R_lab_assignment01_new.R

Admin

2024-02-19

```
#1. Consider mtcars and iris (Motor Trend Car Road Tests and Iris)
#data sets available in R-statistical software, and find
#i. Mean, median, mode, 1st quartile, 2nd quartile, 3rd quartile, variance,
#standard deviation, and covariance between any two variables using inbuilt
#functions and by writing your own function with proper documentation.
rm(list=ls(all=TRUE))
#checklen function used in almost all programs
checklen=function(x){
  i=1;
  while(!is.na(x[i,1])){
    i=i+1;
    if(is.na(x[i,1])){
      break;
    }
  }
  checklen=i-1
  checklen
}
```

```
x=mtcars
y=iris
mean(x[,1])
```

```
## [1] 20.09062
```

```
mean(y[,1])
```

```
## [1] 5.843333
```

```
#ans=20.09062 for mtcars
#ans=5.843333 for iris

#for finding sum of observations of mpg column and Sepal.Length
#here we are passing dataset and column number as parameter
findMean = function(x,n){
  i=1; #to keep track of iterations
  sum=0;
  total=checklen(x)
  for(i in 1:total){
    sum=sum+x[i,n]
  }
  #mean= sum of observations/total number of observations
  findMean=sum/checklen(x)
  findMean
}
#ans 20.09062 for mtcars
#ans 5.843333 for iris
```

```
median(x[,1])
```

```
## [1] 19.2
```

```
median(y[,1])
```

```
## [1] 5.8
```

```
#ans=19.2 for mtcars
#ans=5.8 for iris
findMedian=function(x){
  #code below is to sort the array. t is a temporary variable used in swapping
  for(i in 1:(checklen(x)-1)){
    for(j in (i+1):checklen(x)){
      if(x[j,1]<x[i,1]){
        t=x[i,1]
        x[i,1]=x[j,1]
        x[j,1]=t
      }
    }
  }
  #if number of elements odd then median at (n+1)/2th position
  # %% used to check remainder
  if(checklen(x)%%2==1){
    med=x[((checklen(x)+1)/2),1]
  }
  else{
    m1=x[((checklen(x))/2),1]
    m2=x[(((checklen(x))/2)+1),1]
    med=(m1+m2)/2
  }
  findMedian=med
  findMedian
}
#ans=19.2
```

```
f=table(x[,1])
table(y[,1])
```

```
## 
## 4.3 4.4 4.5 4.6 4.7 4.8 4.9   5 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9   6 6.1 6.2 
##   1   3   1   4   2   5   6  10   9   4   1   6   7   6   8   7   3   6   6   4 
## 6.3 6.4 6.5 6.6 6.7 6.8 6.9   7 7.1 7.2 7.3 7.4 7.6 7.7 7.9 
##   9   7   5   2   8   3   4   1   1   3   1   1   1   4   1
```

```
#frequencies of numbers shown. 10.4, 15.2, 19.2, 21, 21.4, 22,8, 30.4 occur
#occur two times
#function to find mode without in build function
findMode=function(x){
  #sorting array
  for(i in 1:(checklen(x)-1)){
    for(j in ((i+1):(checklen(x)))){
      if(x[j,1]<x[i,1]){
        t=x[i,1]
        x[i,1]=x[j,1]
        x[j,1]=t
      }
    }
  }

  h=rep(0,(checklen(x)))
  #checking for frequency and updating
  for(i in 1:(checklen(x)-1)){
    for(j in (i+1):checklen(x)){
      if(x[i,1]==x[(j),1]){
        h[i]=h[i]+1
      }
    }


  }
  #finding max frequency
  max=h[1]
  for(i in 1:(checklen(x))){
    if(h[i]>max){
      max=h[i]
    }
  }
  #printing numbers with max frequency
  for(i in 1:(checklen(x))){
    if(h[i]==max){
      print(x[i,1])
    }
  }
}
```

```
quartile=quantile(x[,1],c(0.25,0.5,0.75))
#this in build function gives value of 1st quartile, median and 3rd quartile
#ans = 15.425, 19.2, 22.8 for mtcars
#ans = 5.1, 5.8, 6.4
#creating our own function
findQuartile=function(x,n){
  stopifnot(n>= 1 && n<=3)
  #sorting array
  for(i in 1:(checklen(x)-1)){
    for(j in (i+1):(checklen(x))){
      if(x[j,1]<x[i,1]){
        t=x[i,1]
        x[i,1]=x[j,1]
        x[j,1]=t
      }
    }
  }
  #first quartile
  if(n==1){
    findQuartile=(x[as.integer((checklen(x)+1)/4),1])
    findQuartile
  }
  #third quartile
  else if(n==3){
    findQuartile=(x[as.integer(3*(checklen(x)+1)/4),1])
    findQuartile
  }
  #median
  else if(n==2){
    findQuartile=(x[as.integer((checklen(x)+1)/2),1])
    findQuartile
  }
}
```

```
var(x[,1])
```

```
## [1] 36.3241
```

```
var(y[,1])
```

```
## [1] 0.6856935
```

```
#in build function, ans=36.3241
#in build function, ans=0.685693

findVar=function(x){
  sum=0
  i=1
  mean=findMean(x)
  for(i in 1:checklen(x)){
    sum=sum+((x[i,1]-mean)^2)/(checklen(x)-1)
  }
  findVar=sum
  findVar
}
```

```
sd(x[,1])
```

```
## [1] 6.026948
```

```
sd(y[,1])
```

```
## [1] 0.8280661
```

```
#in build function, ans=6.026948 for mtcars
#ans=0.8280661 for iris
findSd=function(x){
  findSd=sqrt(findVar(x))
  findSd
}
```

```
cov(x[,1],x[,2])  #-9.172379
```

```
## [1] -9.172379
```

```
cov(y[,1],y[,2])  #-0.042434
```

```
## [1] -0.042434
```

```
findCov=function(x){
  sum=0
  for(i in 1:(checklen(x))){
    sum=sum+(((x[i,1]-findMean(x,1))*(x[i,2]-findMean(x,2)))/(checklen(x)-1))
  }
  findCov=sum
  findCov
}
```

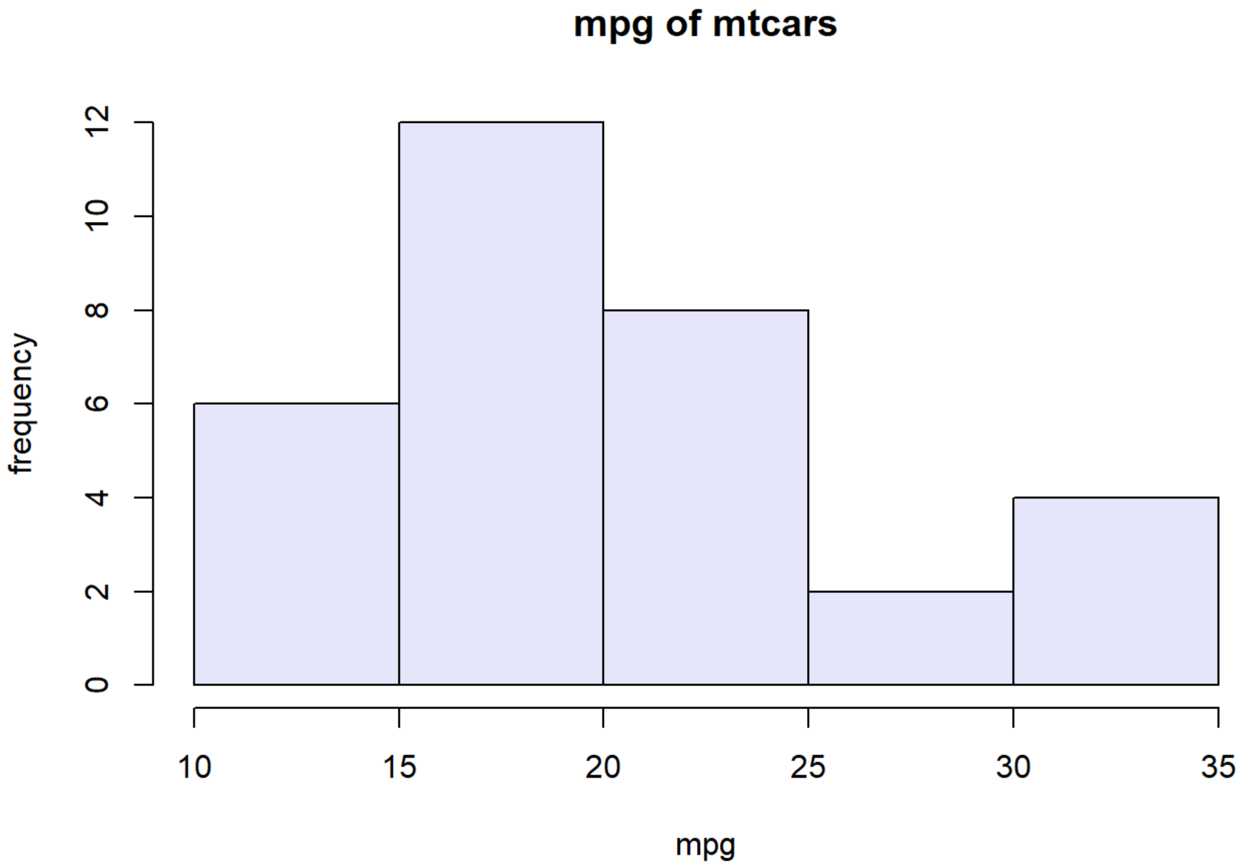
```
summary(x)
```

```
##       mpg             cyl             disp             hp
##  Min.   :10.40   Min.   :4.000   Min.   : 71.1   Min.   : 52.0
##  1st Qu.:15.43   1st Qu.:4.000   1st Qu.:120.8   1st Qu.: 96.5
##  Median :19.20   Median :6.000   Median :196.3   Median :123.0
##  Mean   :20.09   Mean   :6.188   Mean   :230.7   Mean   :146.7
##  3rd Qu.:22.80   3rd Qu.:8.000   3rd Qu.:326.0   3rd Qu.:180.0
##  Max.   :33.90   Max.   :8.000   Max.   :472.0   Max.   :335.0
##       drat             wt             qsec             vs
##  Min.   :2.760   Min.   :1.513   Min.   :14.50   Min.   :0.0000
##  1st Qu.:3.080   1st Qu.:2.581   1st Qu.:16.89   1st Qu.:0.0000
##  Median :3.695   Median :3.325   Median :17.71   Median :0.0000
##  Mean   :3.597   Mean   :3.217   Mean   :17.85   Mean   :0.4375
##  3rd Qu.:3.920   3rd Qu.:3.610   3rd Qu.:18.90   3rd Qu.:1.0000
##  Max.   :4.930   Max.   :5.424   Max.   :22.90   Max.   :1.0000
##        am              gear            carb
##  Min.   :0.0000   Min.   :3.000   Min.   :1.000
##  1st Qu.:0.0000   1st Qu.:3.000   1st Qu.:2.000
##  Median :0.0000   Median :4.000   Median :2.000
##  Mean   :0.4062   Mean   :3.688   Mean   :2.812
##  3rd Qu.:1.0000   3rd Qu.:4.000   3rd Qu.:4.000
##  Max.   :1.0000   Max.   :5.000   Max.   :8.000
```

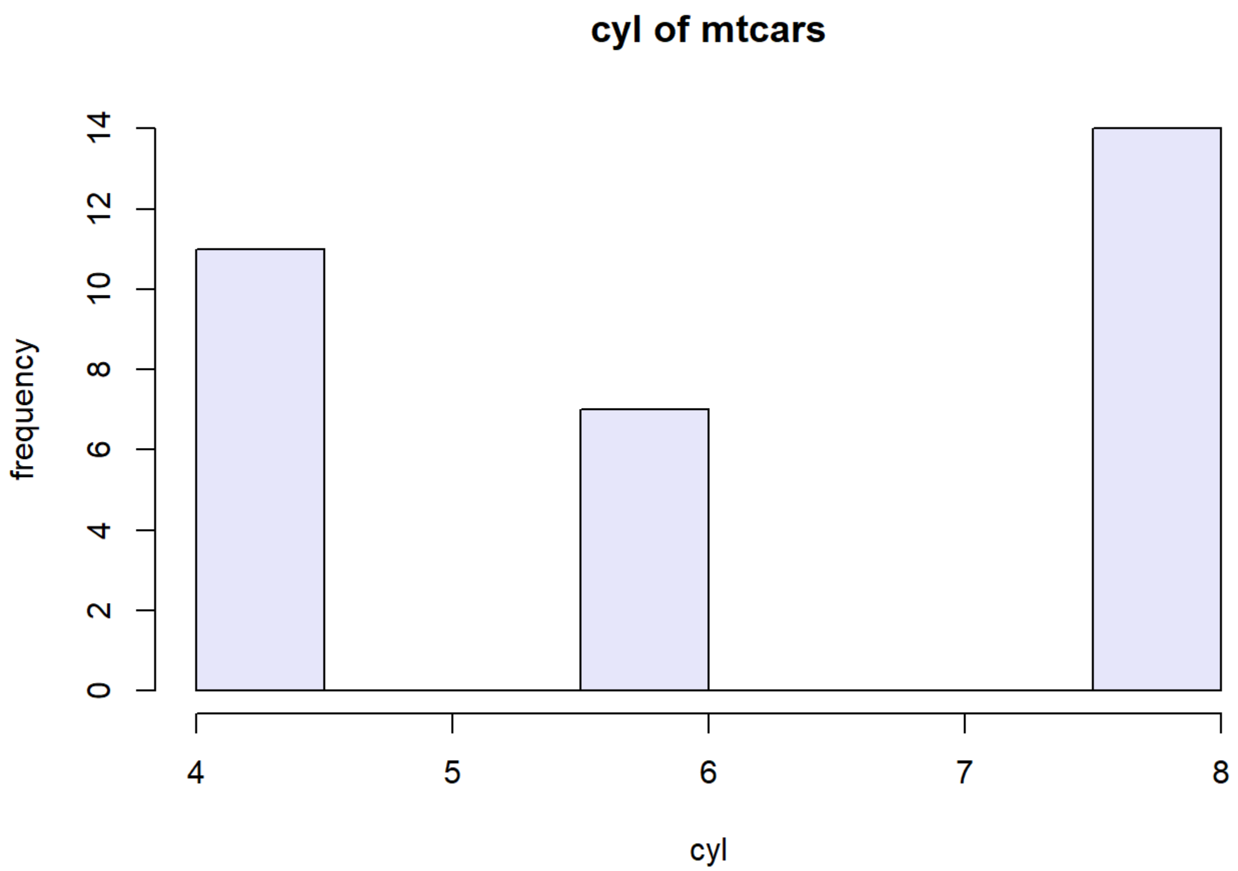
```
summary(y)
```

```
##   Sepal.Length    Sepal.Width     Petal.Length    Petal.Width
##  Min.   :4.300   Min.   :2.000   Min.   :1.000   Min.   :0.100
##  1st Qu.:5.100   1st Qu.:2.800   1st Qu.:1.600   1st Qu.:0.300
##  Median :5.800   Median :3.000   Median :4.350   Median :1.300
##  Mean   :5.843   Mean   :3.057   Mean   :3.758   Mean   :1.199
##  3rd Qu.:6.400   3rd Qu.:3.300   3rd Qu.:5.100   3rd Qu.:1.800
##  Max.   :7.900   Max.   :4.400   Max.   :6.900   Max.   :2.500
##        Species
##  setosa    :50
##  versicolor:50
##  virginica :50
##
##
##
```

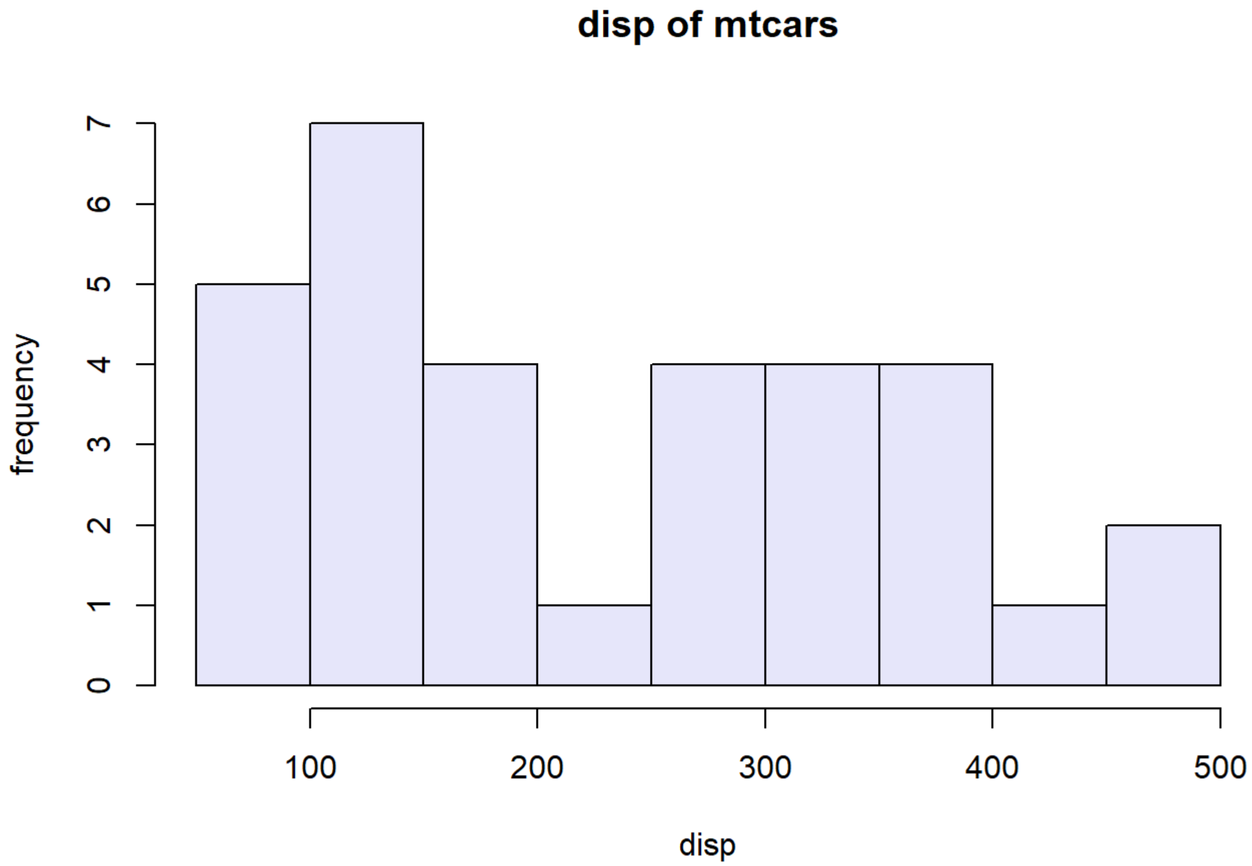
```
#illustrate data on different variables.

x=mtcars;
#for(i in 1:11){
  hist(x[,1],
       xlab="mpg",
       ylab="frequency",
       main=("mpg of mtcars"),
       col="lavender"
  )
```



