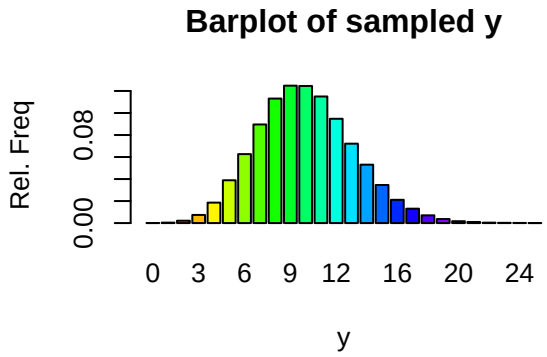


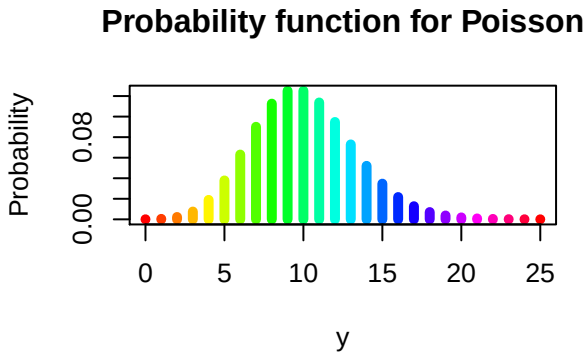




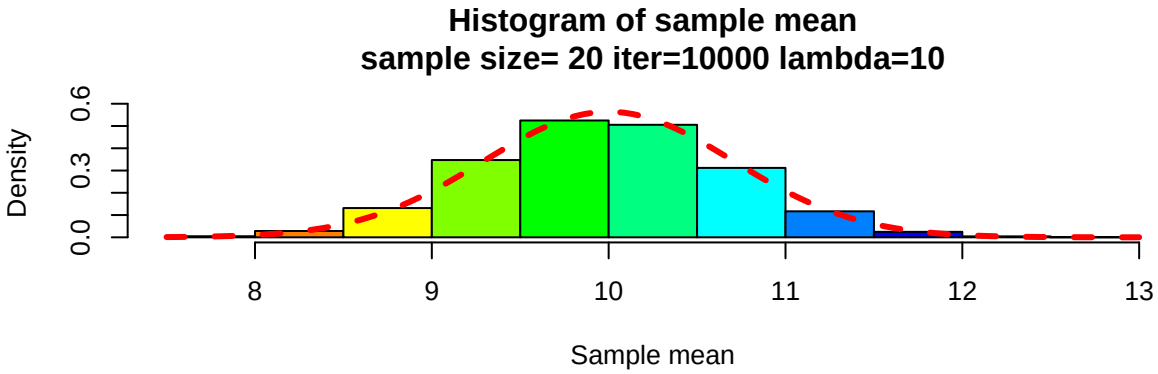

```
mycltp(n=10,iter=10000, lambda = 10)
```

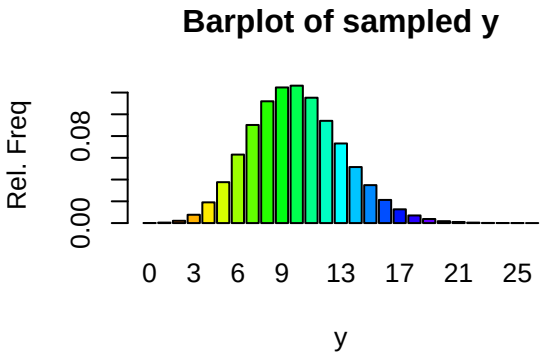


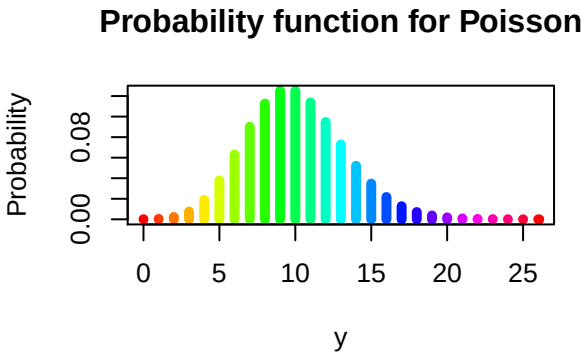





```
mycltp(n=20,iter=10000, lambda = 10)
```


Histogram of sample mean
sample size= 20 iter=10000 lambda=10
Density
0.0
0.3
0.6
8
9
10
11
12
13
Sample mean


Barplot of sampled y
Rel. Freq
0.00
0.08
0 3 6 9 13 17 21 25
y


Probability function for Poisson
Probability
0.00
0.08
0
5
10
15
20
25
y