Cargar un archivo

getwd()

Despliega el directorio actual de trabajo

```
> getwd()
[1] "C:/Users/marze/OneDrive/Documentos"
```

setwd()

asigna el directorio actual de trabajo

```
> setwd("E:/clases2021_2/ECD/code")
> getwd()
[1] "E:/clases2021_2/ECD/code"
>
```

ls()

Lista las variables en el workspace

```
> ls()
 [1] "a"      "b"      "c"      "datos"  "food"
 [6] "mdat"   "mdatb"  "mydata" "paso"   "surtido"
[11] "title"  "week1"  "week2"  "week3"  "x"
[16] "xlist"
>
```

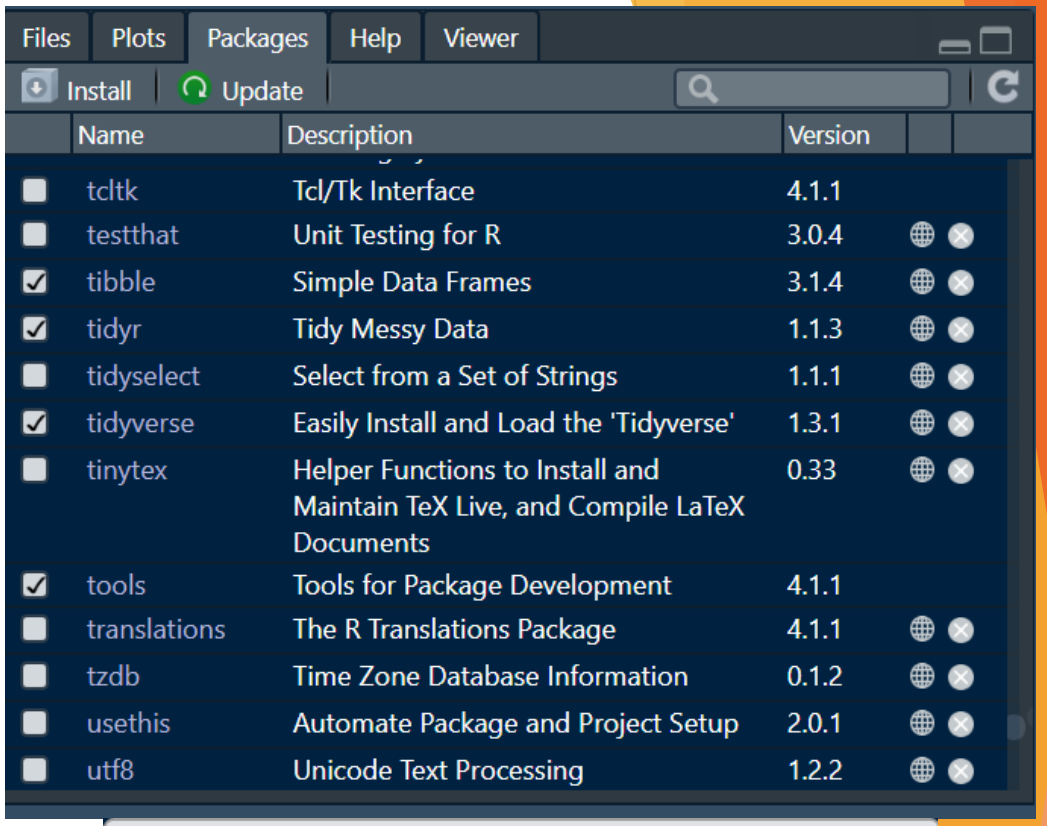
Packages

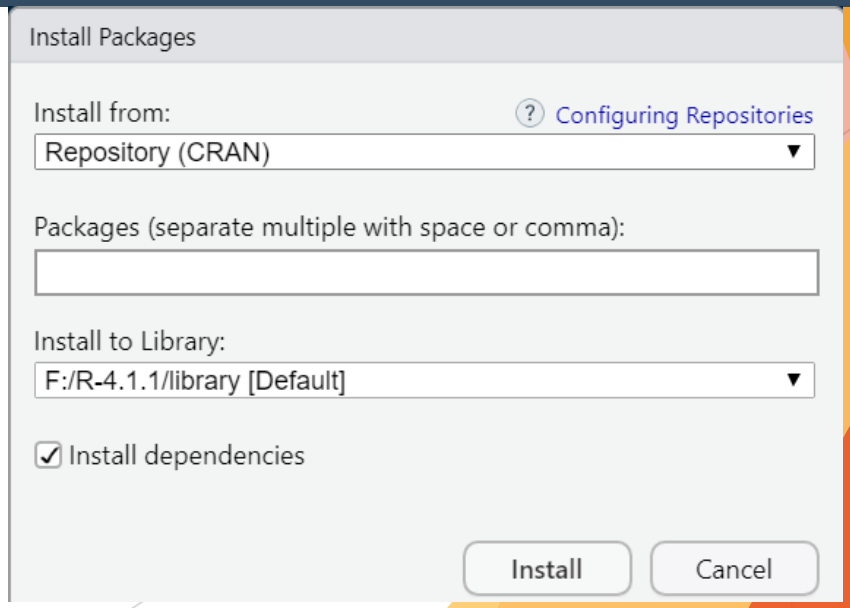
install.packages()

```
>
> install.packages("tidyverse")
```

library()

```
>
> library(tidyverse)
```





Data files

read.table()

```
>
> mydata=read.table("demographics.csv",sep=',',header=TRUE,stri
ngsAsFactors = FALSE)
>
```

filename
sep
header
stringAsFactors

read.csv()