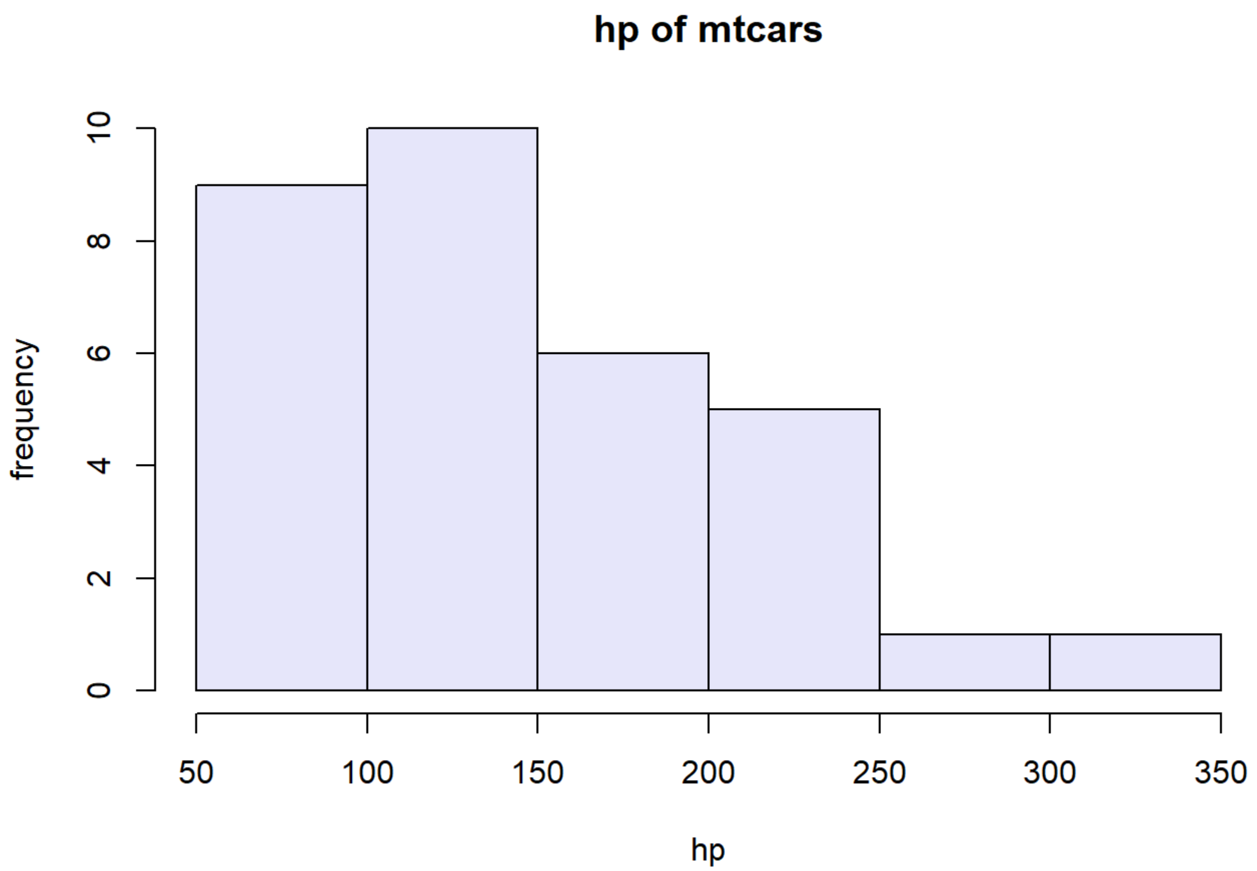
```
#}
hist(x[,2],
     xlab="cyl",
     ylab="frequency",
     main=("cyl of mtcars"),
     col="lavender"
)
```



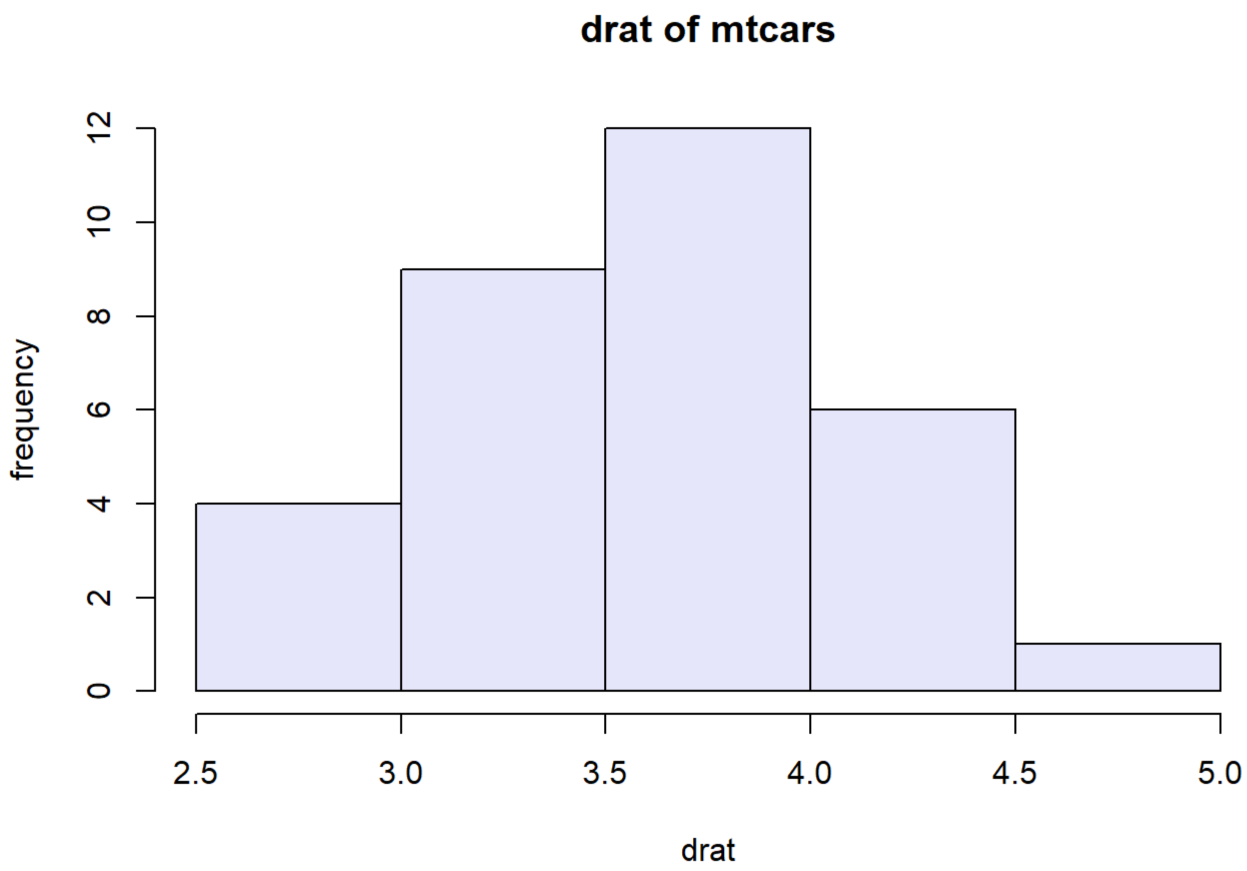
```
hist(x[,3],
     xlab="disp",
     ylab="frequency",
     main=("disp of mtcars"),
     col="lavender"
)
```



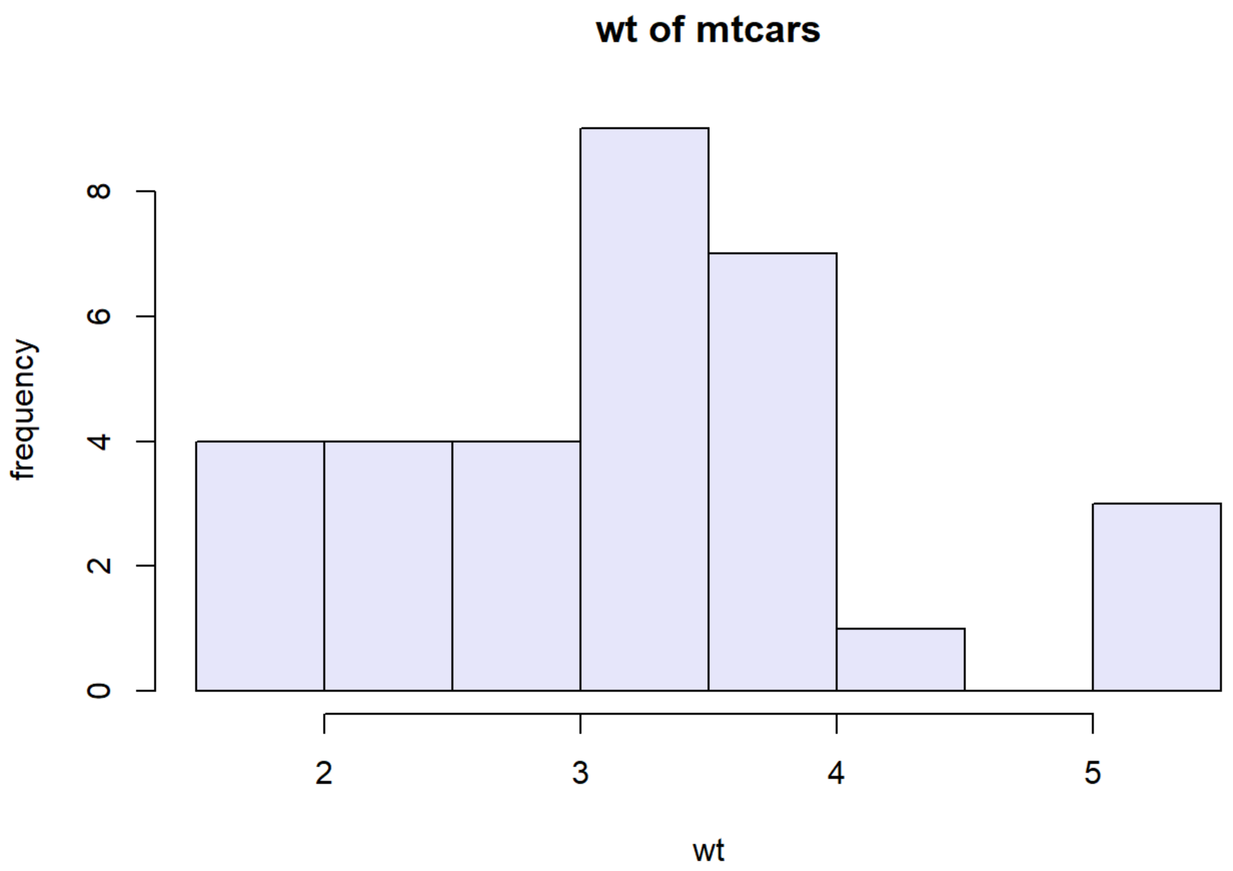
```
hist(x[,4],
     xlab="hp",
     ylab="frequency",
     main=("hp of mtcars"),
     col="lavender"
)
```



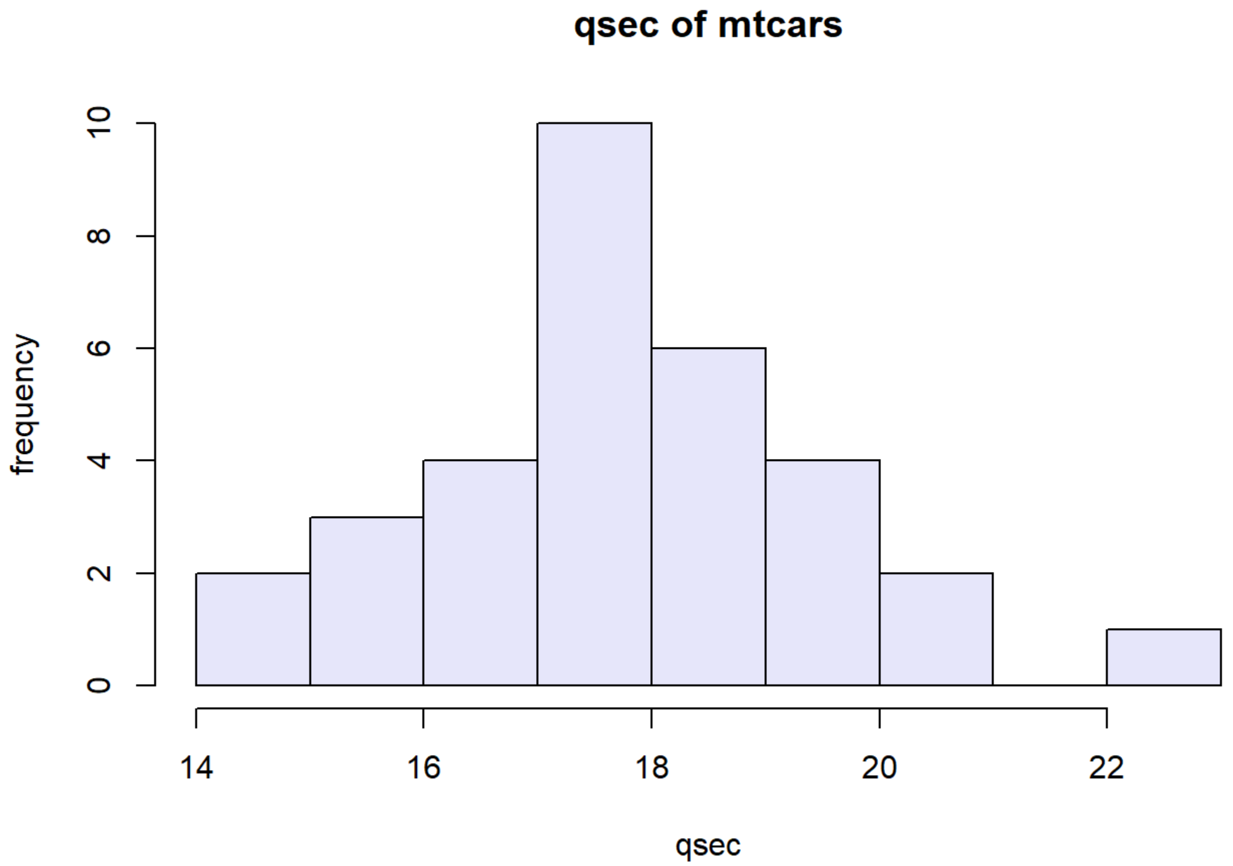
```
hist(x[,5],
     xlab="drat",
     ylab="frequency",
     main=("drat of mtcars"),
     col="lavender"
)
```



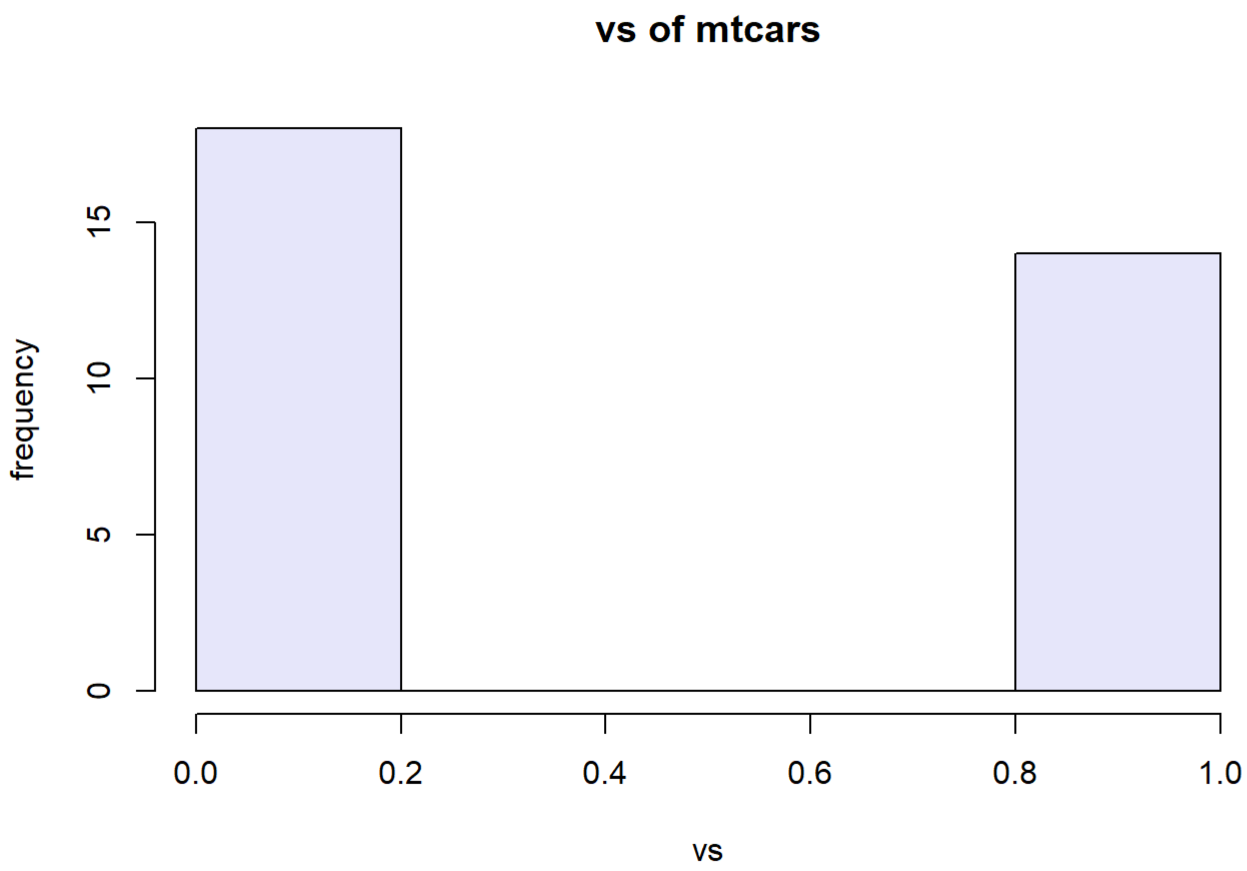
```
hist(x[,6],
     xlab="wt",
     ylab="frequency",
     main=("wt of mtcars"),
     col="lavender"
)
```



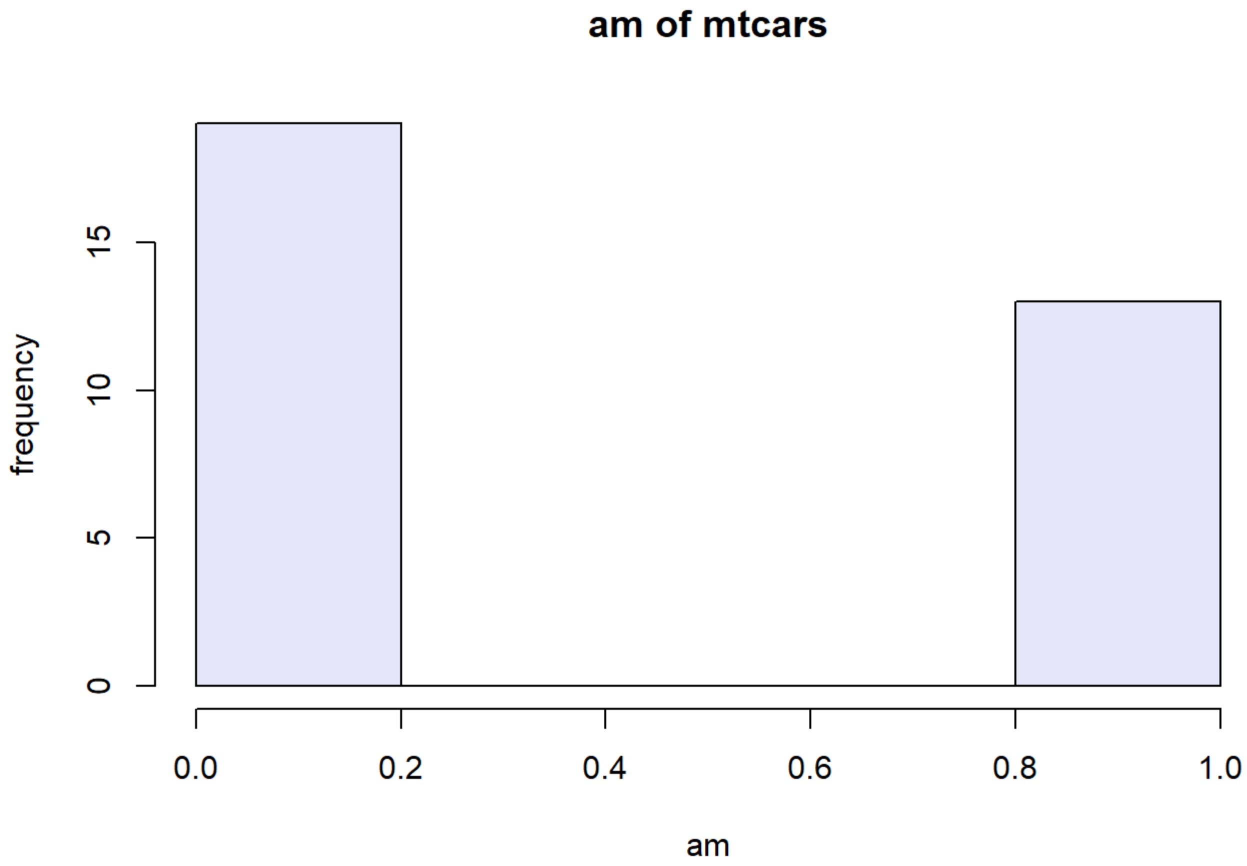
```
hist(x[,7],
     xlab="qsec",
     ylab="frequency",
     main=("qsec of mtcars"),
     col="lavender"
)
```