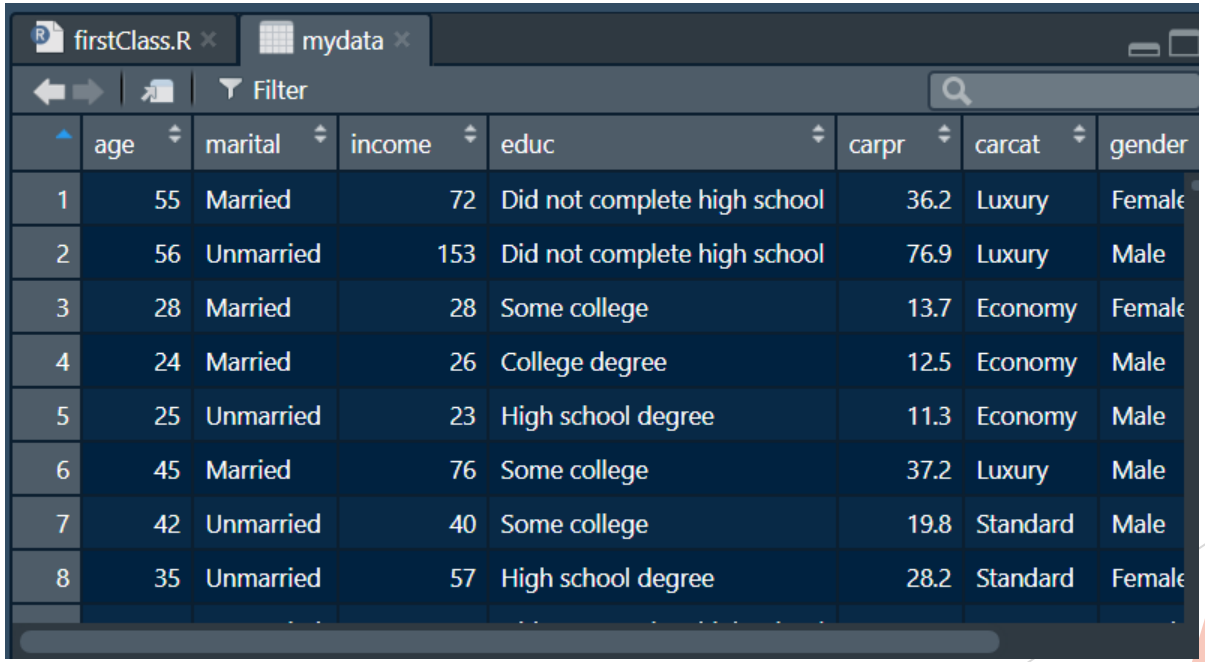
Lee un archivos

mydata<-read.csv("demographics.csv")

Display data

view()

```
>
> view(mydata)
>
```



firstClass.R | mydata

Filter

	age	marital	income	educ	carpr	carcat	gender
1	55	Married	72	Did not complete high school	36.2	Luxury	Female
2	56	Unmarried	153	Did not complete high school	76.9	Luxury	Male
3	28	Married	28	Some college	13.7	Economy	Female
4	24	Married	26	College degree	12.5	Economy	Male
5	25	Unmarried	23	High school degree	11.3	Economy	Male
6	45	Married	76	Some college	37.2	Luxury	Male
7	42	Unmarried	40	Some college	19.8	Standard	Male
8	35	Unmarried	57	High school degree	28.2	Standard	Female

str()

```
> str(mydata)
'data.frame':   510 obs. of  8 variables:
 $ age    : int  55 56 28 24 25 45 42 35 46 34 ...
 $ marital: chr  "Married" "Unmarried" "Married" "Married" ...
 $ income : int  72 153 28 26 23 76 40 57 24 89 ...
 $ educ   : chr  "Did not complete high school" "Did not complete
 high school" "Some college" "College degree" ...
 $ carpr  : num  36.2 76.9 13.7 12.5 11.3 37.2 19.8 28.2 12.2 46.1
 ...
 $ carcat : chr  "Luxury" "Luxury" "Economy" "Economy" ...
 $ gender : chr  "Female" "Male" "Female" "Male" ...
 $ retired: chr  "No" "No" "No" "No" ...
>
```

names()

```
> names(mydata)
[1] "age"     "marital" "income"  "educ"    "carpr"
[6] "carcat"  "gender"  "retired"
>
```

stringAsFactors=TRUE

```
> str(mydata)
'data.frame':   510 obs. of  8 variables:
 $ age    : int  55 56 28 24 25 45 42 35 46 34 ...
 $ marital: Factor w/ 2 levels "Married","Unmarried": 1 2 1 1 2
 1 2 2 2 1 ...
 $ income : int  72 153 28 26 23 76 40 57 24 89 ...
 $ educ   : Factor w/ 5 levels "College degree",..: 2 2 5 1 3 5
 5 3 2 5 ...
 $ carpr  : num  36.2 76.9 13.7 12.5 11.3 37.2 19.8 28.2 12.2 4
6.1 ...
 $ carcat : Factor w/ 3 levels "Economy","Luxury",..: 2 2 1 1 1
 2 3 3 1 2 ...
 $ gender : Factor w/ 2 levels "Female","Male": 1 2 1 2 2 2 2 1
 1 2 ...
 $ retired: Factor w/ 2 levels "No","Yes": 1 1 1 1 1 1 1 1 1 1
 ...
>
```

head()	Muestra los primeros 6 renglones
tail()	Muestra los últimos 6 renglones
dim()	Muestra la dimensión del data frame
nrow()	Numero de renglones
ncol()	Numero de columnas
str()	Estructura del data frame
names() / colnames	Nombres de cada columna
rownames	Nombres de los renglones

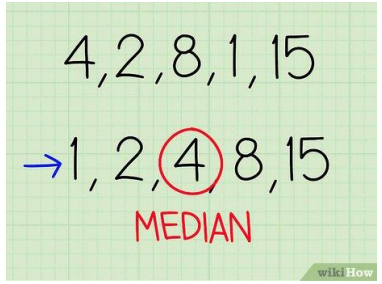
summary()

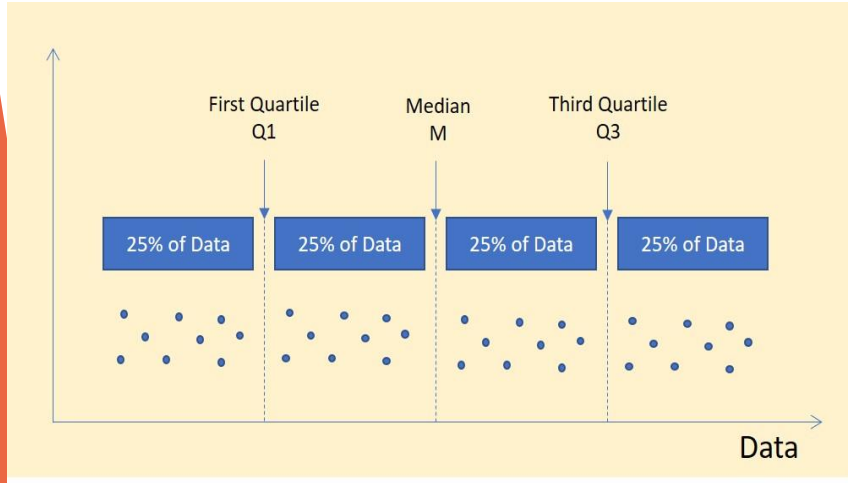
```
> summary(mydata)
      age              marital         income
 Min.   :18.00   Married  :254   Min.   :   9.00
 1st Qu.:32.00   Unmarried:256   1st Qu.:  28.00
 Median :41.00                   Median :  45.00
 Mean   :42.06                   Mean   :  78.59
 3rd Qu.:51.00                   3rd Qu.:  86.00
 Max.   :73.00                   Max.   :1116.00
                            educ          carpr
 College degree                :113   Min.   : 4.40
 Did not complete high school:125   1st Qu.:13.82
 High school degree            :132   Median :22.20
 Post-undergraduate degree     : 27   Mean   :30.84
 Some college                  :113   3rd Qu.:42.42
                                      Max.   :98.60
      carcat        gender    retired
 Economy :147   Female:250   No :485
 Luxury  :190   Male  :260   Yes: 25
 Standard:173
```

summary()

```
> summary(mydata)
      age            marital                income      
 Min.   :18.00   Length:510         Min.   :   9.00  
 1st Qu.:32.00   Class :character   1st Qu.:  28.00  
 Median :41.00   Mode  :character   Median :  45.00  
 Mean   :42.06                      Mean   :  78.59  
 3rd Qu.:51.00                      3rd Qu.:  86.00  
 Max.   :73.00                      Max.   :1116.00  
     educ            carpr           carcat         
 Length:510         Min.   : 4.40   Length:510        
 Class :character   1st Qu.:13.82   Class :character  
 Mode  :character   Median :22.20   Mode  :character  
                    Mean   :30.84                     
                    3rd Qu.:42.42                     
                    Max.   :98.60                     
   gender             retired         
 Length:510         Length:510        
 Class :character   Class :character  
 Mode  :character   Mode  :character
```

$$\overline{x} = \frac{\sum_{i=1}^{N} x_i}{N}$$





mean(x)

median(x)

1st quartile

3rd quartile

min(x)

max(x)

```
> mydata2=as.data.frame(starwars,stringAsFactors=TRUE)
> mydata2=mydata2[-c(12:14)]
> str(mydata2)
'data.frame':   87 obs. of  11 variables:
 $ name      : chr  "Luke Skywalker" "C-3PO" "R2-D2" "Darth Vad
er" ...
 $ height    : int  172 167 96 202 150 178 165 97 183 182 ...
 $ mass      : num  77 75 32 136 49 120 75 32 84 77 ...
 $ hair_color: chr  "blond" NA NA "none" ...
 $ skin_color: chr  "fair" "gold" "white, blue" "white" ...
 $ eye_color : chr  "blue" "yellow" "red" "yellow" ...
 $ birth_year: num  19 112 33 41.9 19 52 47 NA 24 57 ...
 $ sex       : chr  "male" "none" "none" "male" ...
 $ gender    : chr  "masculine" "masculine" "masculine" "mascul
ine" ...
 $ homeworld : chr  "Tatooine" "Tatooine" "Naboo" "Tatooine"
 ...
 $ species   : chr  "Human" "Droid" "Droid" "Human" ...
>
```

Slicing and selecting data

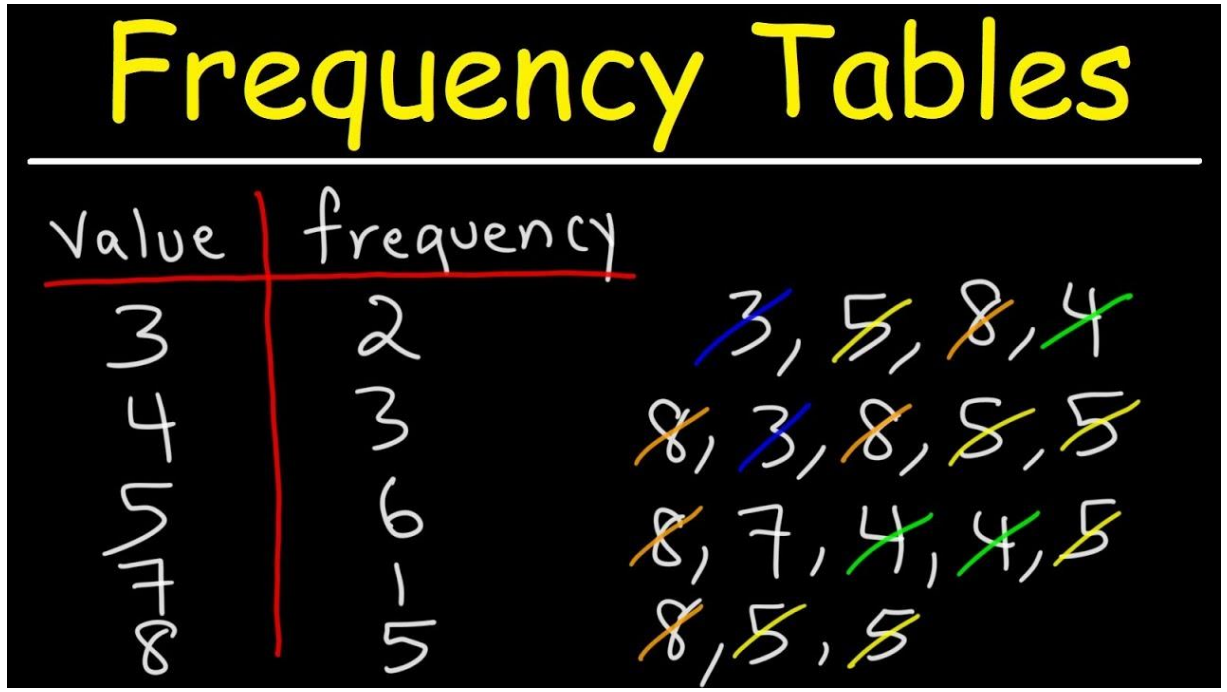
`dat[1, 3]`	Accesar a un elemento
`dat[["y"]]`	Accesar a una columna
`dat$y`	Accesar a una columna

head()	Muestra los primeros 6 renglones
tail()	Muestra los últimos 6 renglones
dim()	Muestra la dimensión del data frame
nrow()	Numero de renglones
ncol()	Numero de columnas
str()	Estructura del data frame
names() / colnames	Nombres de cada columna

Basic statistics

Frequency distribution table

Frequency distribution table



frequency distribution table

A data table that lists a set of scores and their frequency.

score	tally	frequency (f)
1	𝍸	4
2	𝍸 𝍸	9
3	𝍸	6
4	𝍸	7
5	𝍸	3
6	𝍸	2

A local convenience store owner records how many customers enter the store each day over a 25-day period. The results are as follows:
20, 21, 23, 21, 26, 24, 20, 24, 25, 22, 22, 23, 21, 24, 21, 26, 24, 22, 21, 23, 25, 22, 21, 24, 21

Are these discrete or continuous variables?
Present these data in a frequency distribution table.
Which result occurs most frequently?