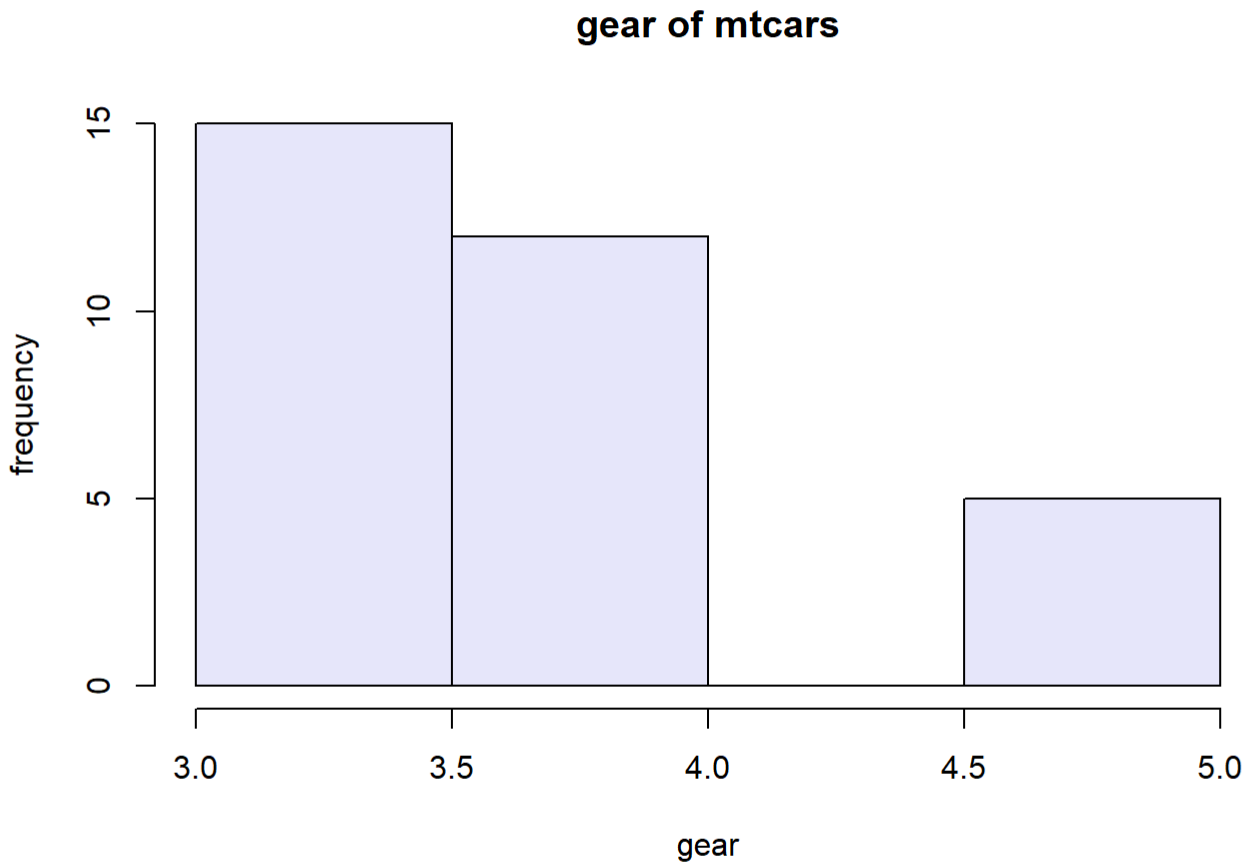
```
hist(x[,8],
     xlab="vs",
     ylab="frequency",
     main=("vs of mtcars"),
     col="lavender"
)
```



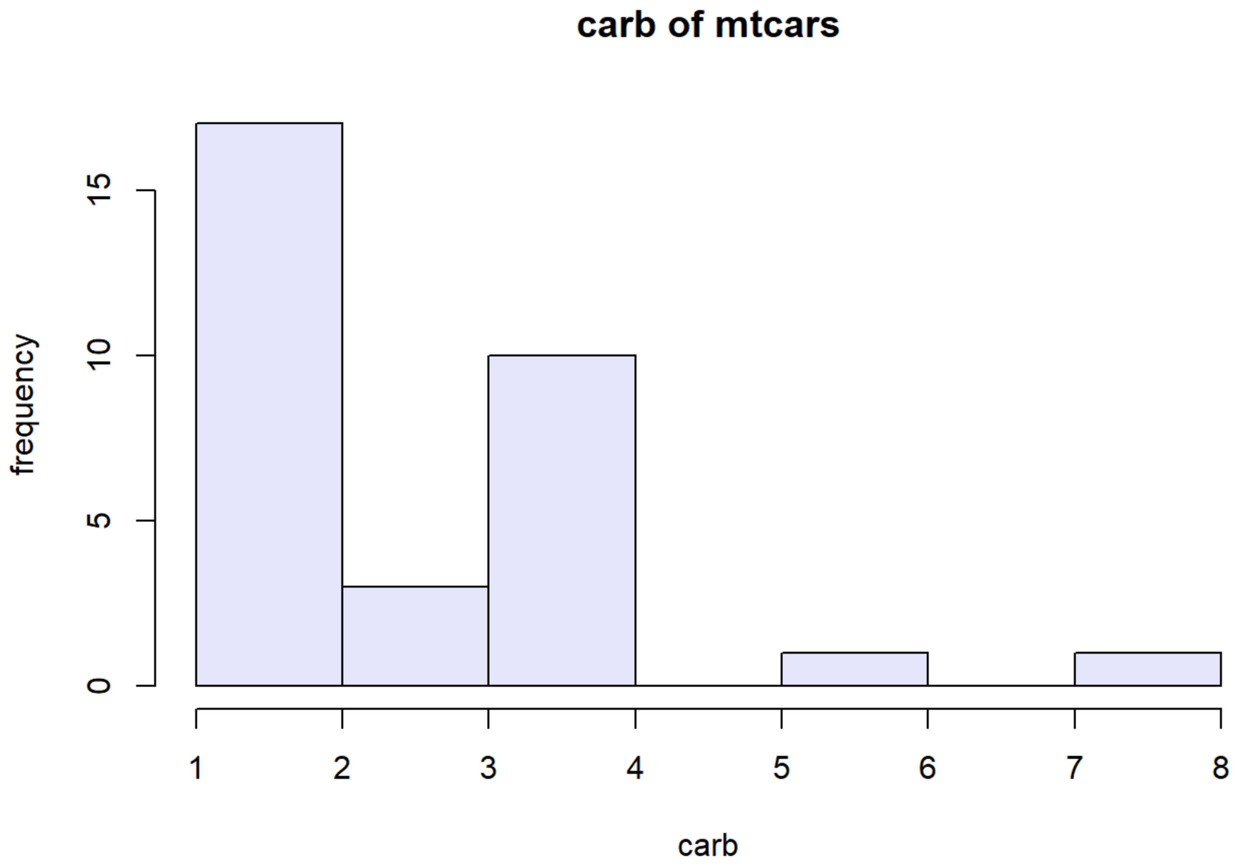
```
hist(x[,9],
     xlab="am",
     ylab="frequency",
     main=("am of mtcars"),
     col="lavender"
)
```



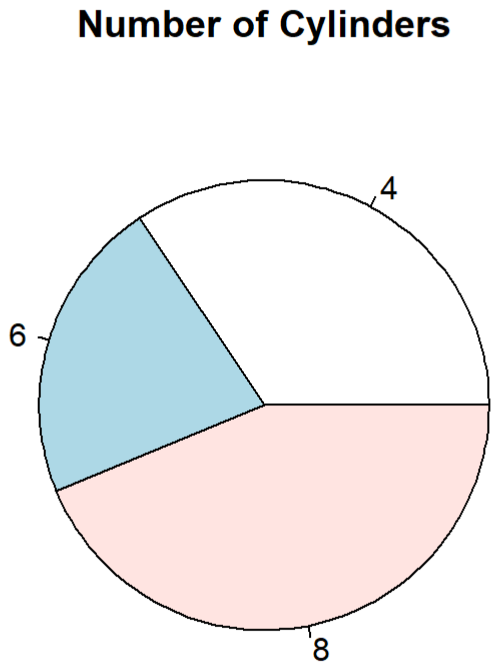
```
hist(x[,10],
     xlab="gear",
     ylab="frequency",
     main=("gear of mtcars"),
     col="lavender"
)
```



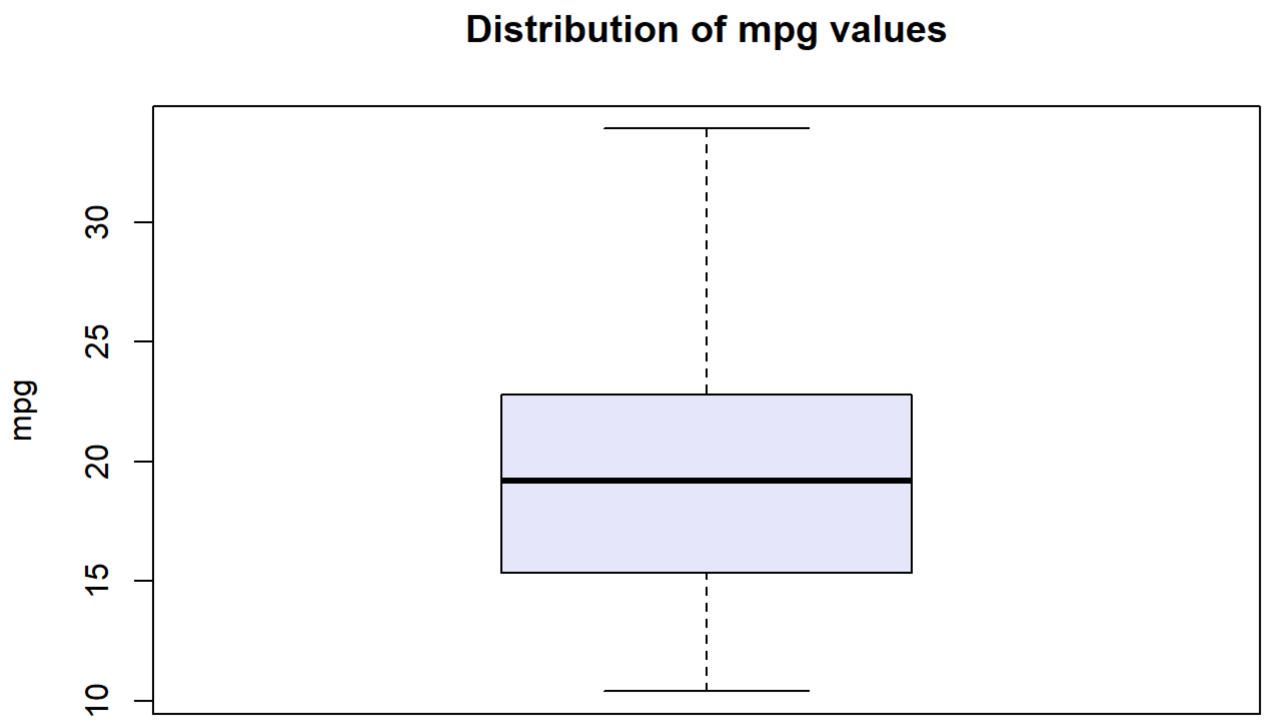
```
hist(x[,11],
     xlab="carb",
     ylab="frequency",
     main=("carb of mtcars"),
     col="lavender"
)
```



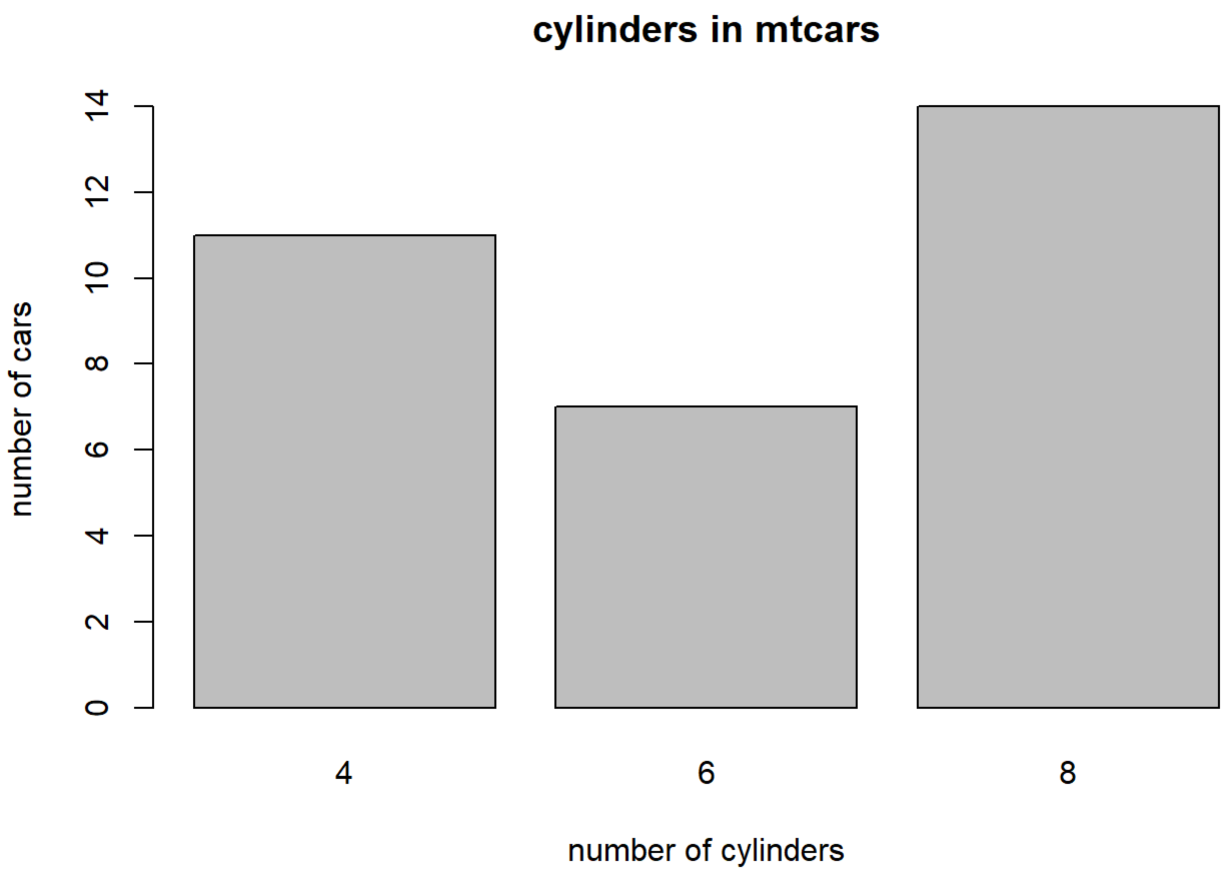
```
#pie chart on number of cylinders
pie(table(x[,2]),
    main="Number of Cylinders"
    )
```



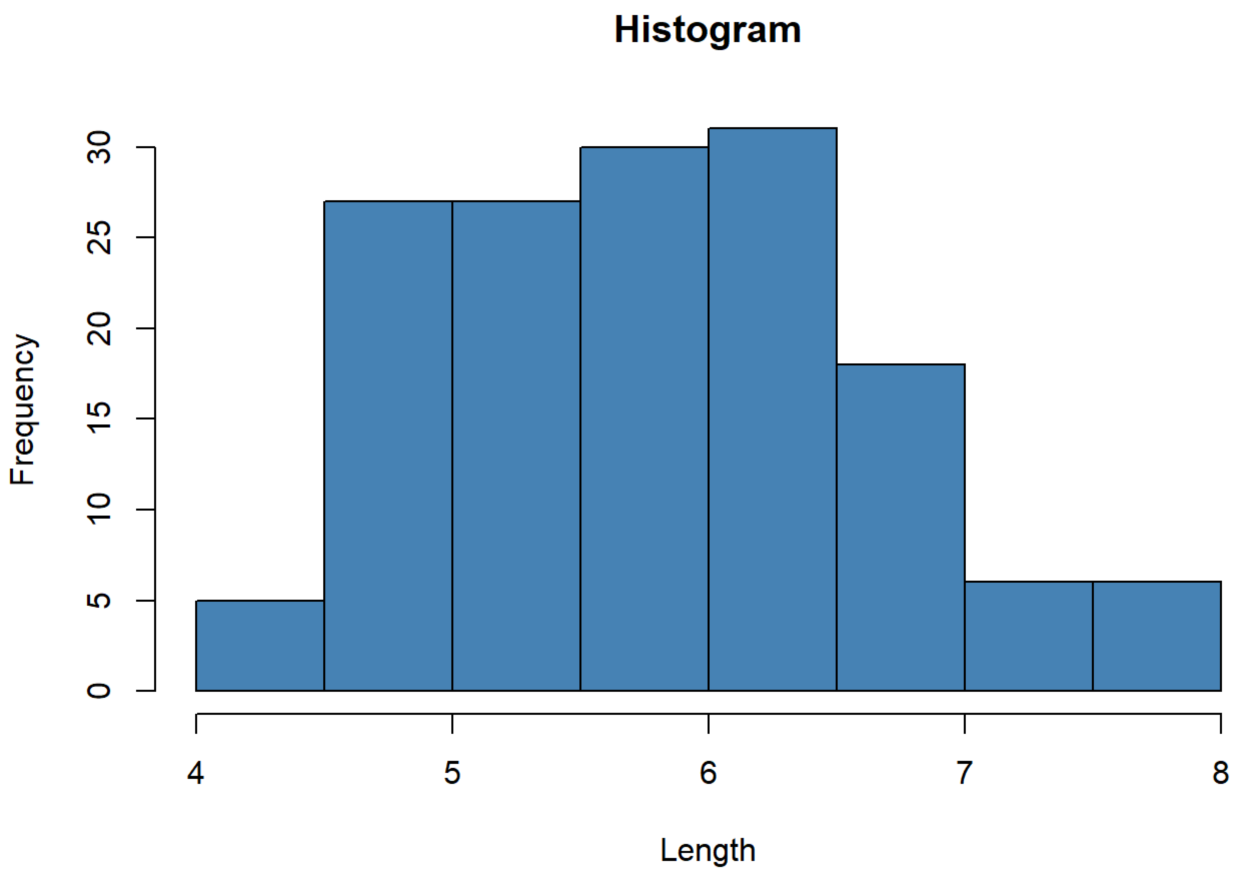
```
boxplot(mtcars$mpg,
        main='Distribution of mpg values',
        ylab='mpg',
        col='lavender',
        border='black')
```



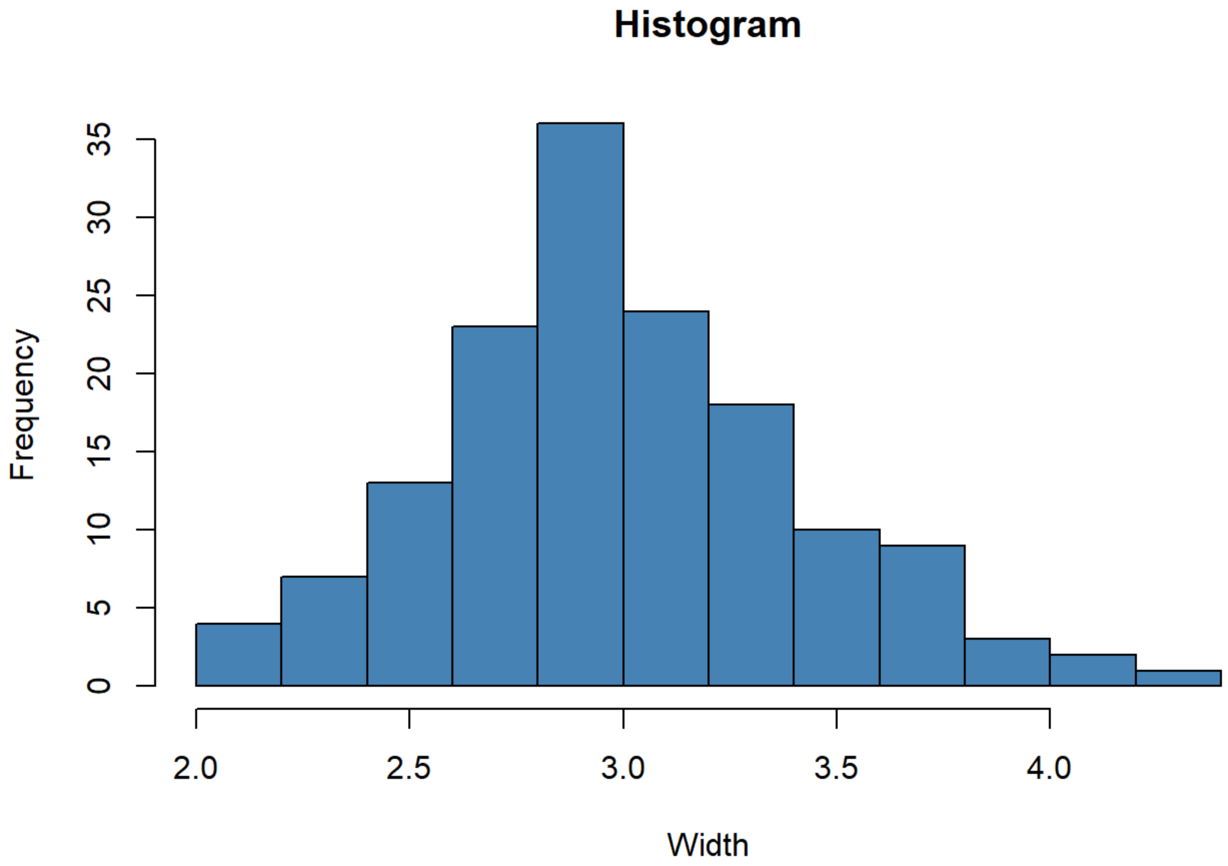
```
barplot(
  table(x[,2]),
  xlab="number of cylinders",
  ylab="number of cars",
  main="cylinders in mtcars"
)
```