Frequency distribution

The frequency distribution of a data variable is a summary of the data occurrence in a collection of non-overlapping categories.

Frequency distribution table

Barplot

table()

Create a table of the counts at each combination of factor levels.

```
library(MASS)
```

```
> str(painters)
'data.frame':   54 obs. of  5 variables:
 $ Composition: int  10 15 8 12 0 15 8 15 4 17 ...
 $ Drawing    : int  8 16 13 16 15 16 17 16 12 18 ...
 $ Colour     : int  16 4 16 9 8 4 4 7 10 12 ...
 $ Expression : int  3 14 7 8 0 14 8 6 4 18 ...
 $ School     : Factor w/ 8 levels "A","B","C","D",..: 1 1 1 1 1 1
 1 1 1 1 ...
>
```

Categorical data

```
school <- painters$School
schooltable<-table(school)
```

```
> schooltable
school
 A  B  C  D  E  F  G  H
10  6  6 10  7  4  7  4
>
```

Calcula tabla de frecuencia del campo composicion

```
> cbind(schooltable)
  schooltable
A          10
B           6
C           6
D          10
E           7
F           4
G           7
H           4
>
```

```
cbind(schooltable)
```

De que escuela hay más pintores?

De que escuela hay menos pintores?

```
names(schooltable)
```

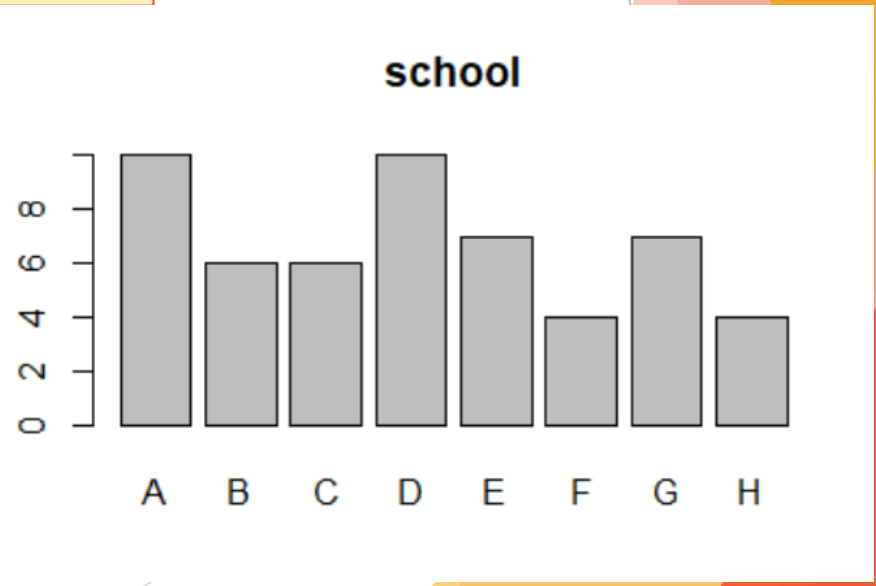
Categorical data

barplot(schooltable)

consists of vertical parallel bars that shows the frequency distribution graphically.

barplot(schooltable, main="school")

```
>
> barplot(schooltable, main="school")
>
```



max(schooltable)

```
> max(schooltable)
[1] 10
>
```

which.max(schooltable)

Return the first maximum in the data

which.max(schooltable)

```
> which.max(schooltable)
A
1
> which.min(schooltable)
F
6
>
```

maxST=max(schooltable)

```
> maxST=max(schooltable)
> maxST
[1] 10
```

Res=(schooltable==maxST)

```
> Res
school
    A     B     C     D     E     F     G     H
 TRUE FALSE FALSE  TRUE FALSE FALSE FALSE FALSE
>
```

Operacion element-wise

Look for a value in the frequency table, return a logical vector

x=schooltable[Res]

```
> x=schooltable[Res]
> x
school
 A  D
10 10
>
```

Select the registers where Res is true

names(x)

```
>
> names(x)
[1] "A" "D"
>
```

Return all the column's names with value equal to the max

Basic statistics

histogram

Quantitative Data / continuous data

frequency distribution of a data variable is a summary of the data occurrence in a collection of non-overlapping categories.

- Select data
- Find range
- Defining a sequence of equal distance for the break points (intervals)
- Divide the data using the intervals
- Compute the frequency in each interval

Range

The range of a data set is the difference of its largest and smallest data values.
It is how much the data spreads.


```
mydata          510 obs. of 8 variables
  $ age    : int  55 56 28 24 25 45 42 35 46 34 ...
  $ marital: Factor w/ 2 levels "Married","Unmarried":
  $ income : int  72 153 28 26 23 76 40 57 24 89 ...
  $ educ   : Factor w/ 5 levels "College degree",..: 2…
  $ carpr  : num  36.2 76.9 13.7 12.5 11.3 37.2 19.8 2…
  $ carcat : Factor w/ 3 levels "Economy","Luxury",..:…
  $ gender : Factor w/ 2 levels "Female","Male": 1 2 1…
  $ retired: Factor w/ 2 levels "No","Yes": 1 1 1 1 1 …
```

```
> salary=mydata$income
> range(salary)
[1]    9 1116
>
```

Create the intervals

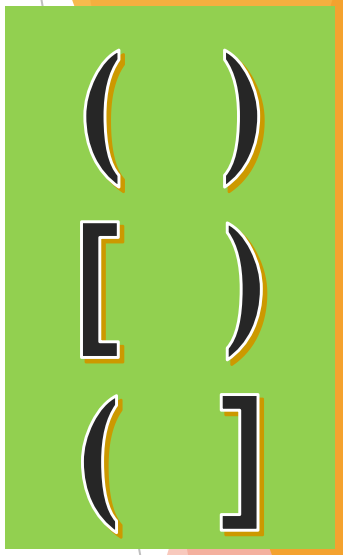
```
breaks=seq(0,1150,by=50)
```

```
> breaks=seq(0,1150,by=50)
> length(breaks)
[1] 24
> breaks
 [1]    0   50  100  150  200  250  300  350  400  450  500  550
[13]  600  650  700  750  800  850  900  950 1000 1050 1100 1150
>
```

Divide the data using the intervals

salary_cut=cut(salary, breaks, right = FALSE)

```
> salary_cut=cut(salary,breaks,right = FALSE)
> str(salary_cut)
 Factor w/ 23 levels "[0,50)","[50,100)",..: 2 4 1 1 1 2 1 2 1 2 ...
> head(salary_cut)
[1] [50,100)  [150,200) [0,50)    [0,50)    [0,50)    [50,100)
23 Levels: [0,50) [50,100) [100,150) [150,200) ... [1.1e+03,1.15e+03)
```



Convert numeric to factor

```
> levels(salary_cut)
 [1] "[0,50)"              "[50,100)"            "[100,150)"
 [4] "[150,200)"           "[200,250)"           "[250,300)"
 [7] "[300,350)"           "[350,400)"           "[400,450)"
[10] "[450,500)"           "[500,550)"           "[550,600)"
[13] "[600,650)"           "[650,700)"           "[700,750)"
[16] "[750,800)"           "[800,850)"           "[850,900)"
[19] "[900,950)"           "[950,1e+03)"         "[1e+03,1.05e+03)"
[22] "[1.05e+03,1.1e+03)" "[1.1e+03,1.15e+03)"
>
```

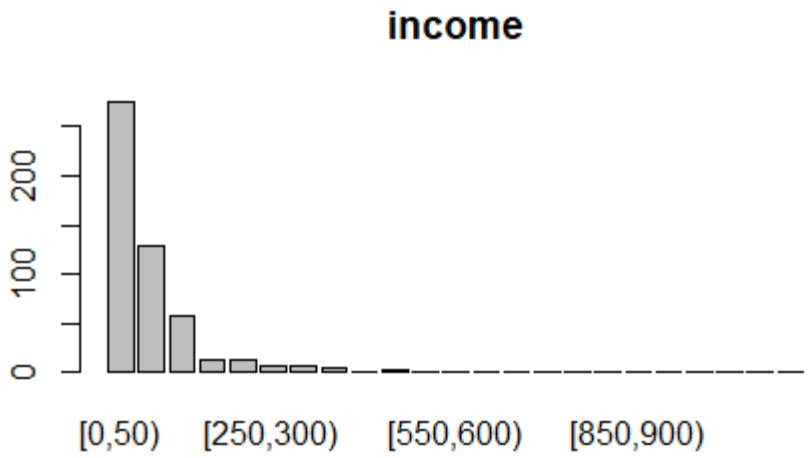
Numeric as a factor

```
temp=cbind(mydata$income,salary_cut)
```

```
> head(temp)
      salary_cut
[1,]  72          2
[2,] 153          4
[3,]  28          1
[4,]  26          1
[5,]  23          1
[6,]  76          2
>
```

Graph the barplot

```
tableSalary=table(salary_cut)
barplot(tableSalary, main="income")
```



```
salary=mydata$income
```

```
range(salary)
breaks=seq(0,1150,by=50)
```

cut divides the range of x into intervals and codes the values in x according to which interval they fall

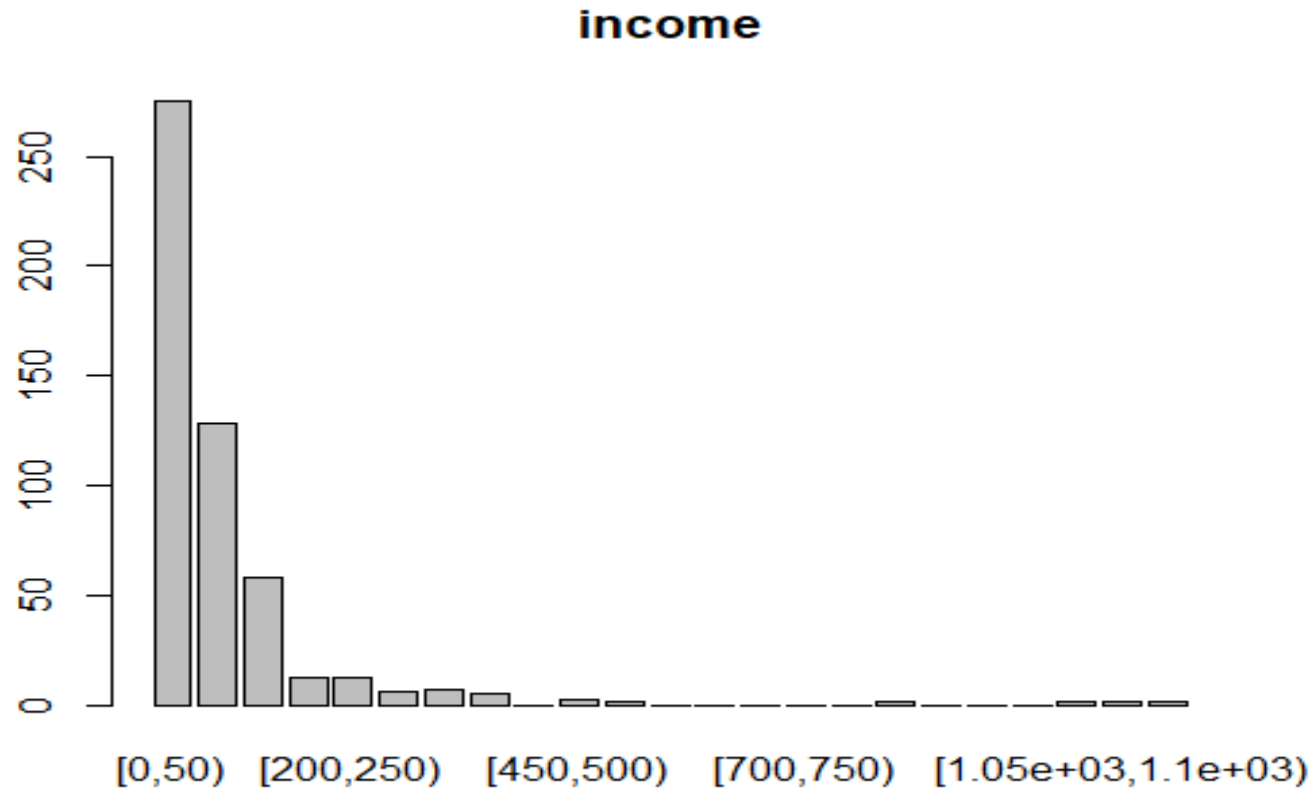
```
salary_cut=cut(salary,breaks,right = FALSE)
```

```
tableSalary=table(salary_cut)
barplot(tableSalary, main="income")
```

- Select data
- Find range
- Defining a sequence of equal distance break points
- Divide the data using the intervals
- Compute the frequency in each interval

[min, max]