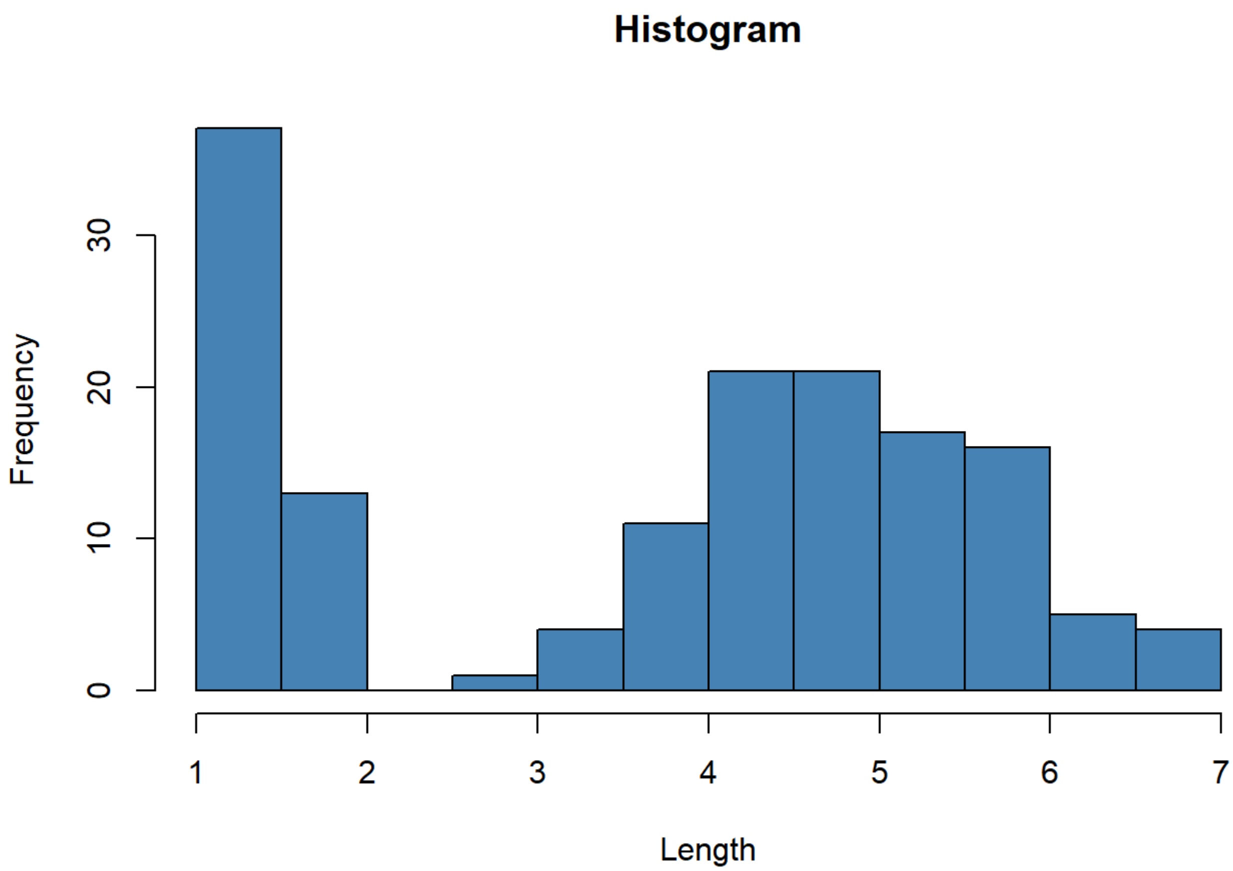
```
#hist, pie and bar chart for iris
y=iris;

hist(iris$Sepal.Length,
     col='steelblue',
     main='Histogram',
     xlab='Length',
     ylab='Frequency')
```



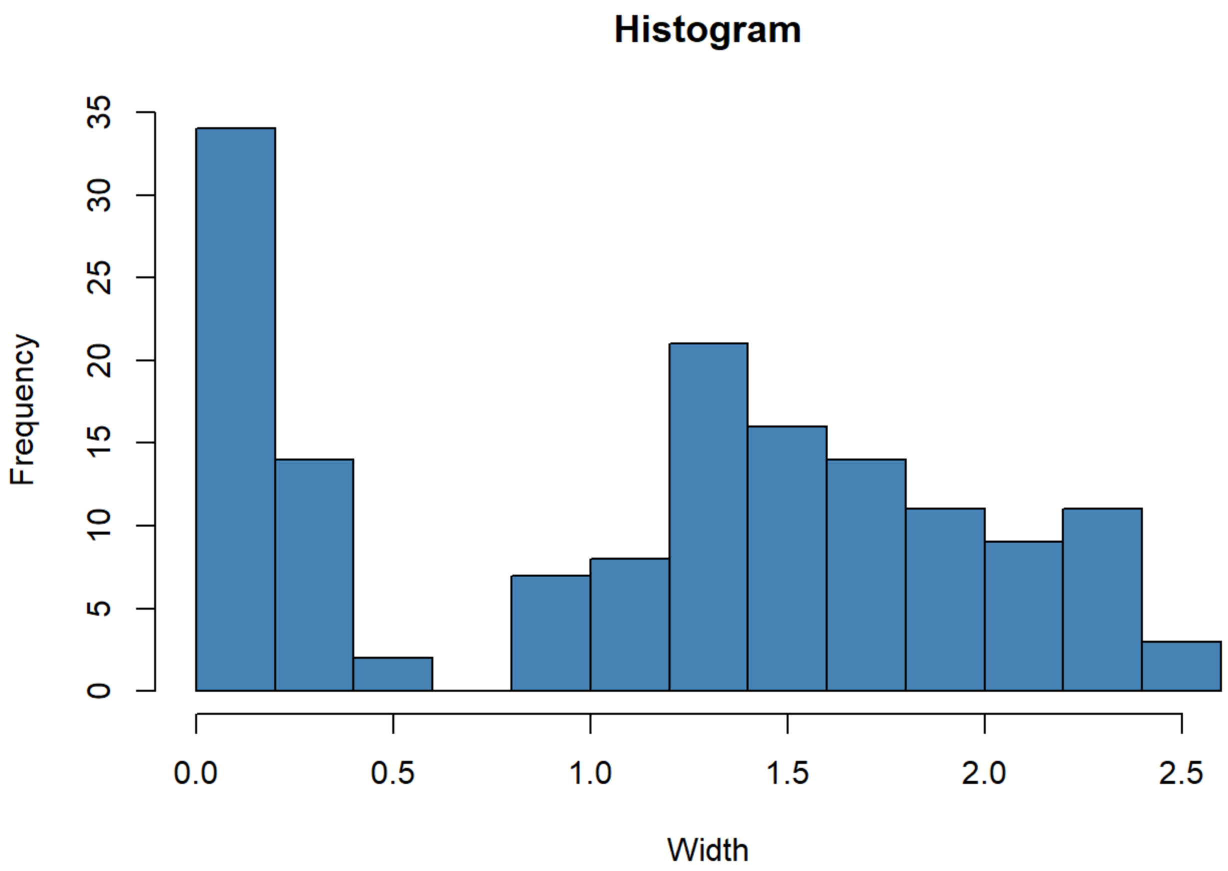
```
hist(iris$Sepal.Width,
     col='steelblue',
     main='Histogram',
     xlab='Width',
     ylab='Frequency')
```



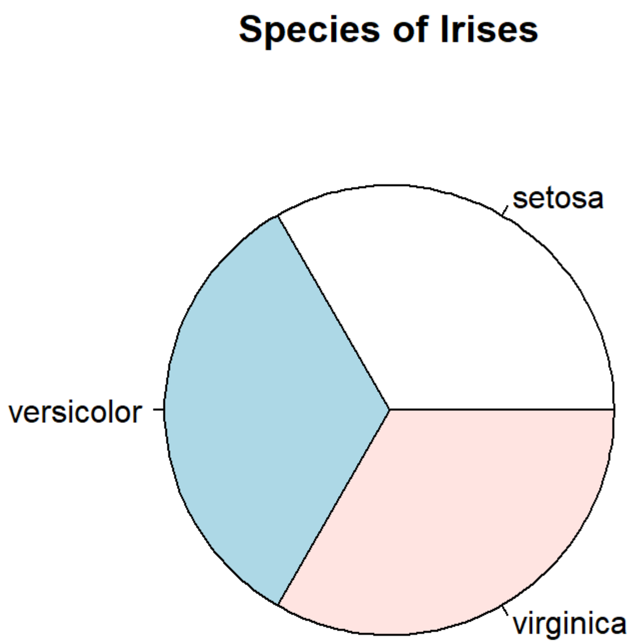
```
hist(iris$Petal.Length,
     col='steelblue',
     main='Histogram',
     xlab='Length',
     ylab='Frequency')
```



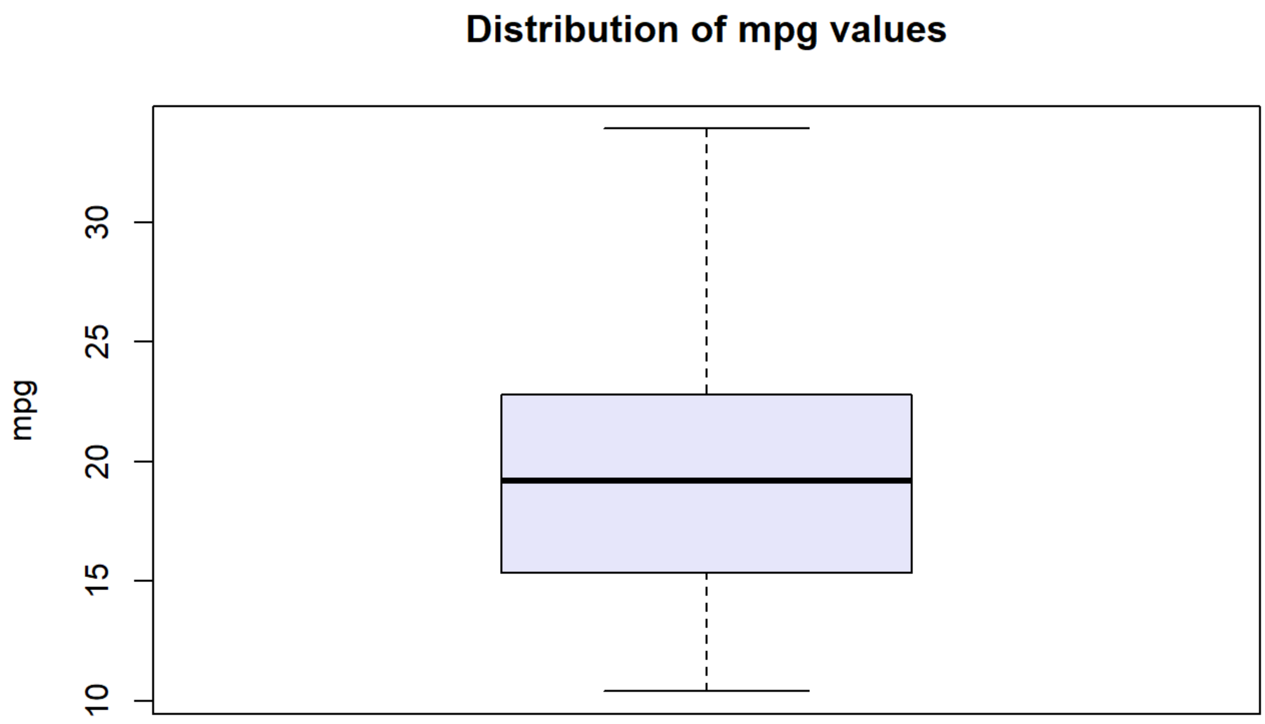
```
hist(iris$Petal.Width,
     col='steelblue',
     main='Histogram',
     xlab='Width',
     ylab='Frequency')
```



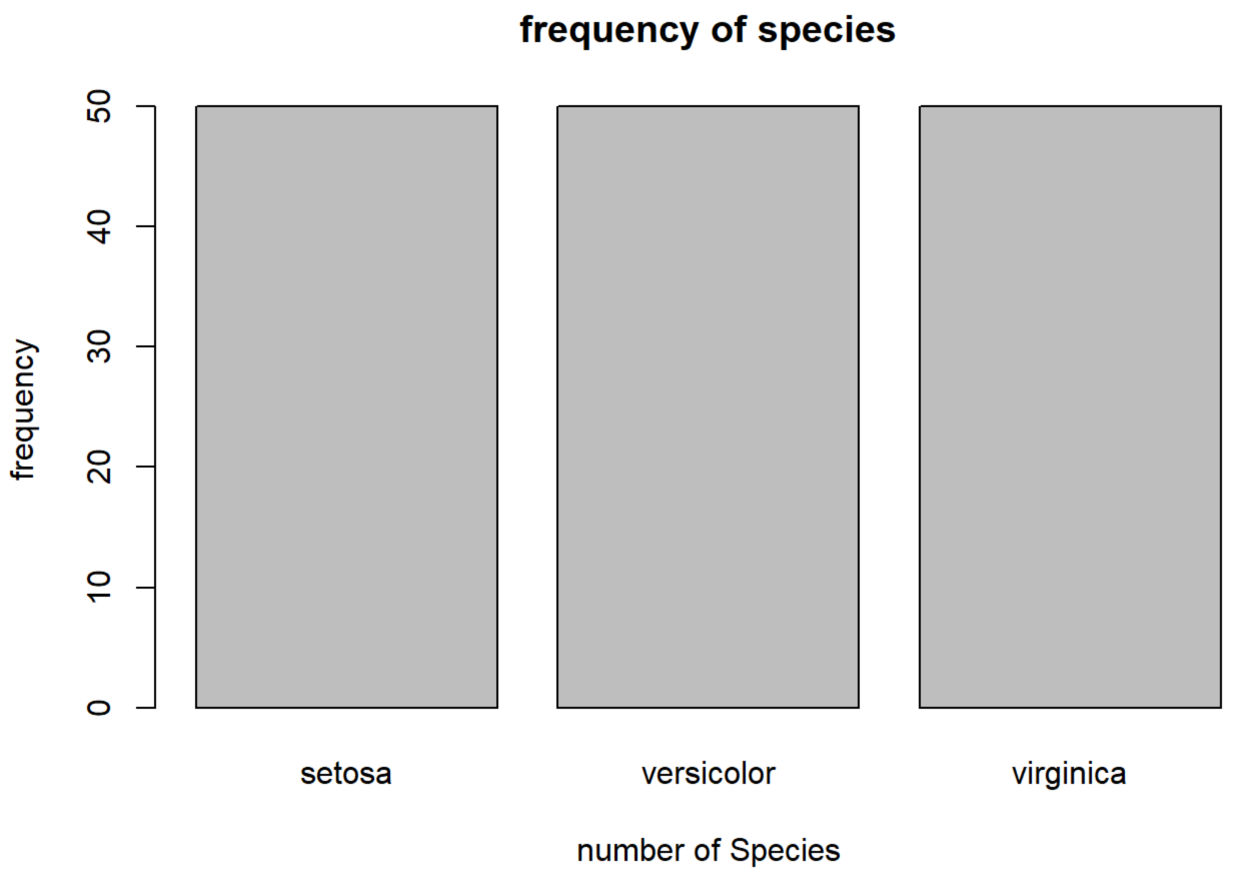
```
#hist for species throws error as it requres numeric inputs
#pie chart on number of species
pie(table(y[,5]),
    main="Species of Irises"
)
```



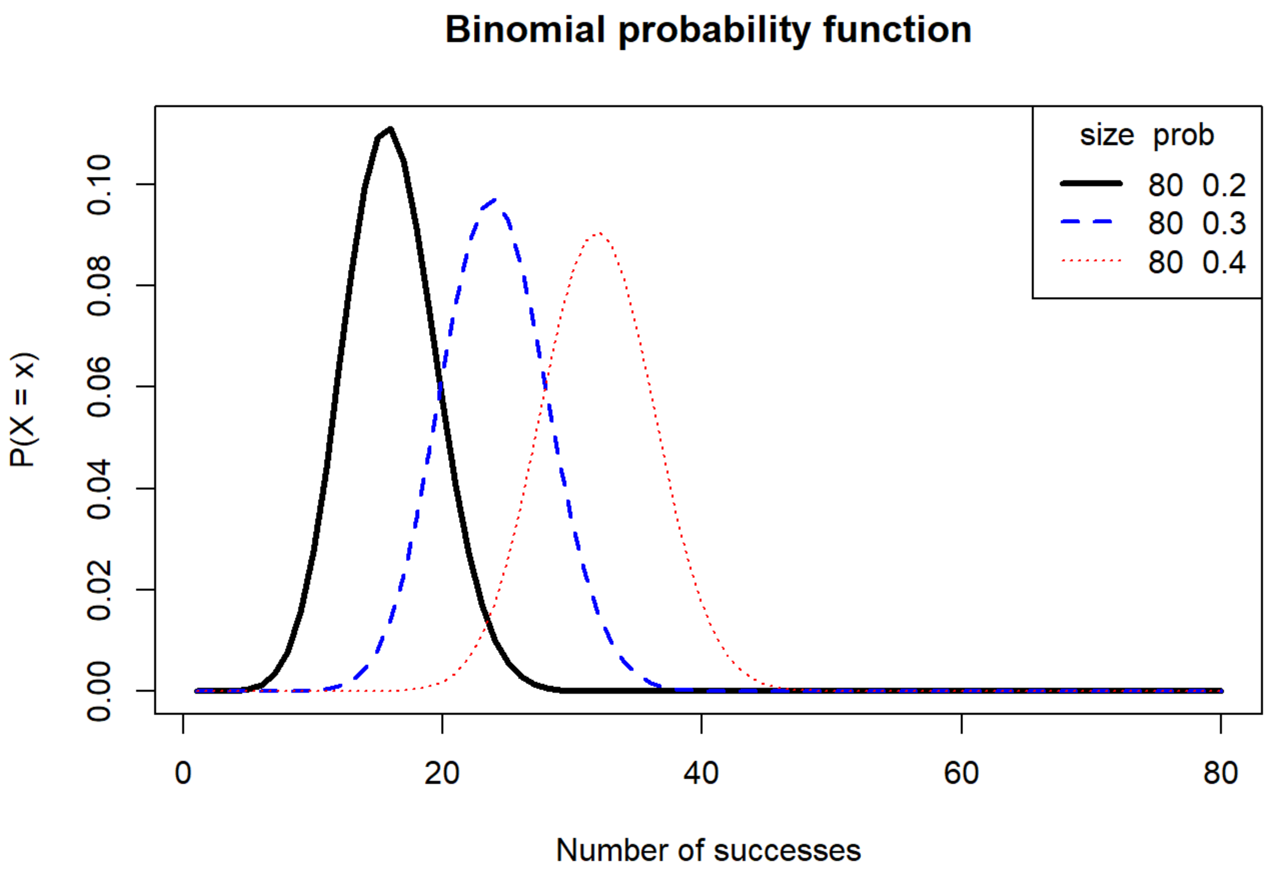
```
boxplot(mtcars$mpg,
        main='Distribution of mpg values',
        ylab='mpg',
        col='lavender',
        border='black')
```