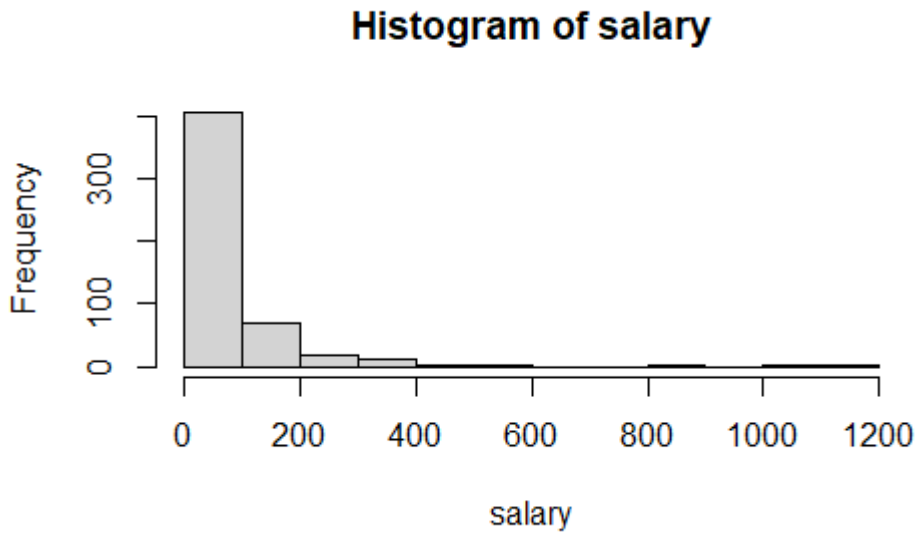
[min, max)


income
0
50
100
150
200
250
[0,50)
[200,250)
[450,500)
[700,750)
[1.05e+03,1.1e+03)

histogram

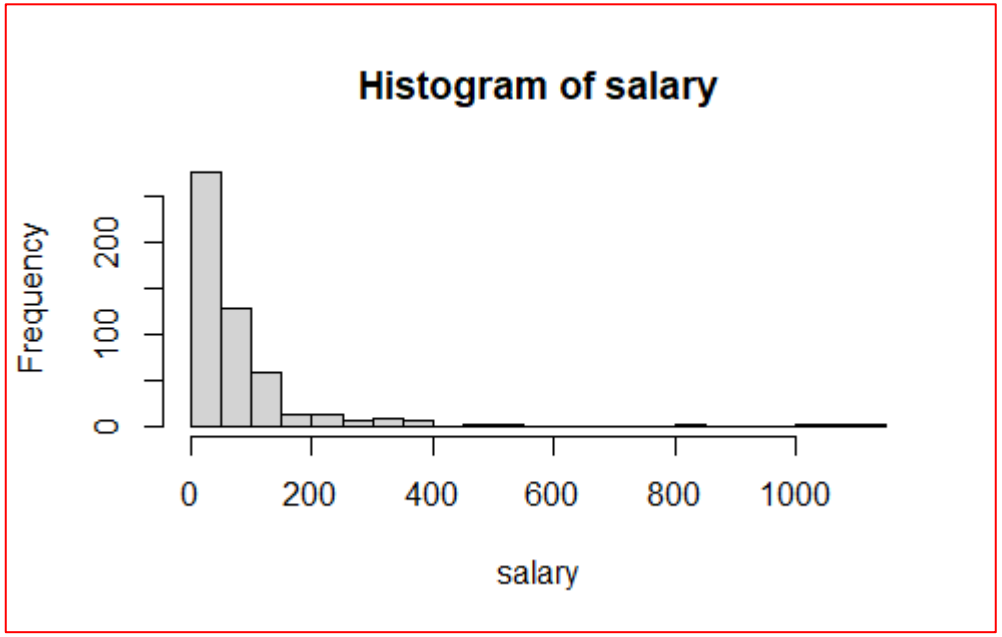
histogram consists of parallel vertical bars that graphically shows the frequency distribution of a quantitative variable. The area of each bar is proportional to the frequency of items found in each class.

```
hist(salary)
```



histogram

```
h = hist(salary, breaks=breaks, right=FALSE)
```



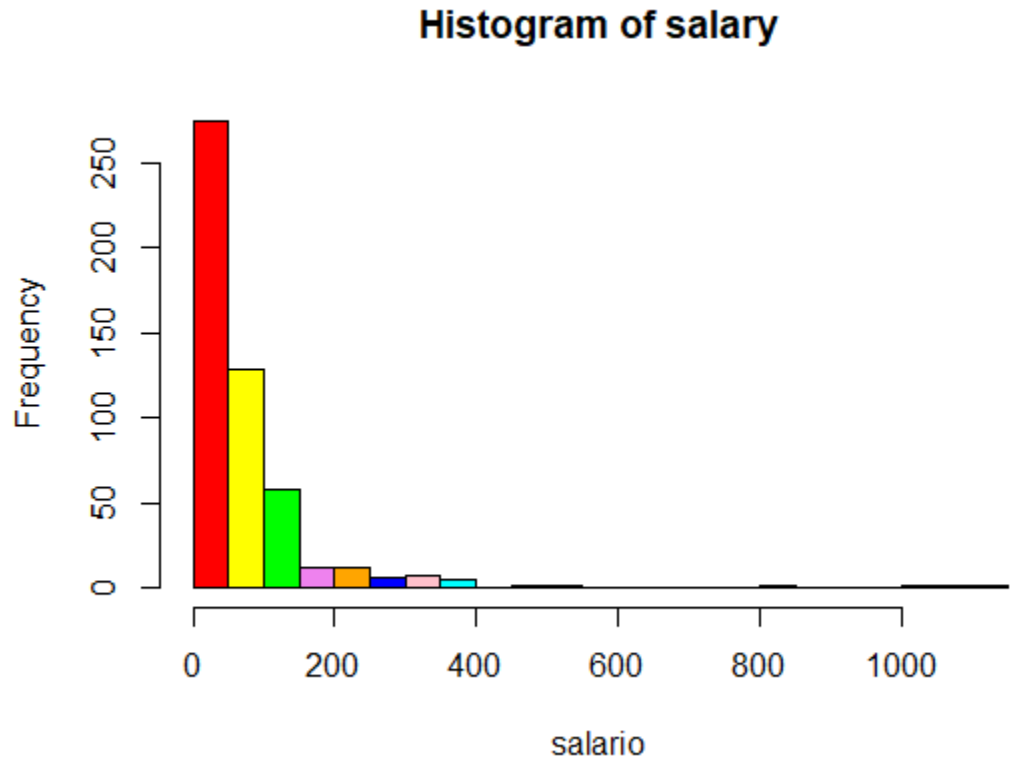

```
h = hist(salary, breaks=breaks, right=FALSE, plot=FALSE)
```

histogram

h = hist(salary, breaks=breaks, right=FALSE, plot=FALSE)

```
> h = hist(salary, breaks=breaks, right=FALSE, plot=FALSE)
> str(h)
List of 6
 $ breaks  : num [1:24] 0 50 100 150 200 250 300 350 400 450 ...
 $ counts  : int [1:23] 275 128 58 12 12 6 7 5 0 2 ...
 $ density : num [1:23] 0.010784 0.00502 0.002275 0.000471 0.000471
 ...
 $ mids    : num [1:23] 25 75 125 175 225 275 325 375 425 475 ...
 $ xname   : chr "salary"
 $ equidist: logi TRUE
 - attr(*, "class")= chr "histogram"
>
```