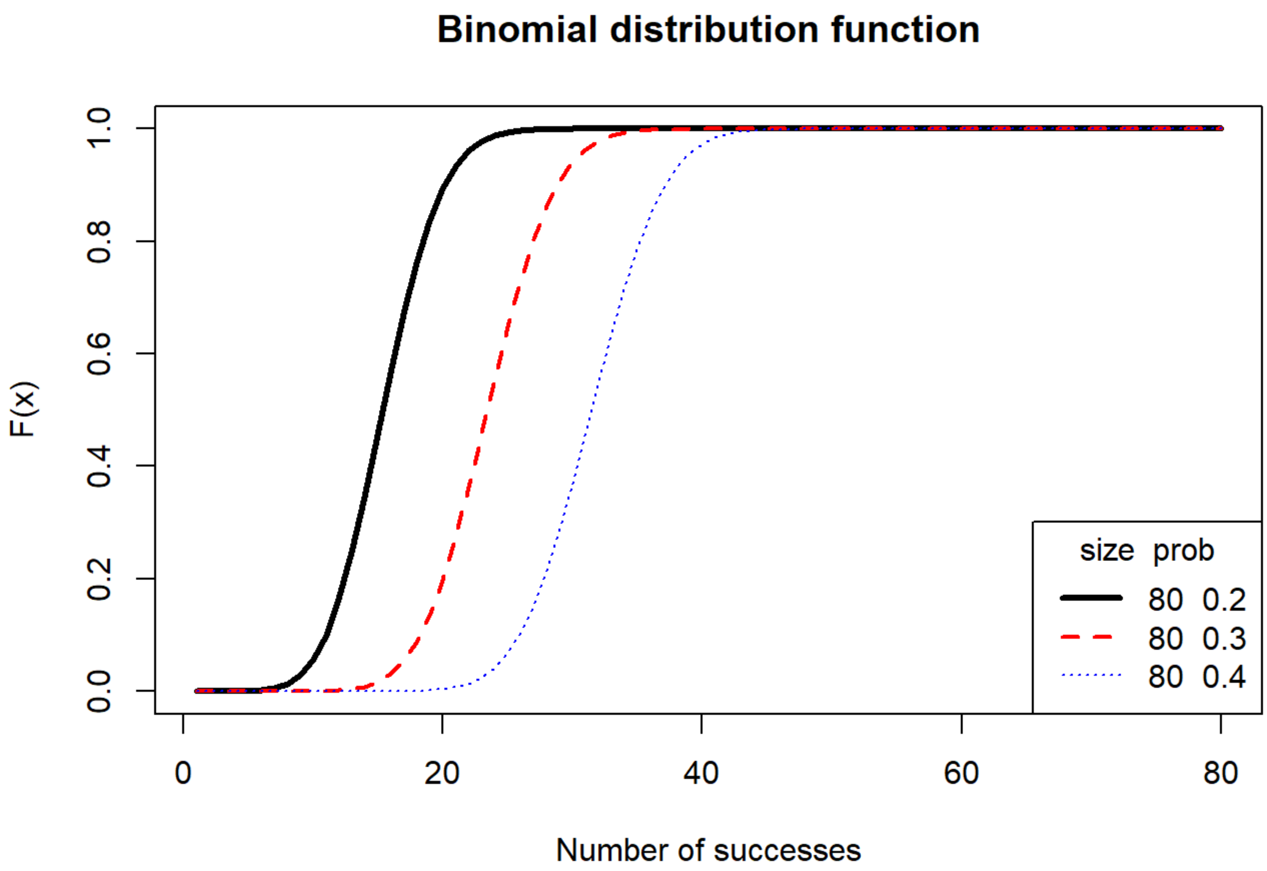
```
#barplot for iris table
barplot(
  table(y[,5]),
  #gives frequency of species
  xlab="number of Species",
  ylab="frequency",
  main="frequency of species"
)
```


frequency of species
frequency
0
10
20
30
40
50
setosa
versicolor
virginica
number of Species

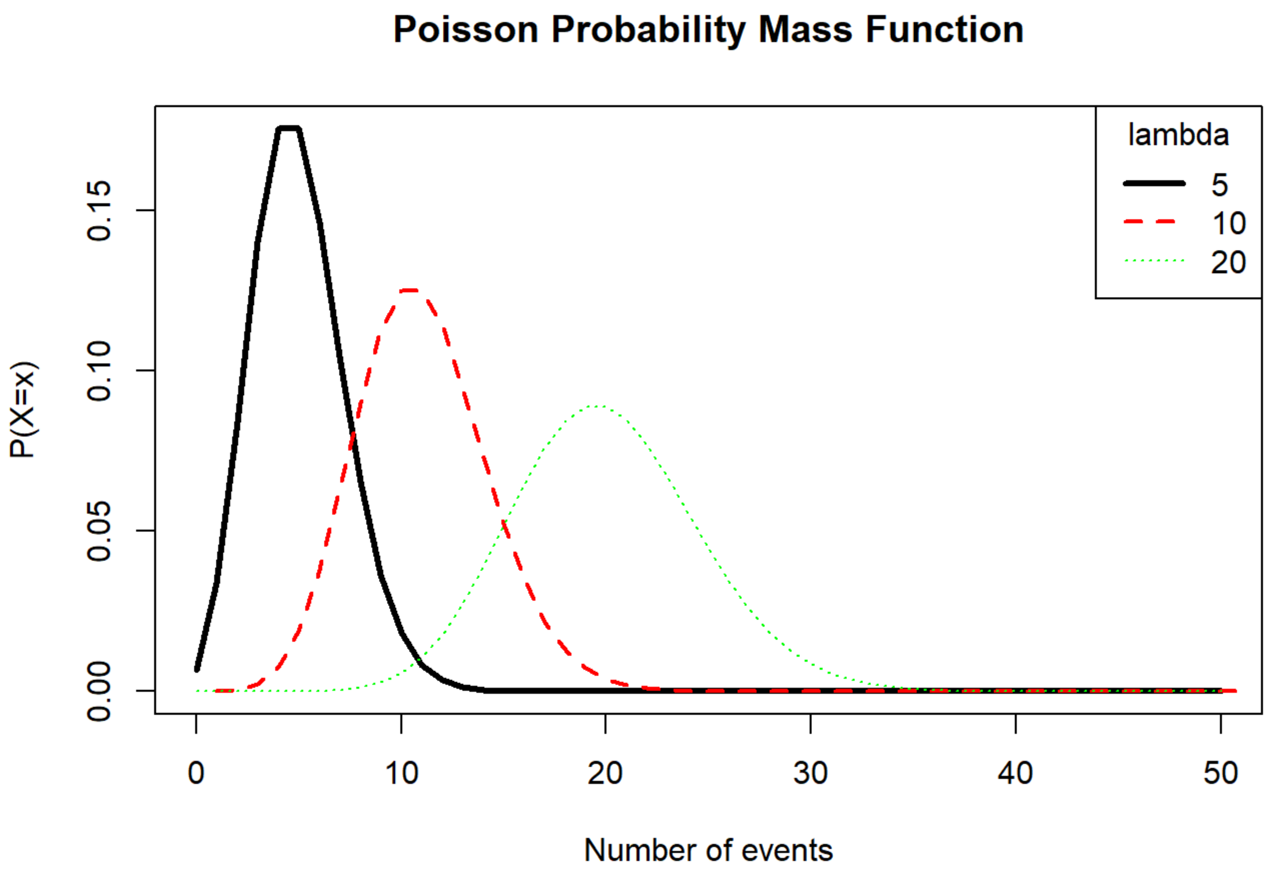
```r
#graph of PMF/PDFs and CDFs of following statistical distributions
#corresponding to various parameter values on the same x-axis.

#i. binomial
#dbinom
x = 1:80

# size = 80, prob = 0.2
plot(dbinom(x, size = 80, prob = 0.2),
     type = "l",
     main = "Binomial probability function",
     ylab = "P(X = x)",
     xlab = "Number of successes",
     col="black",
     lty=1,
     lwd = 3,
     )

# size = 80, prob = 0.3
lines(dbinom(x, size = 80, prob = 0.3),
      type = "l",
      lty=2,
      lwd = 2,
      col = "blue")

# size = 80, prob = 0.4
lines(dbinom(x, size = 80, prob = 0.4),
      type = "l",
      lty = 3,
      lwd= 1,
      col = "red")

# Add a legend
legend("topright", legend = c("80  0.2", "80  0.3", "80  0.4"),
       title = "size  prob",
       lty=c(1,2,3),
       lwd=c(3,2,1),
       col=c("black","blue","red")
       )
```


Binomial probability function
size prob
80 0.2
80 0.3
80 0.4
P(X = x)
0.00
0.02
0.04
0.06
0.08
0.10
0
20
40
60
80
Number of successes

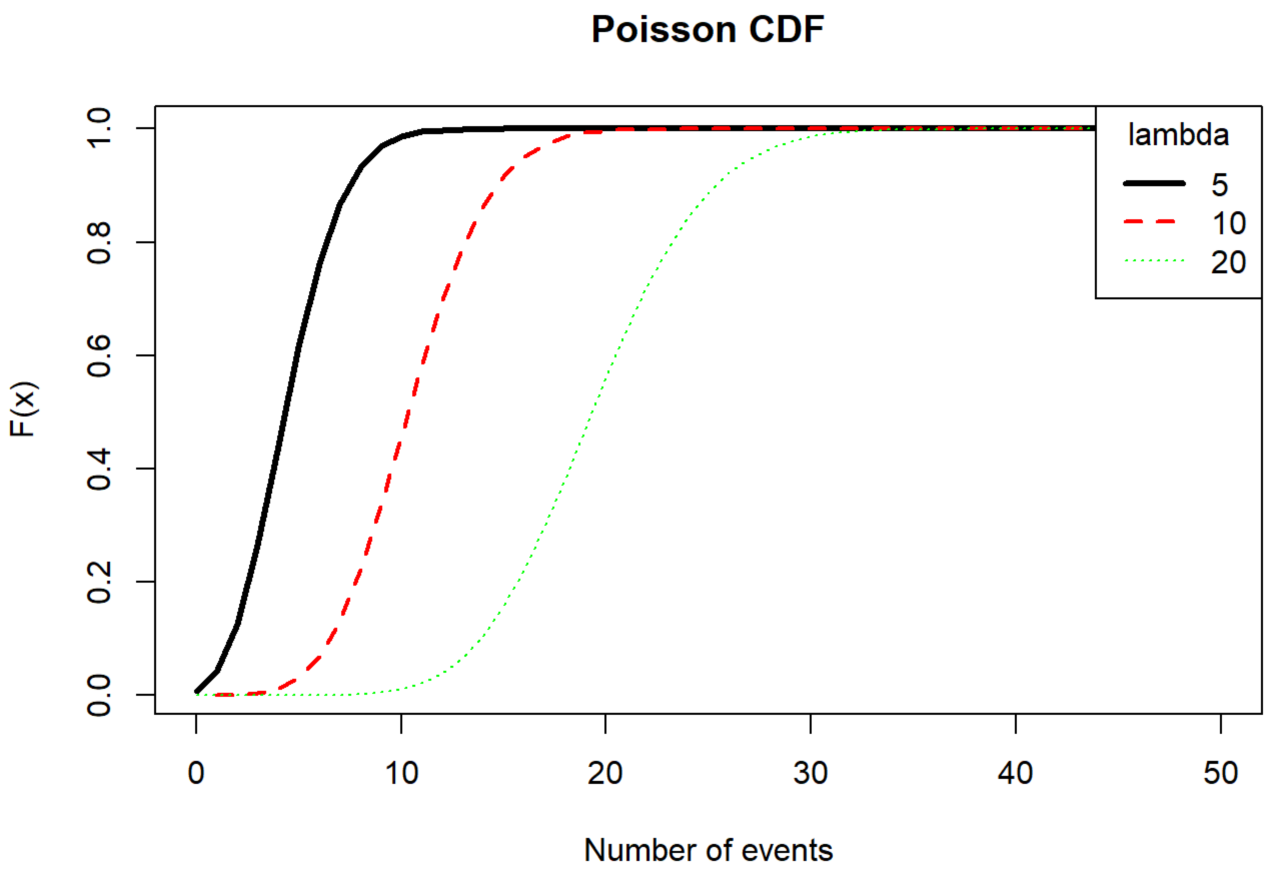
```r
#pbinom

# size = 80, prob = 0.2
plot(pbinom(x, size = 80, prob = 0.2),
     type = "l",
     lty=1,
     lwd = 3,
     main = "Binomial distribution function",
     xlab = "Number of successes",
     ylab = "F(x)",
     col="black"
     )

# size = 80, prob = 0.3
lines(pbinom(x, size = 80, prob = 0.3),
      type = "l",
      lwd = 2, lty = 2,
      col="red"
      )

# size = 80, prob = 0.4
lines(pbinom(x, size = 80, prob = 0.4),
      type = "l",
      lty=3,
      lwd = 1,
      col = "blue")

# Add a legend
legend("bottomright",
       legend = c("80  0.2", "80  0.3", "80  0.4"),
       title = "size  prob",
       lty=c(1,2,3),
       lwd=c(3,2,1),
       col=c("black","red","blue")
       )
```


Binomial distribution function
F(x)
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Number of successes
size prob
80 0.2
80 0.3
80 0.4

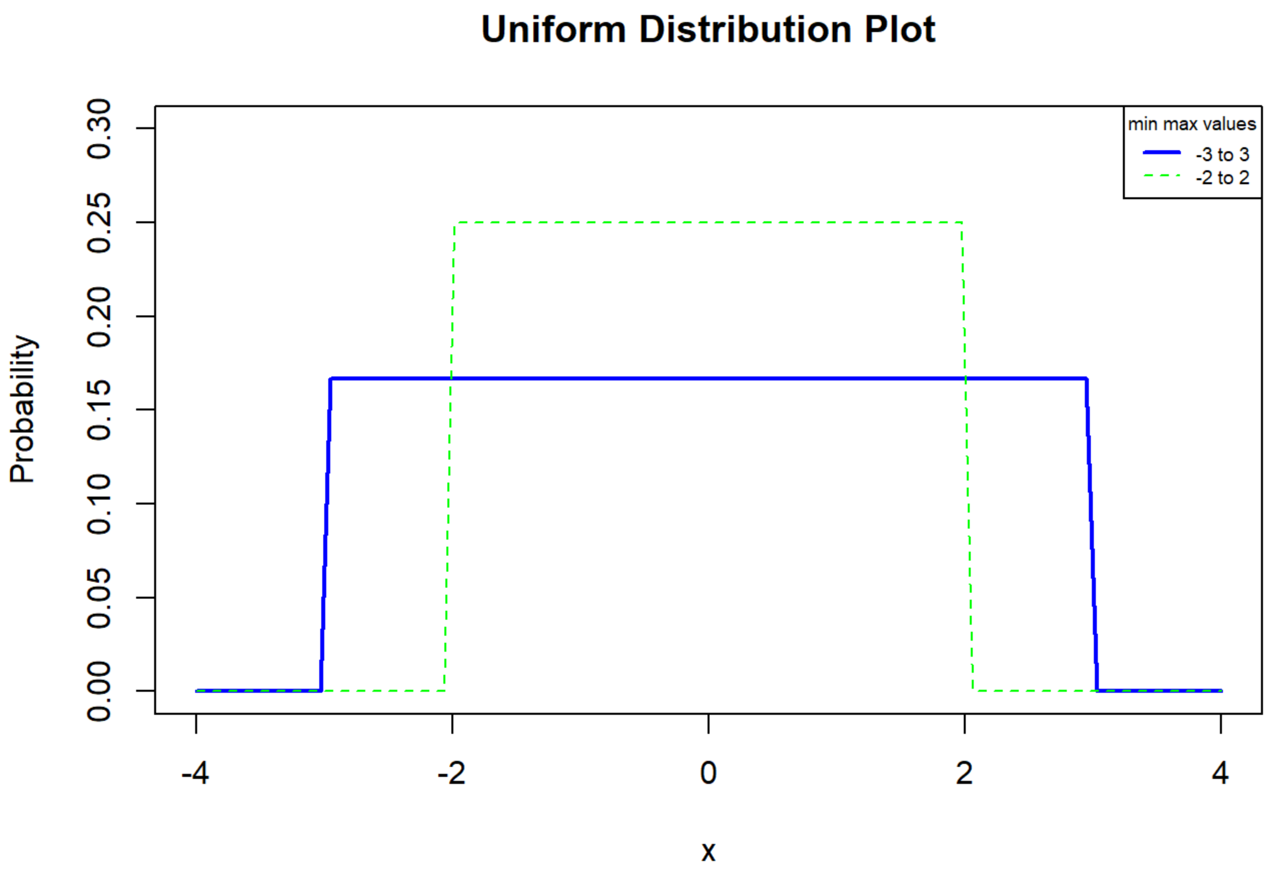
```
#ii. poisson
x=0:50
#using dpois to find pmf
lambda=5
plot(x,dpois(x,lambda),
     type='l',
     main="Poisson Probability Mass Function",
     ylab="P(X=x)",
     xlab=("Number of events"),
     col='black',
     lty=1,
     lwd=3
)
lambda=10
lines(dpois(x,lambda),
      type='l',
      col='red',
      lty=2,
      lwd=2
)
lambda=20
lines(x,dpois(x,lambda),
      type='l',
      col='green',
      lty=3,
      lwd=1
)

legend("topright", legend = c("5","10","20"),
       title="lambda",
       col=c("black","red","green"),
       lty=c(1,2,3),
       lwd=c(3,2,1),
)
```


Poisson Probability Mass Function
lambda
5
10
20
P(X=x)
0.00
0.05
0.10
0.15
0
10
20
30
40
50
Number of events

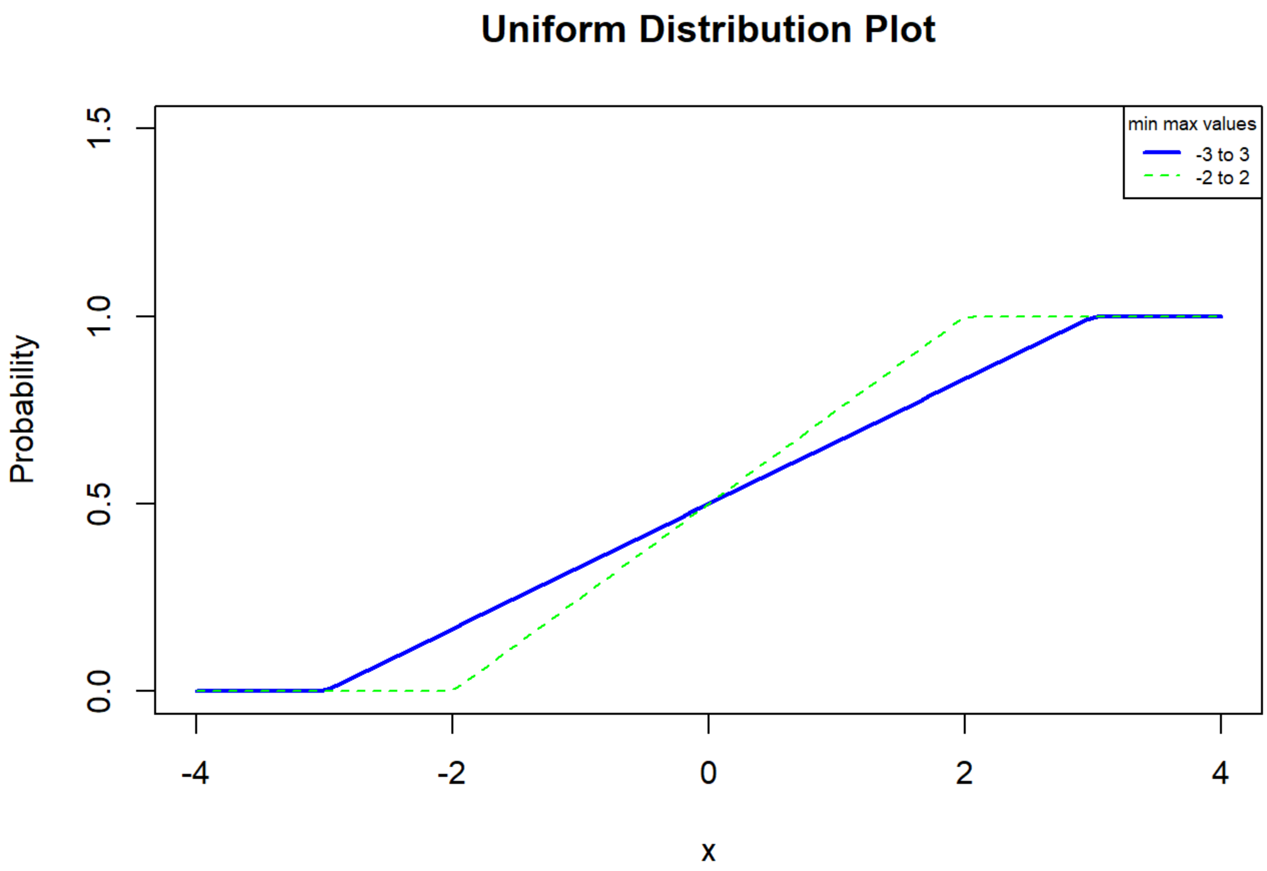
```r
#ppois
lambda=5
plot(x,ppois(x,lambda),
     type='l',
     main="Poisson CDF",
     ylab="F(x)",
     xlab=("Number of events"),
     col='black',
     lty=1,
     lwd=3
)
lambda=10
lines(ppois(x,lambda),
      type='l',
      col='red',
      lty=2,
      lwd=2
)
lambda=20
lines(x,ppois(x,lambda),
      type='l',
      col='green',
      lty=3,
      lwd=1
)

legend("topright", legend = c("5","10","20"),
       title="lambda",
       col=c("black","red","green"),
       lty=c(1,2,3),
       lwd=c(3,2,1),
)
```



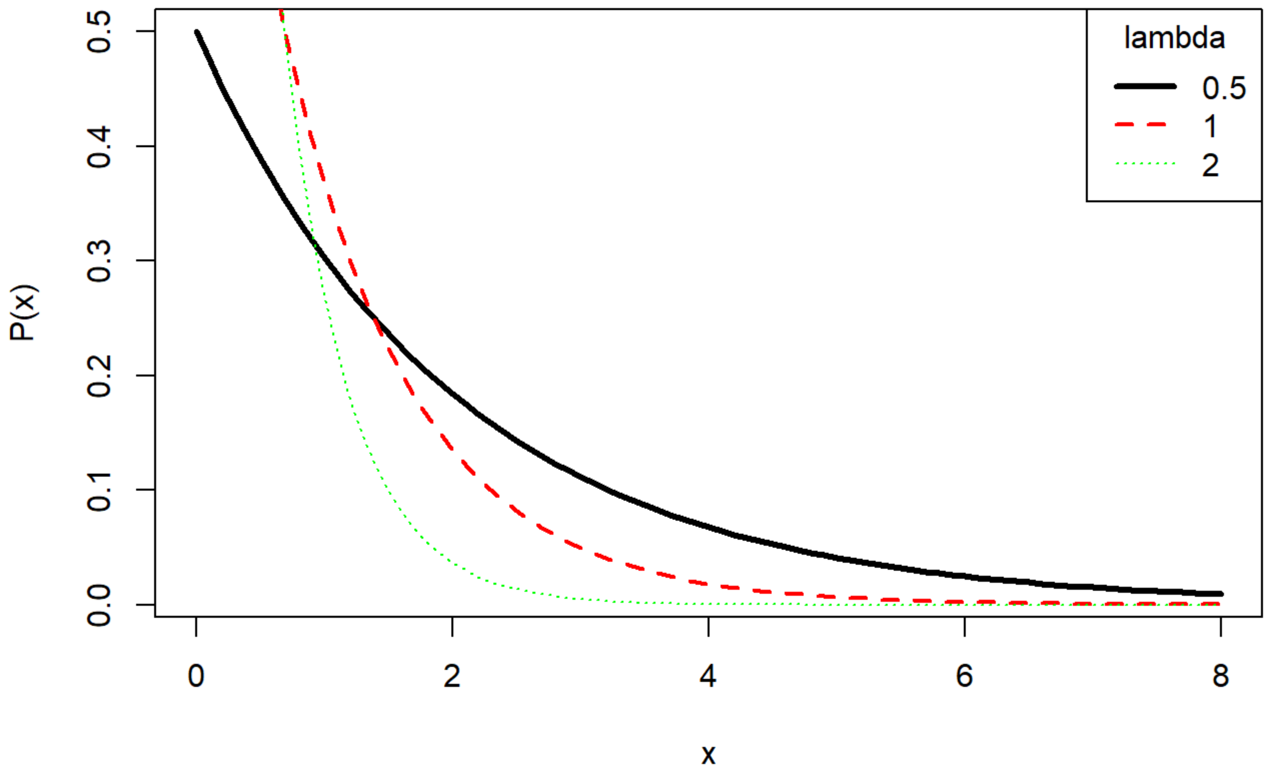
```
#iii. Uniform
x <- seq(-4, 4, length=100)
plot(x, dunif(x,min=-3, max=3),
     type = 'l',
     lty=1,
     lwd = 2,
     ylim = c(0, .3),
     col='blue',
     xlab='x', ylab='Probability', main='Uniform Distribution Plot')
lines(x,dunif(x, min=-2, max=2),
      type='l',
      col='green',
      lty=2,
      lwd=1
)

legend("topright", legend = c("-3 to 3","-2 to 2"),
       title="min max values",
       col=c("blue","green"),
       lty=c(1,2),
       lwd=c(2,1),
       cex=0.6
)
```



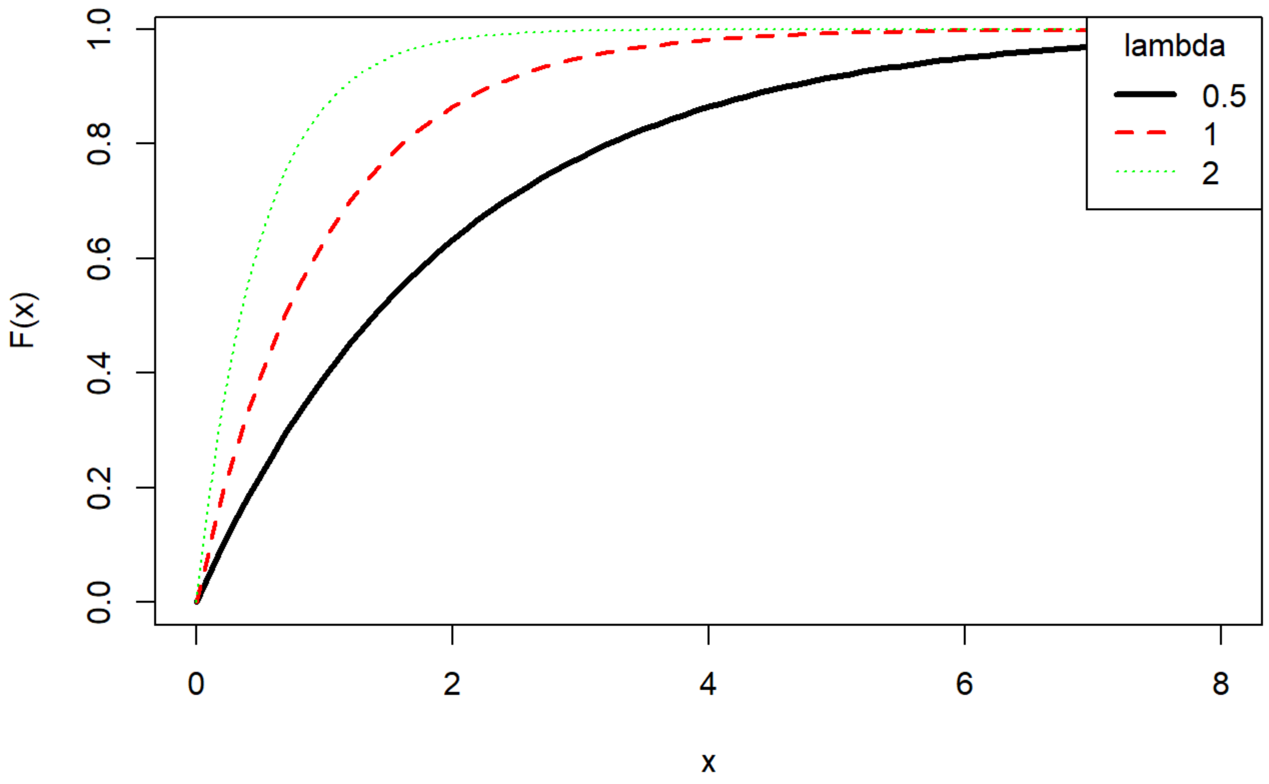
```
#punif
plot(x, punif(x,min=-3, max=3),
     type = 'l',
     lty=1,
     lwd = 2,
     ylim = c(0, 1.5),
     col='blue',
     xlab='x', ylab='Probability', main='Uniform Distribution Plot')
lines(x,punif(x, min=-2, max=2),
      type='l',
      col='green',
      lty=2,
      lwd=1
)

legend("topright", legend = c("-3 to 3","-2 to 2"),
       title="min max values",
       col=c("blue","green"),
       lty=c(1,2),
       lwd=c(2,1),
       cex=0.6
)
```


Uniform Distribution Plot
Probability
0.0
0.5
1.0
1.5
-4
-2
0
2
4
x
min max values
-3 to 3
-2 to 2

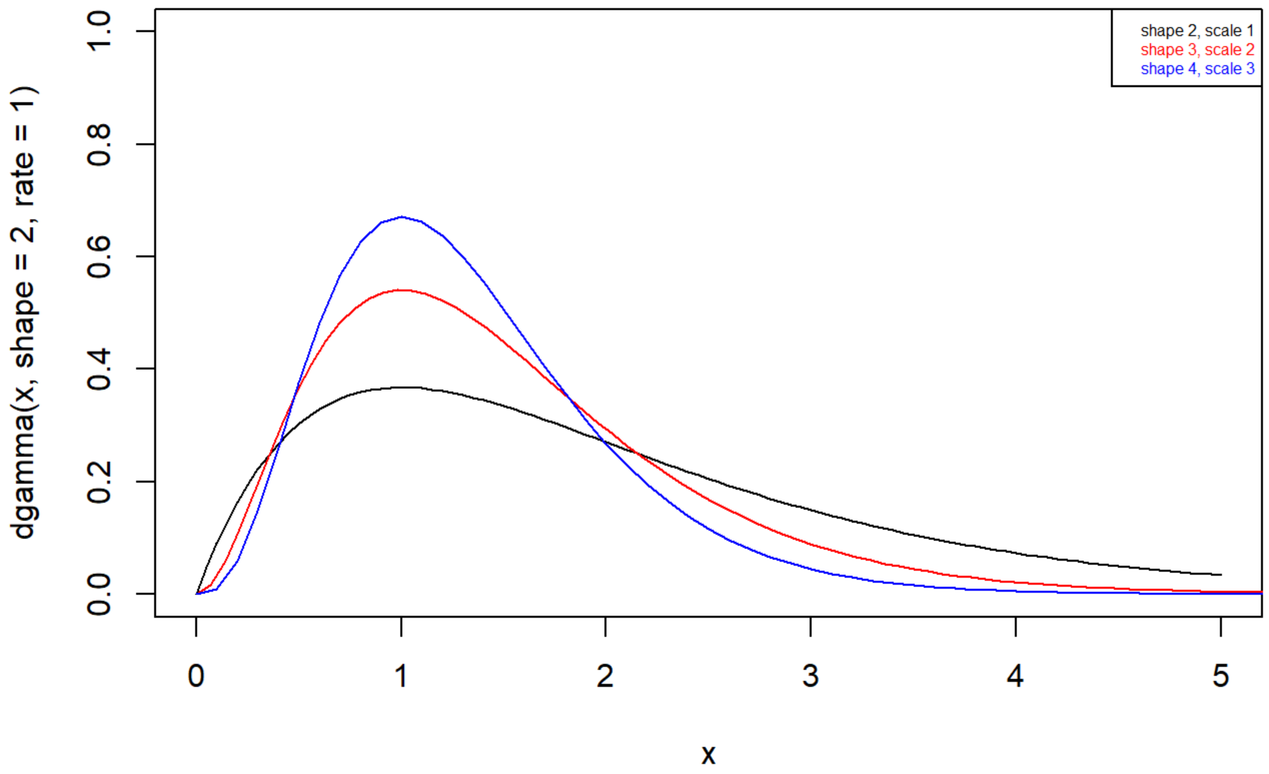
```
#iv. Exponential Function
#dexp
x=seq(0,8,0.1)
lambda=0.5
plot(x,dexp(x,lambda),typ="l",
     ylab="P(x)",
     xlab="x",
     col='black',
     lty=1,
     lwd=3
)
lambda=1
lines(x,dexp(x,lambda),
      type='l',
      col='red',
      lty=2,
      lwd=2
)
lambda=2
lines(x,dexp(x,lambda),
      type='l',
      col='green',
      lty=3,
      lwd=1
)

legend("topright", legend = c("0.5","1","2"),
       title="lambda",
       col=c("black","red","green"),
       lty=c(1,2,3),
       lwd=c(3,2,1),
)
```


lambda
0.5
1
2
P(x)
0.0
0.1
0.2
0.3
0.4
0.5
0
2
4
6
8
x

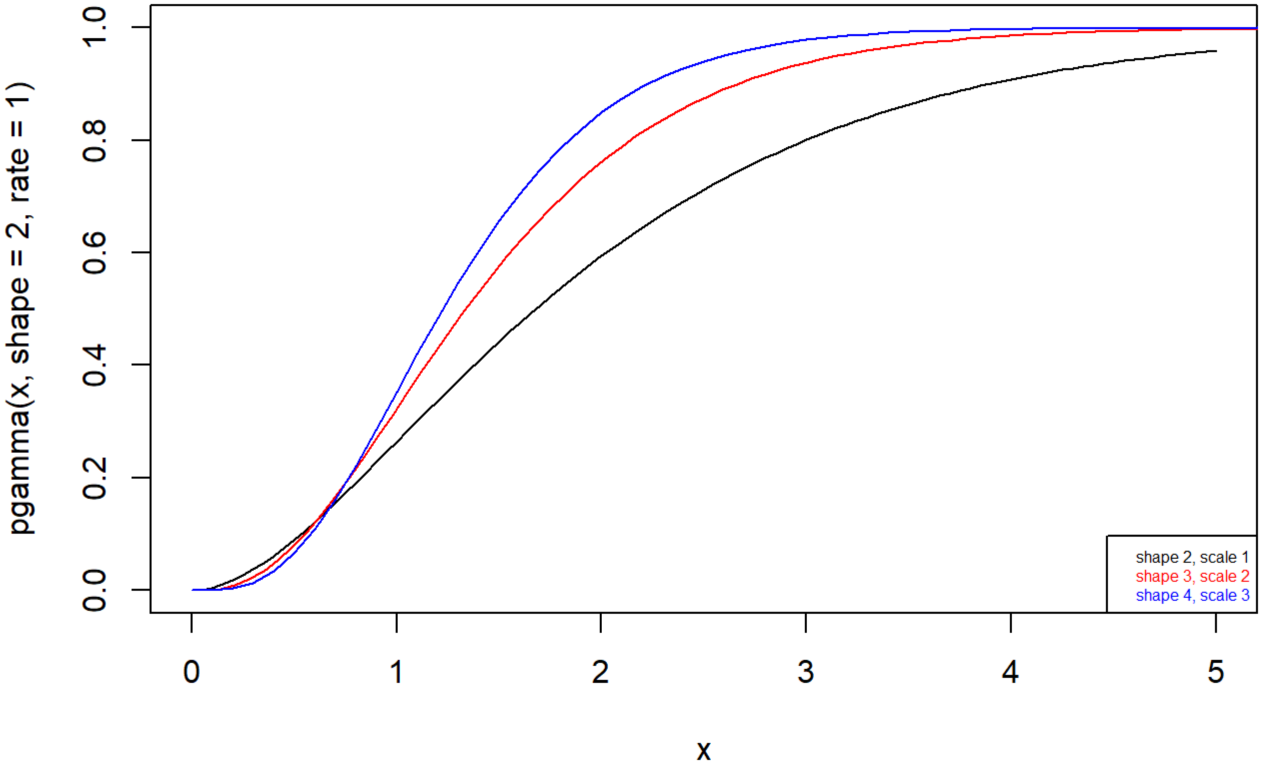
```
#pexp
x=seq(0,8,0.1)
lambda=0.5
plot(x,pexp(x,lambda),typ="l",
     ylab="F(x)",
     xlab="x",
     col='black',
     lty=1,
     lwd=3
)
lambda=1
lines(x,pexp(x,lambda),
      type='l',
      col='red',
      lty=2,
      lwd=2
)
lambda=2
lines(x,pexp(x,lambda),
      type='l',
      col='green',
      lty=3,
      lwd=1
)

legend("topright", legend = c("0.5","1","2"),
       title="lambda",
       col=c("black","red","green"),
       lty=c(1,2,3),
       lwd=c(3,2,1),
)
```



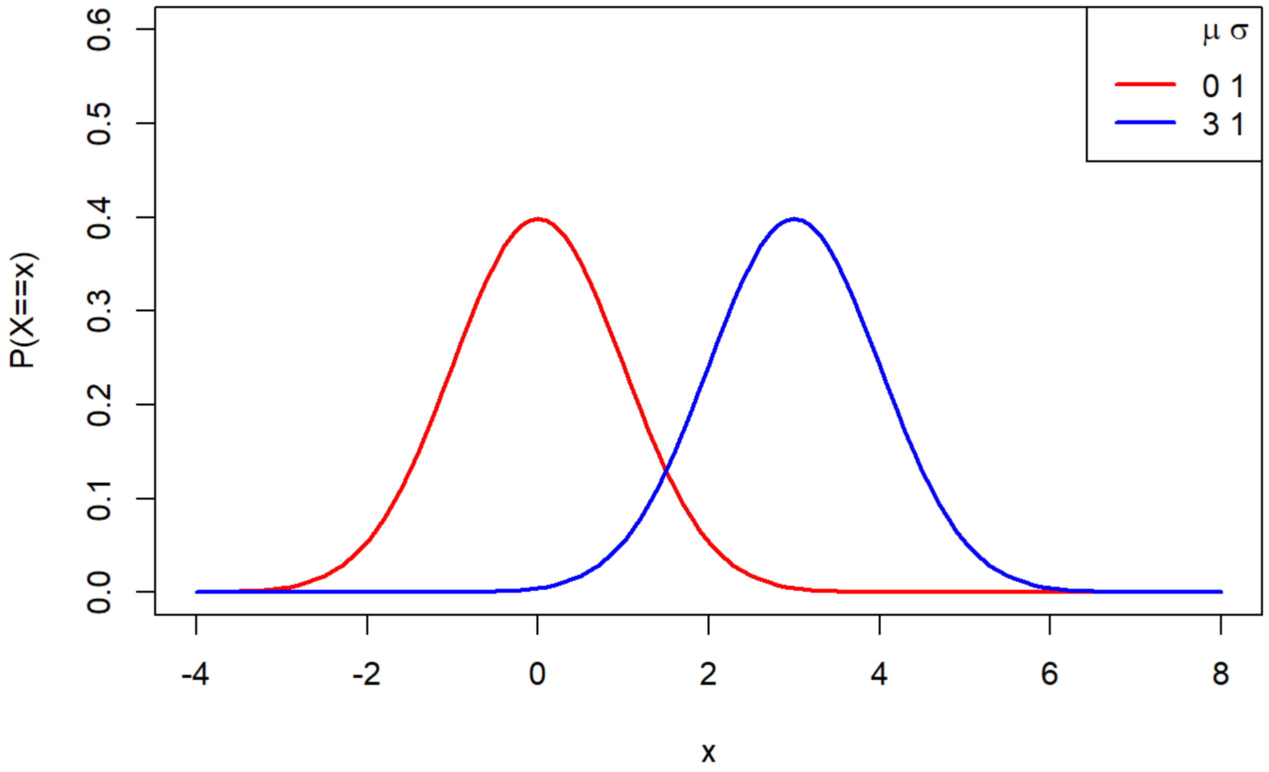
```
#v. gamma function
#dgamma
x=seq(0,2,0.01)
curve(dgamma(x, shape=2, rate=1),
      from=0, to=5,
      ylim=c(0,1),
      col='black')

curve(dgamma(x, shape=3, rate=2),
      from=0, to=7,
      col='red', add=TRUE)

curve(dgamma(x, shape=4, rate=3),
      from=0, to=10,
      col='blue', add=TRUE)
legend("topright",
       legend=c("shape 2, scale 1","shape 3, scale 2","shape 4, scale 3"),
       text.col=c("black","red","blue"),
       cex=0.5
       #for setting the text size
)
```