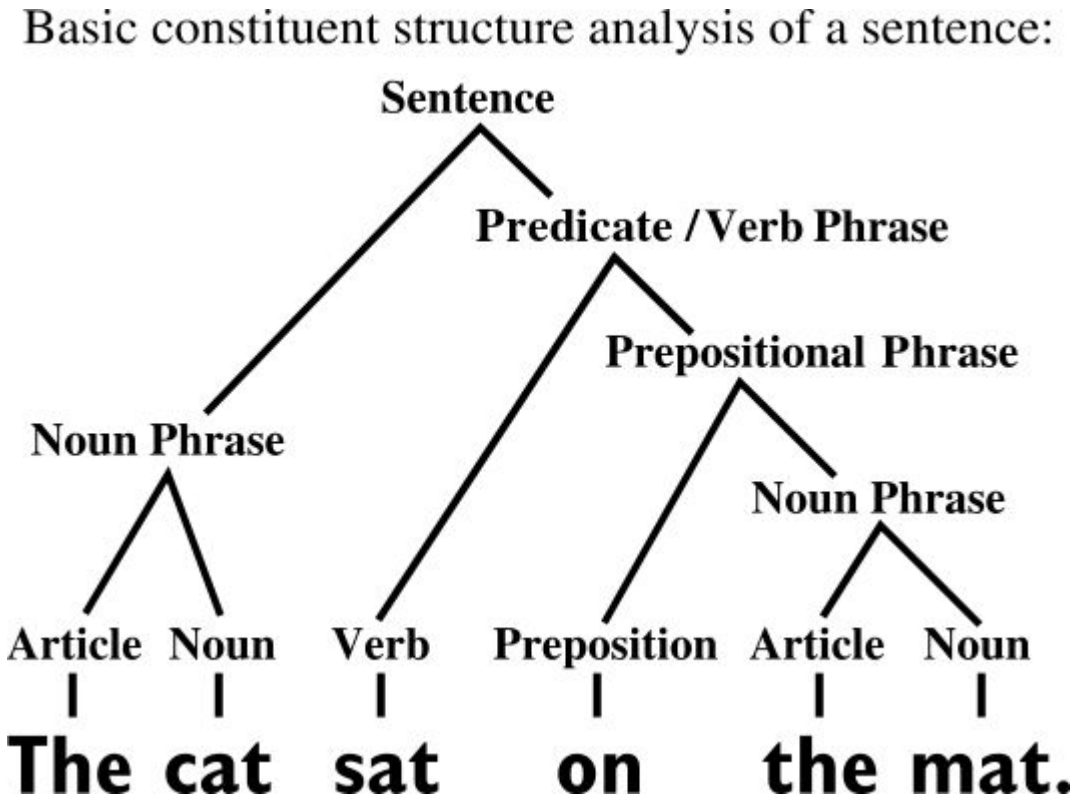
hist(salary, breaks=breaks, right=FALSE, col = colors,xlab="salario")




```
> colors=c("red","blue","green","yellow")
> hist(salary, breaks=breaks, right=FALSE, col = colors,xlab="salario")
>
```