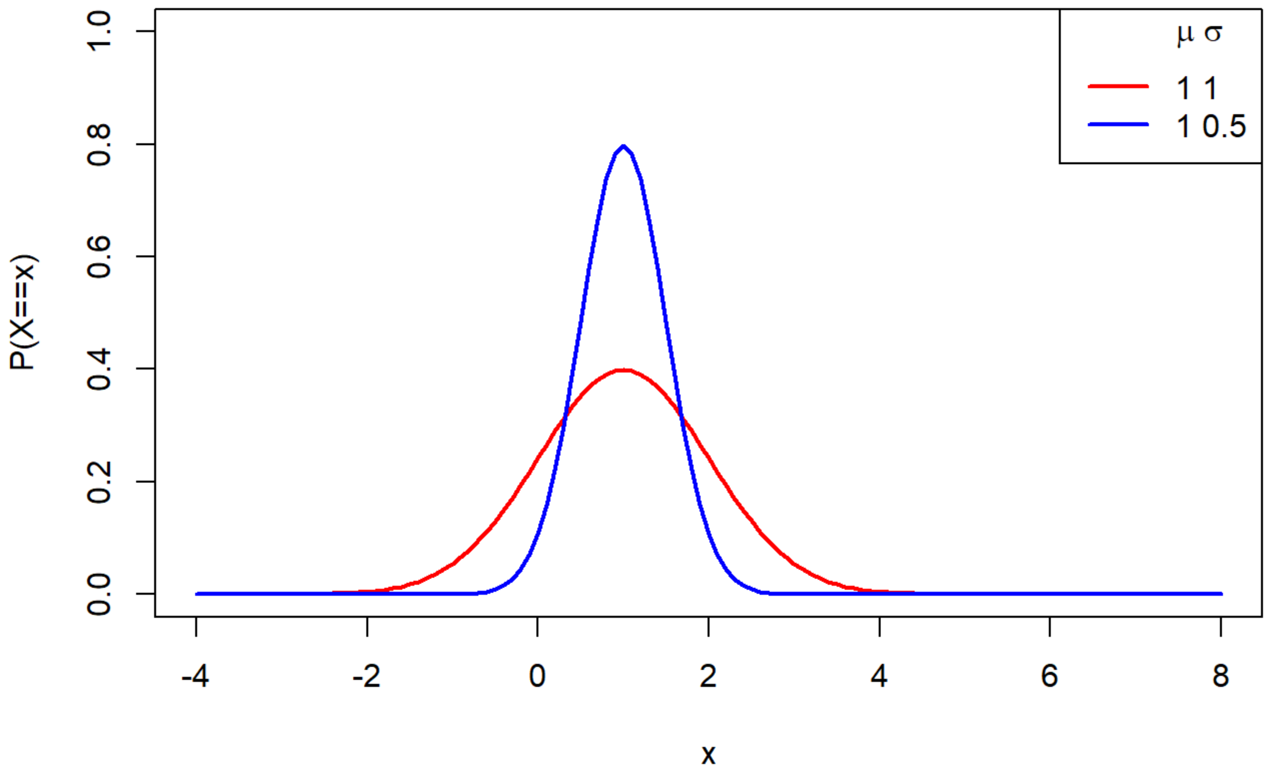
```
#pgamma
x=seq(0,2,0.01)
curve(pgamma(x, shape=2, rate=1),
      from=0, to=5,
      ylim=c(0,1),
      col='black')

curve(pgamma(x, shape=3, rate=2),
      from=0, to=7,
      col='red', add=TRUE)

curve(pgamma(x, shape=4, rate=3),
      from=0, to=10,
      col='blue', add=TRUE)
legend("bottomright",
       legend=c("shape 2, scale 1","shape 3, scale 2","shape 4, scale 3"),
       text.col=c("black","red","blue"),
       cex=0.5
       #for setting the text size
)
```



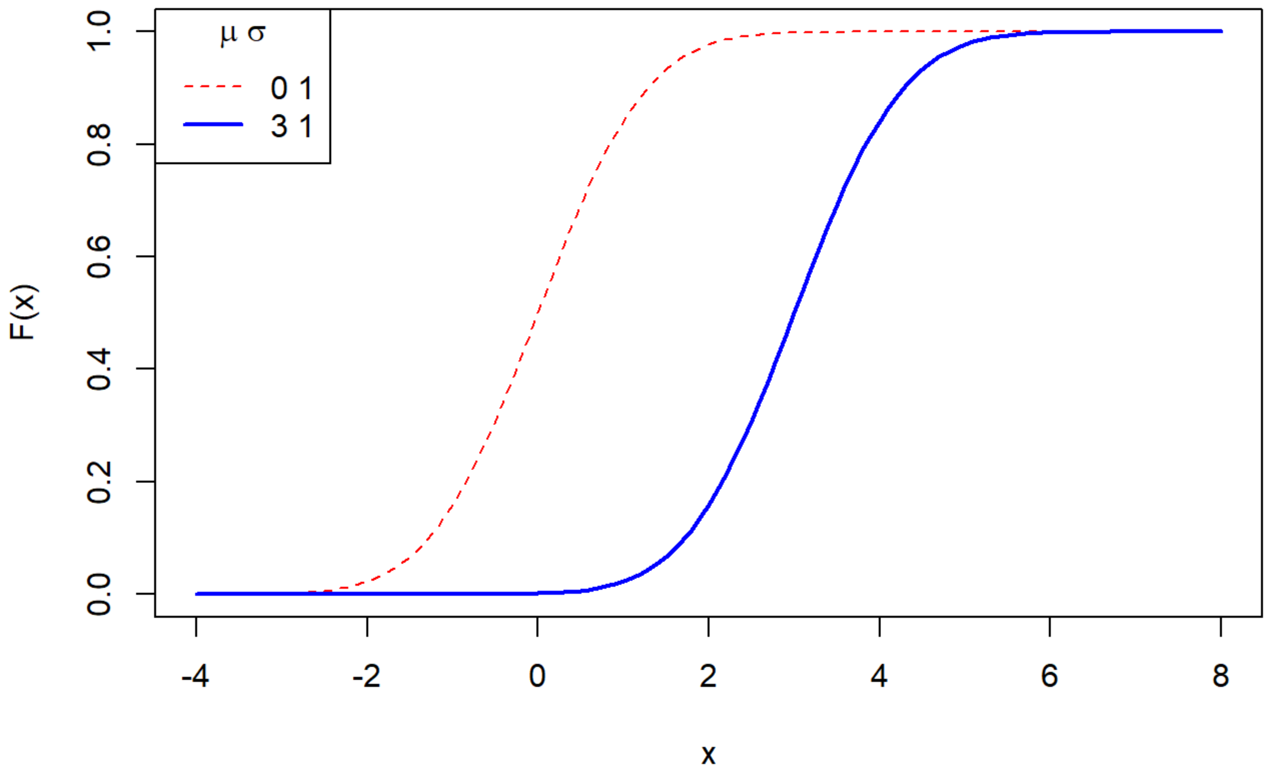
```
#vi. normal distribution
#dnorm
x <- seq(-4, 8, 0.1)

#mean=0, sd=1
plot(x,
     dnorm(x, mean = 0, sd = 1),
     type = "l",
     ylim = c(0, 0.6),
     xlab="x",
     ylab = "P(X==x)",
     lwd = 2,
     col = "red")
#mean=3, sd=1
lines(x,dnorm(x, mean=3, sd=1),
      col="blue",
      lty=1,
      lwd=2
      )
#legend
legend("topright",
       legend = c("0 1", "3 1"),
       col = c("red", "blue"),
       title = expression(paste(mu," ",sigma)),
       title.adj = 0.9, lty = 1, lwd = 2)
```



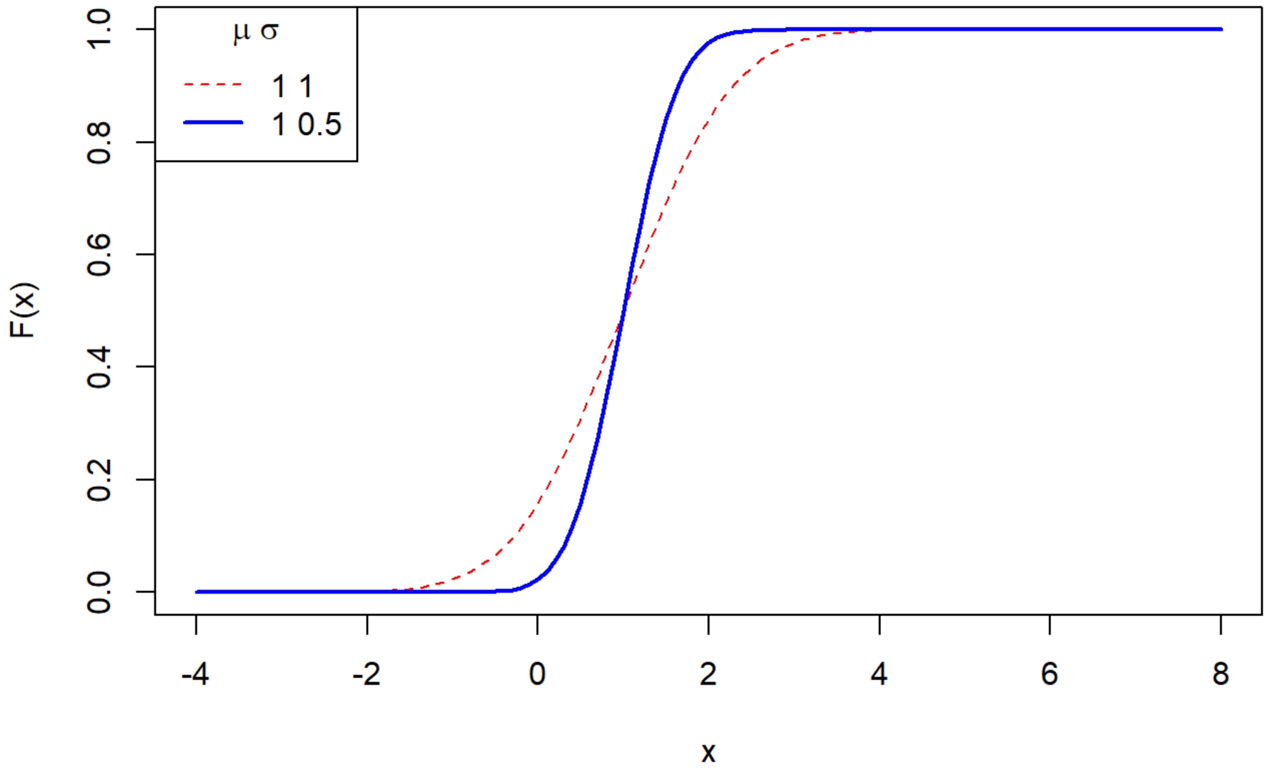
```
#mean same, sd different
# Mean 1, sd 1
plot(x,
     dnorm(x, mean = 1, sd = 1),
     type = "l",
     ylim = c(0, 1),
     ylab = "P(X==x)",
     lwd = 2,
     col = "red")
# Mean 1, sd 0.5
lines(x,
      dnorm(x, mean = 1, sd = 0.5),
      col = "blue",
      lty = 1, lwd = 2)

# Adding a Legend
legend("topright",
       legend = c("1 1", "1 0.5"),
       col = c("red", "blue"),
       title = expression(paste(mu, " ", sigma)),
       title.adj = 0.75,
       lty = 1,
       lwd = 2)
```



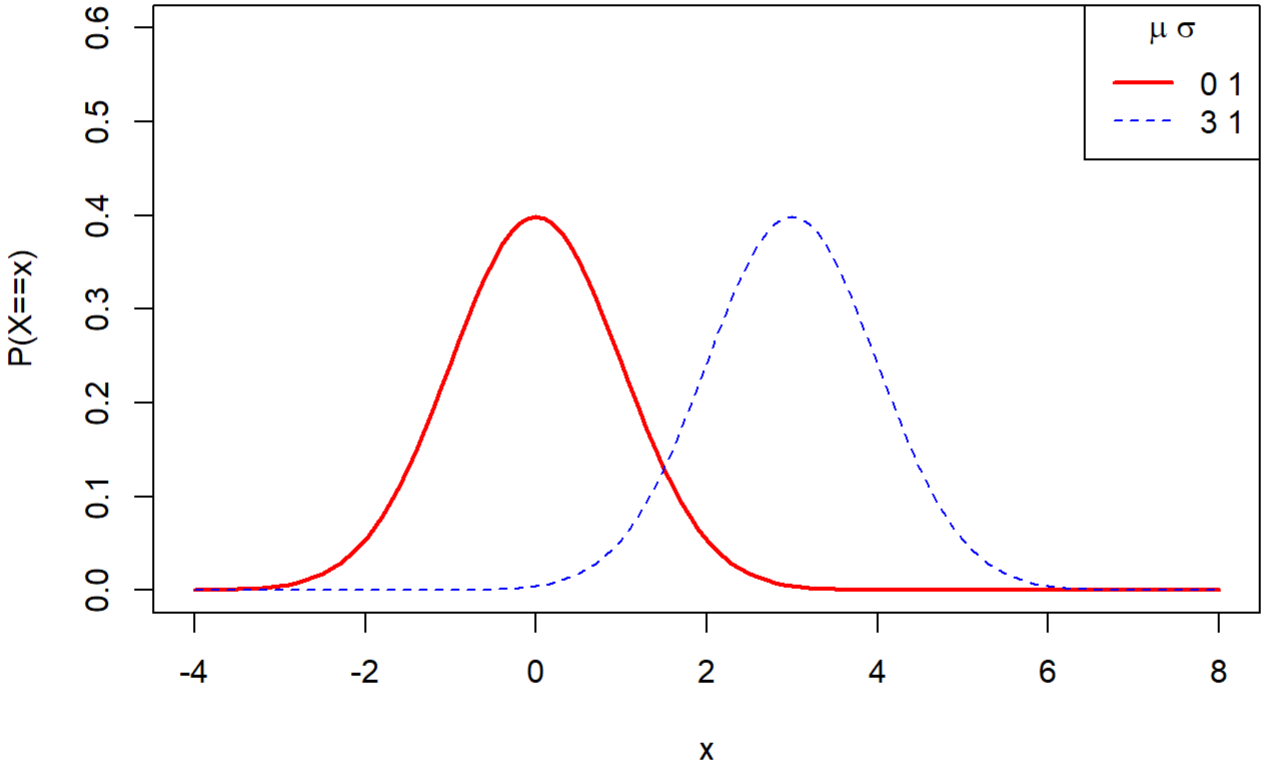
```
#pnorm
# Same sd, different mean
# Mean 0, sd 1
plot(x,
     pnorm(x, mean = 0, sd = 1),
     type = "l",
     ylim = c(0, 1),
     ylab = "F(x)",
     lty=2,
     lwd = 1,
     col = "red")
# Mean 3, sd 1
lines(x,
      pnorm(x, mean = 3, sd = 1),
      col = "blue",
      lty = 1,
      lwd = 2)

# Legend
legend("topleft", legend = c("0 1", "3 1"), col = c("red", "blue"),
       title = expression(paste(mu, " ", sigma)),
       lty = c(2,1), lwd = c(1,2),)
```



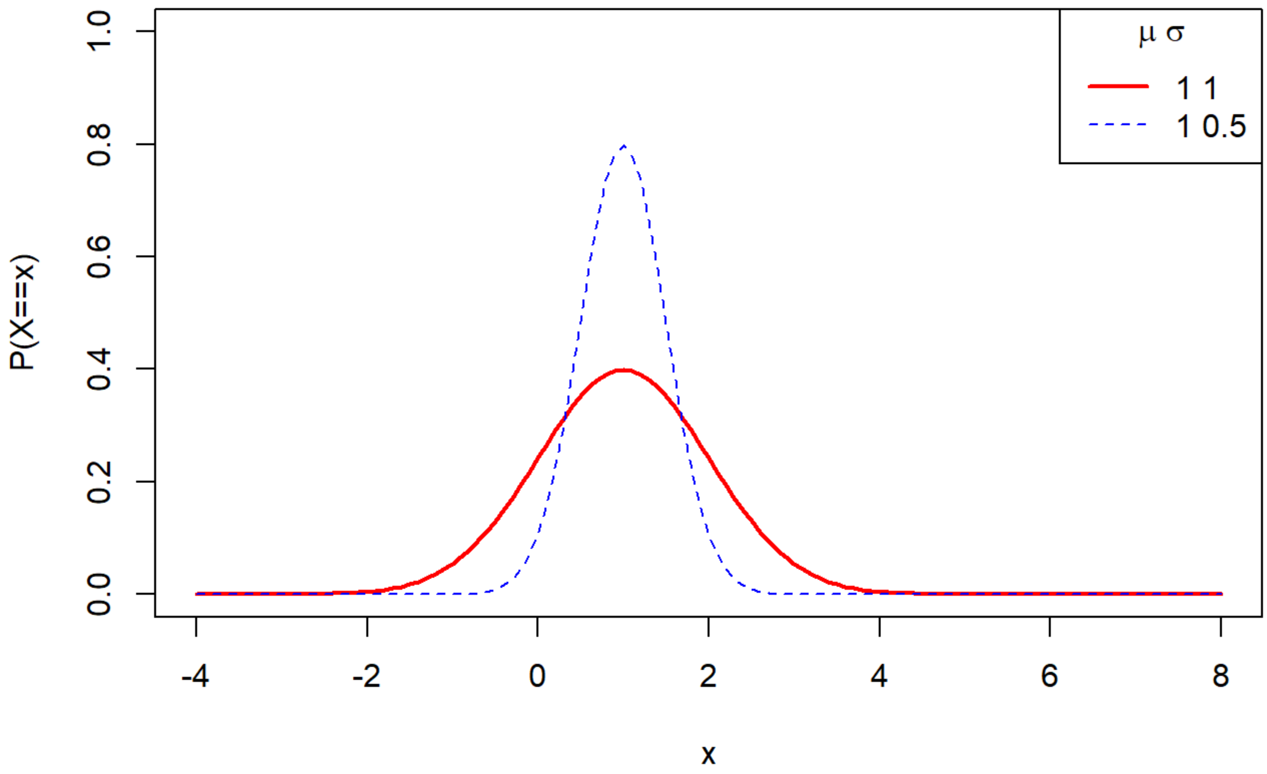
```
# Same mean, different sd
# Mean 1, sd 1
plot(x,
     pnorm(x, mean = 1, sd = 1),
     type = "l",
     ylim = c(0, 1),
     ylab = "F(x)",
     lty=2,
     lwd = 1, col = "red")
# Mean 1, sd 0.5
lines(x,
      pnorm(x, mean = 1, sd = 0.5),
      col = "blue",
      lty = 1, lwd = 2)

# Legend
legend("topleft",
       legend = c("1 1", "1 0.5"),
       col = c("red", "blue"),
       title = expression(paste(mu, " ", sigma)),
       lty=c(2,1),
       lwd=c(1,2)
       )
```



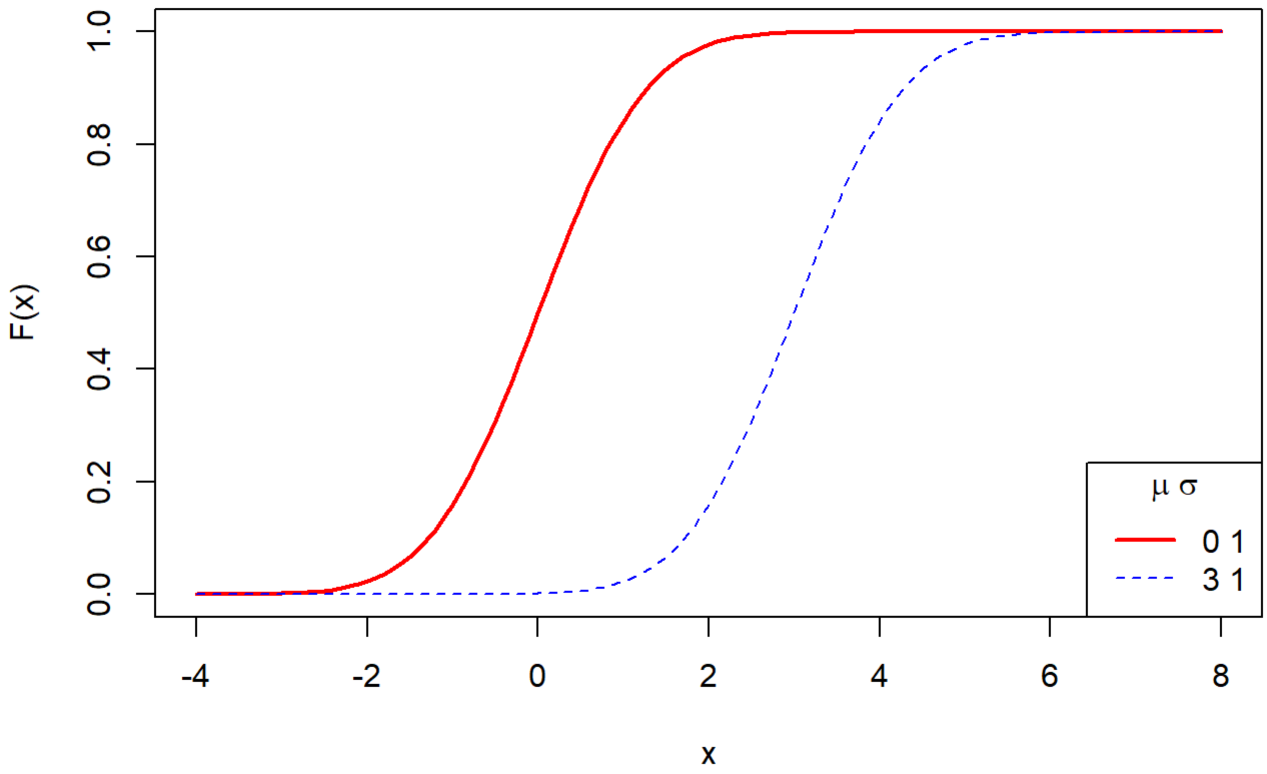
```
#vi. normal distribution
x = seq(-4, 8, 0.1)

# Same sd, different mean
# Mean 0, sd 1
plot(x, dnorm(x, mean = 0, sd = 1),
     type = "l",
     ylim = c(0, 0.6),
     ylab = "P(X==x)",
     lty=1,
     lwd = 2,
     col = "red")
# Mean 3, sd 1
lines(x,
      dnorm(x, mean = 3, sd = 1),
      col = "blue",
      lty = 2, lwd = 1)

# Adding a Legend
legend("topright", legend = c("0 1", "3 1"),
       col = c("red", "blue"),
       title = expression(paste(mu, " ", sigma)),
       lty=c(1,2),
       lwd=c(2,1))
```



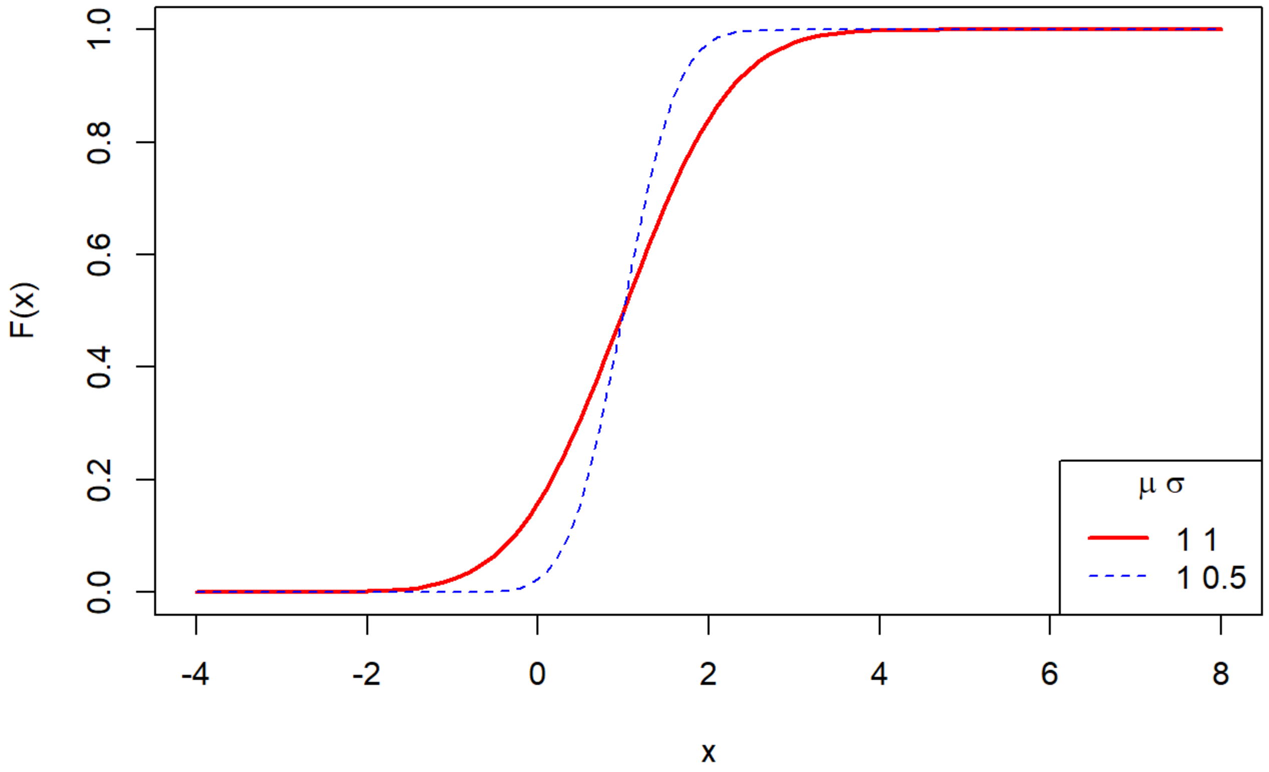
```
# Same mean, different standard deviation
# Mean 1, sd 1
plot(x,
     dnorm(x, mean = 1, sd = 1),
     type = "l",
     ylim = c(0, 1),
     ylab = "P(X==x)",
     lty=1,
     lwd = 2,
     col = "red")
# Mean 1, sd 0.5
lines(x,
      dnorm(x, mean = 1, sd = 0.5),
      col = "blue", lty = 2, lwd = 1)

# Adding a legend
legend("topright",
       legend = c("1 1", "1 0.5"),
       col = c("red", "blue"),
       title = expression(paste(mu, " ", sigma)),
      lty = c(1,2), lwd = c(2,1))
```



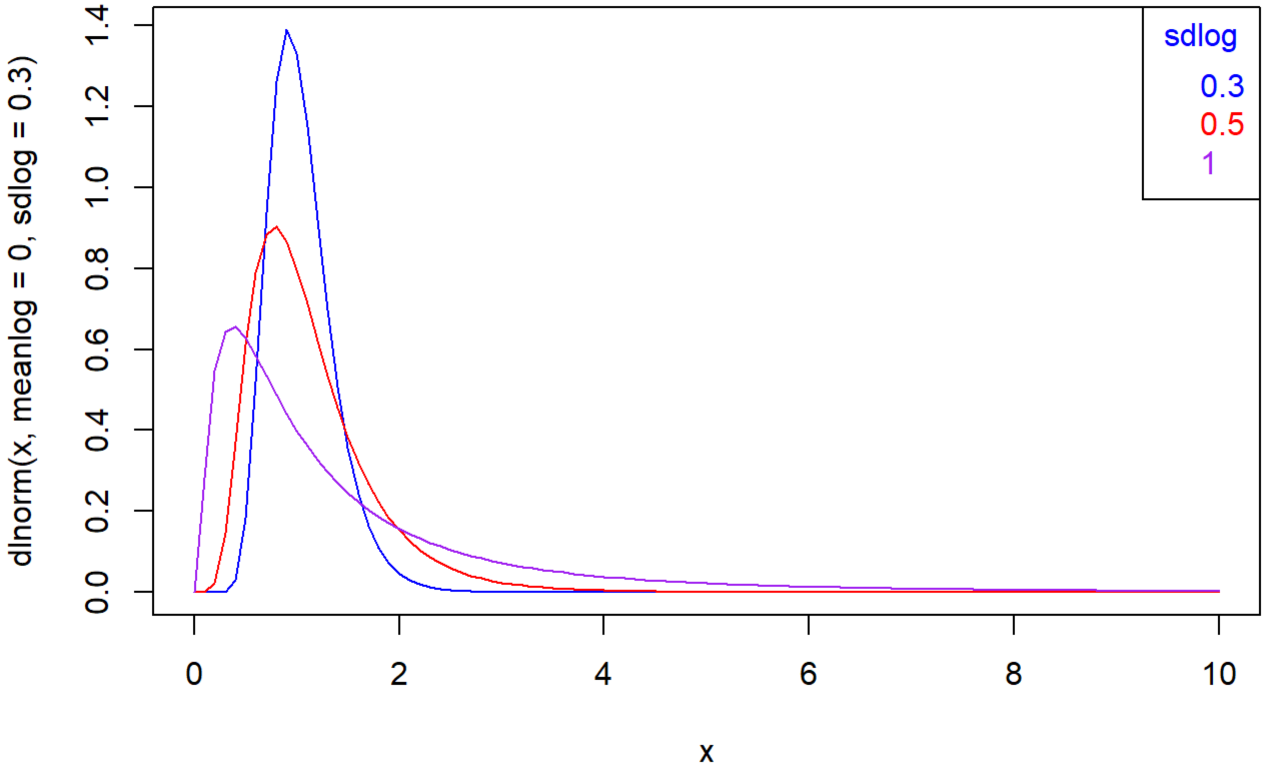
```
#pnorm
# Same sd, different mean
# Mean 0, sd 1
plot(x, pnorm(x, mean = 0, sd = 1),
     type = "l",
     ylim = c(0, 1),
     ylab = "F(x)",
     lty=1,
     lwd = 2,
     col = "red")
# Mean 3, sd 1
lines(x,
      pnorm(x, mean = 3, sd = 1),
      col = "blue",
      lty = 2, lwd = 1)

# Legend
legend("bottomright", legend = c("0 1", "3 1"),
       col = c("red", "blue"),
       title = expression(paste(mu, " ", sigma)),
      lty = c(1,2),
      lwd = c(2,1))
```



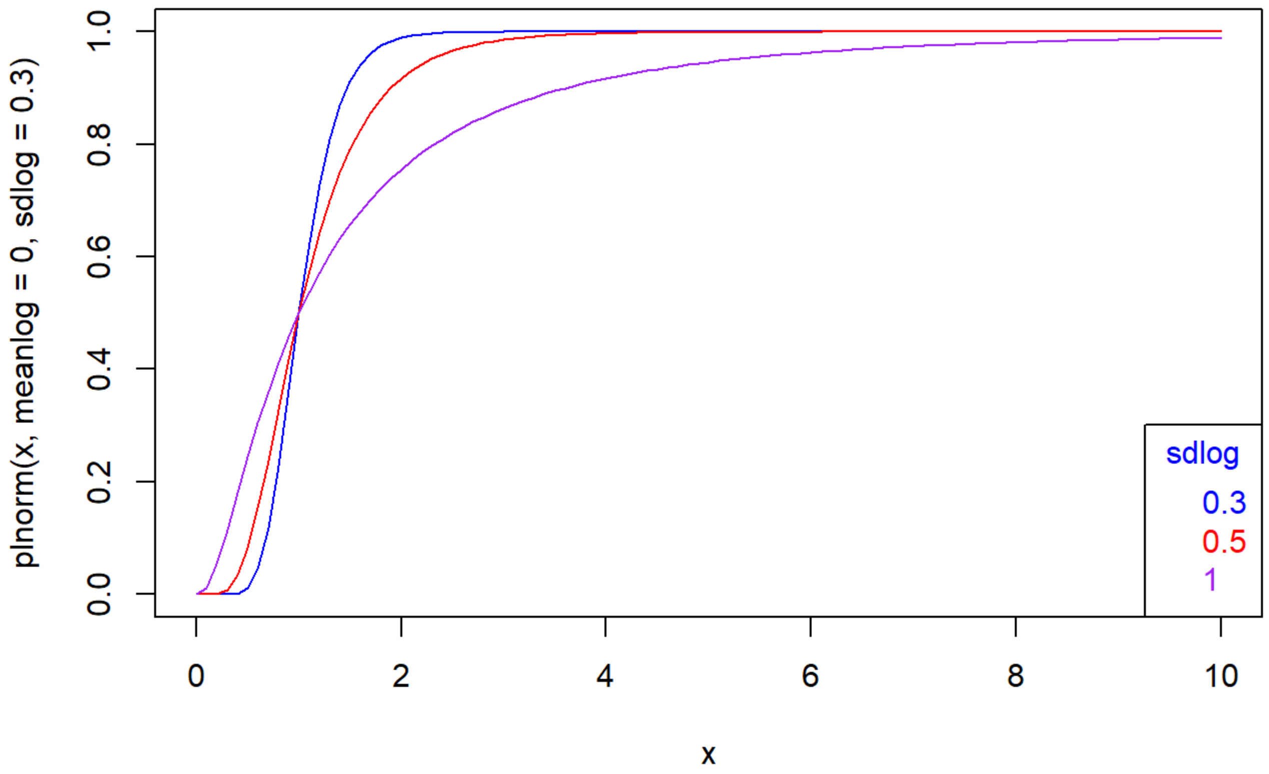
```
# Same mean, different sd
# Mean 1, sd 1
plot(x,
     pnorm(x, mean = 1, sd = 1),
     type = "l",
     ylim = c(0, 1),
     ylab = "F(x)",
     lty=1,
     lwd = 2,
     col = "red")
# Mean 1, sd 0.5
lines(x,
      pnorm(x, mean = 1, sd = 0.5),
      col = "blue",
      lty = 2, lwd = 1)

# Legend
legend("bottomright",
       legend = c("1 1", "1 0.5"),
       col = c("red", "blue"),
       title = expression(paste(mu, " ", sigma)),
      lty=c(1,2),
      lwd=c(2,1))
```



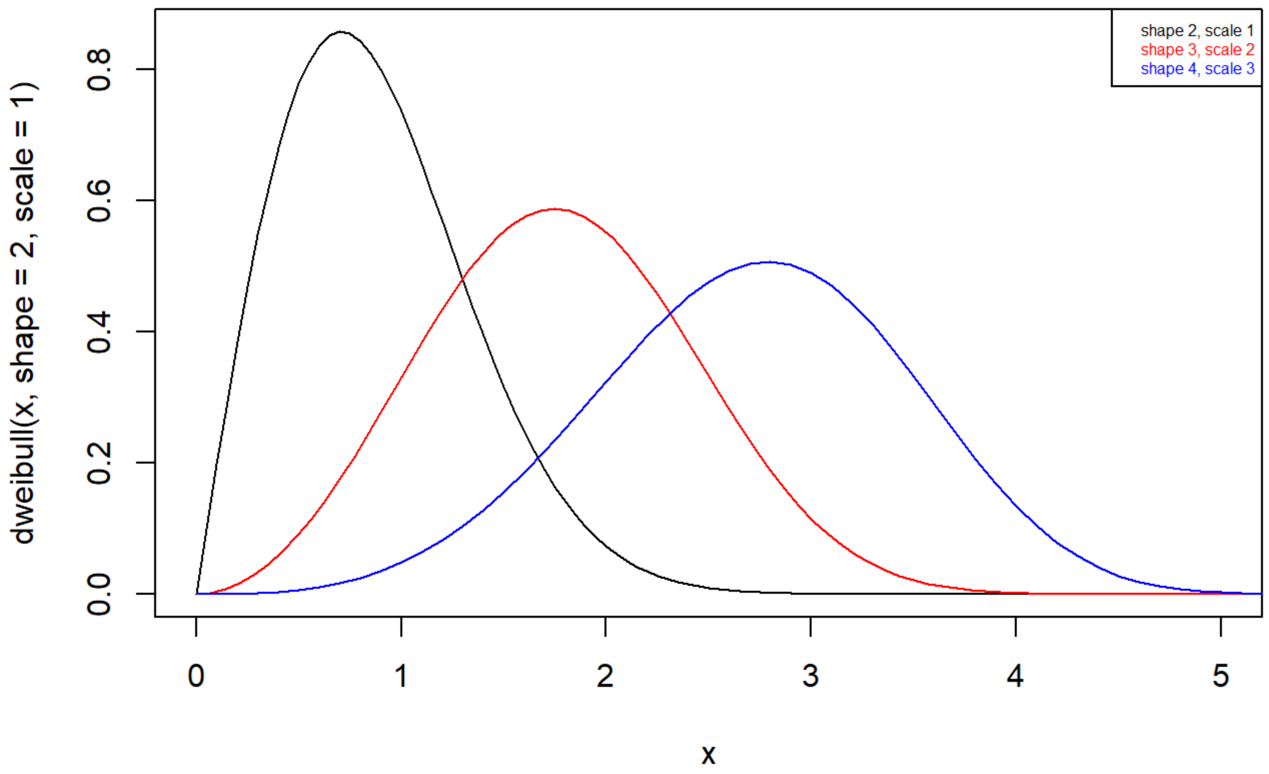
```
#vii. Log-normal distribution
#dlnorm
curve(dlnorm(x, meanlog=0, sdlog=.3),
      from=0, to=10,
      col='blue')
curve(dlnorm(x, meanlog=0, sdlog=.5),
      from=0, to=10,
      col='red', add=TRUE)
curve(dlnorm(x, meanlog=0, sdlog=1),
      from=0, to=10,
      col='purple', add=TRUE)
legend("topright",
       title="sdlog",
       legend=c("0.3","0.5","1"),
       text.col=c("blue","red","purple")
       )
```



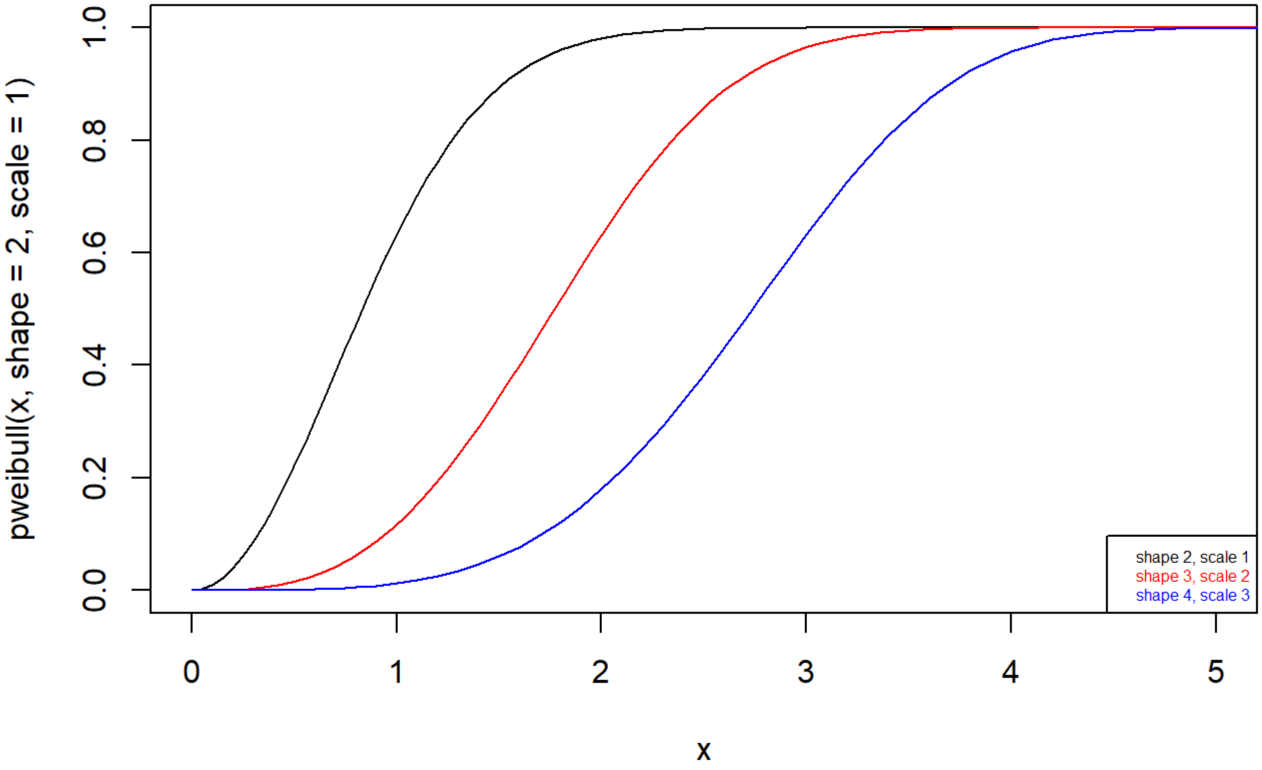
```
#plnorm
curve(plnorm(x, meanlog=0, sdlog=.3),
      from=0, to=10,
      col='blue')
curve(plnorm(x, meanlog=0, sdlog=.5),
      from=0, to=10,
      col='red', add=TRUE)
curve(plnorm(x, meanlog=0, sdlog=1),
      from=0, to=10,
      col='purple', add=TRUE)
legend("bottomright",
       title="sdlog",
       legend=c("0.3","0.5","1"),
       text.col=c("blue","red","purple")
)
```



```
#viii Weibull distribution
#dweibull
curve(dweibull(x, shape=2, scale=1),
      from=0, to=5,
      col='black')

curve(dweibull(x, shape=3, scale=2),
      from=0, to=7,
      col='red', add=TRUE)

curve(dweibull(x, shape=4, scale=3),
      from=0, to=10,
      col='blue', add=TRUE)

legend("topright",
       legend=c("shape 2, scale 1","shape 3, scale 2","shape 4, scale 3"),
       text.col=c("black","red","blue"),
       cex=0.5
       #for setting the text size
       )
```



```
#pweibull
curve(pweibull(x, shape=2, scale=1),
      from=0, to=5,
      col='black')

curve(pweibull(x, shape=3, scale=2),
      from=0, to=7,
      col='red', add=TRUE)

curve(pweibull(x, shape=4, scale=3),
      from=0, to=10,
      col='blue', add=TRUE)
legend("bottomright",
       legend=c("shape 2, scale 1","shape 3, scale 2","shape 4, scale 3"),
       text.col=c("black","red","blue"),
       cex=0.5
       #for setting the text size
)
```


pweibull(x, shape = 2, scale = 1)
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
x
shape 2, scale 1
shape 3, scale 2
shape 4, scale 3