ggplot2

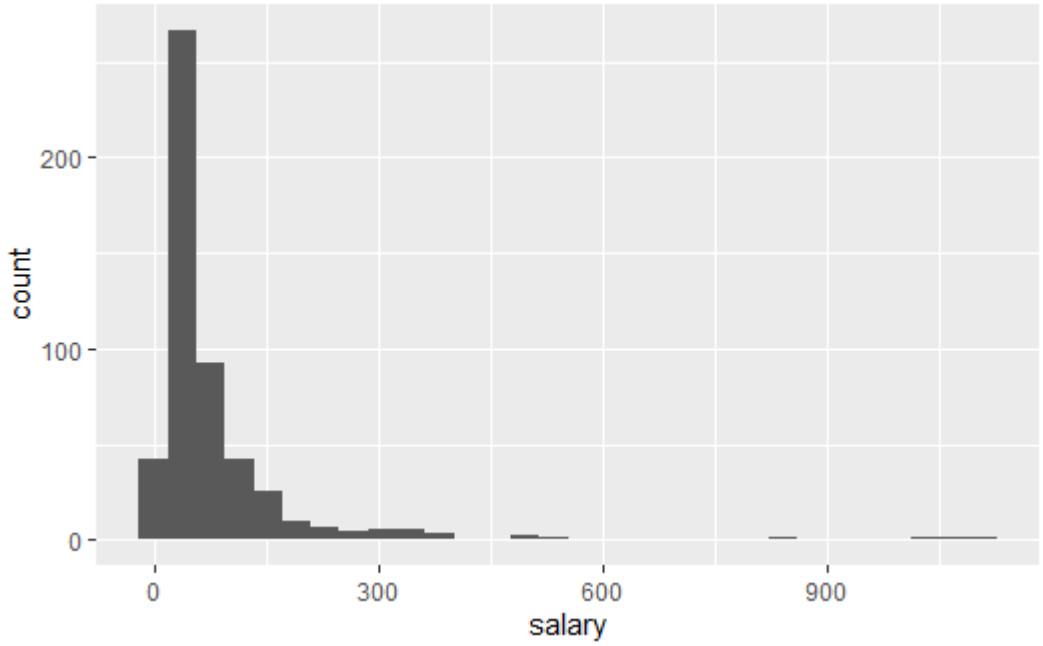
Grammar of graphs



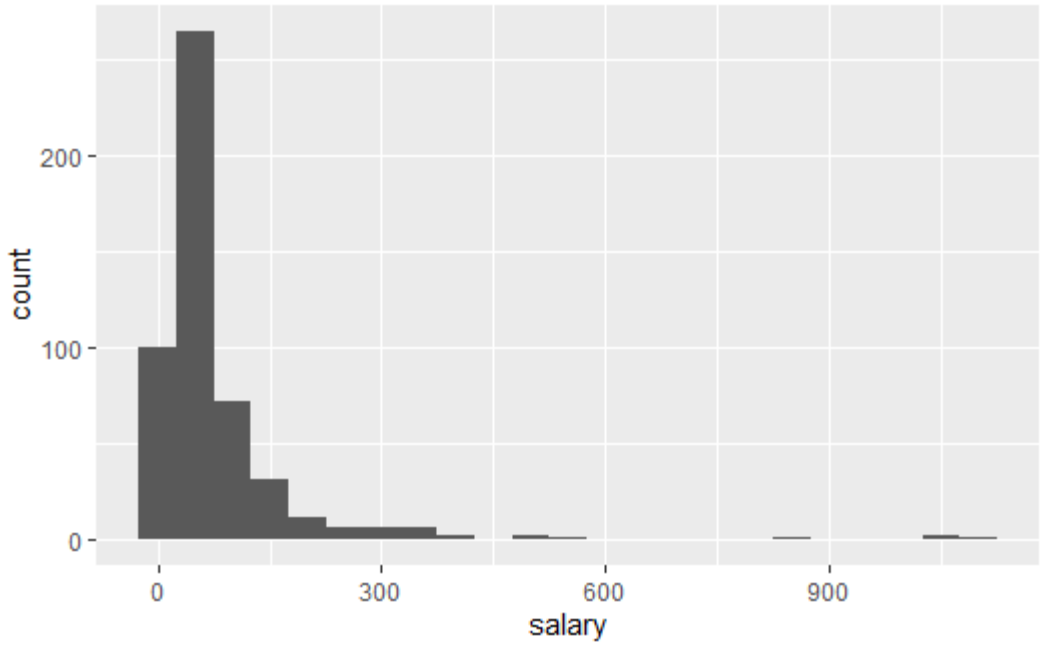
- Data
- Aesthetics
- Geometrics
- Facets
- Stadistics
- Coordinates
- Themes

Histogram

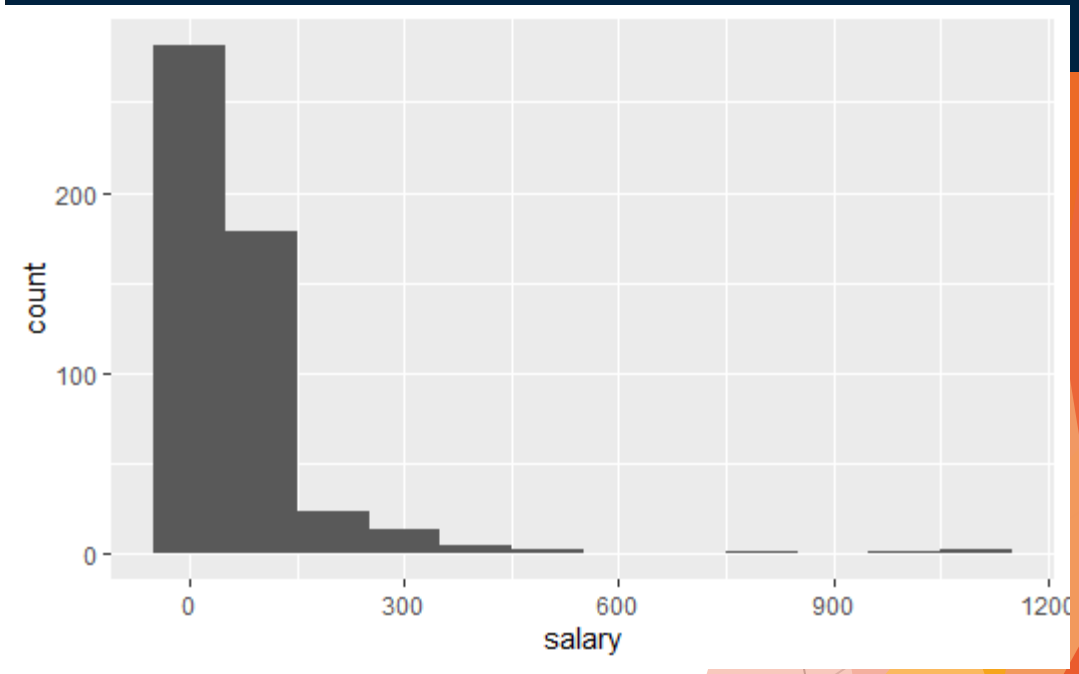
```
> histGraph=ggplot(data=mydata,aes(x=salary))
> histGraph+geom_histogram()
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
>
```



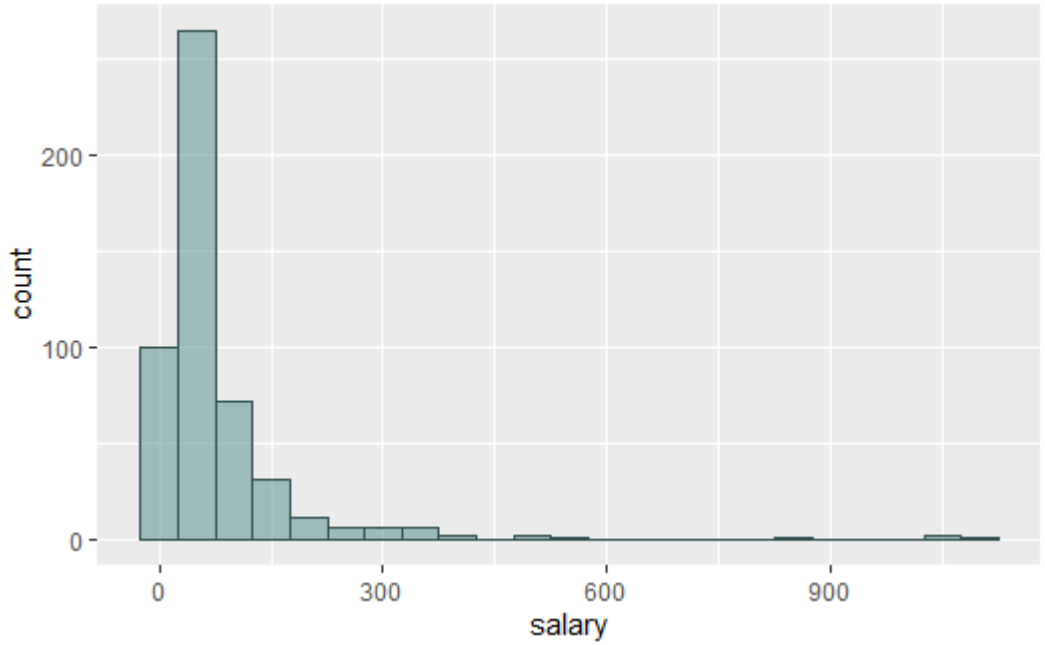
```
>
> histGraph+geom_histogram(binwidth = 50)
>
```



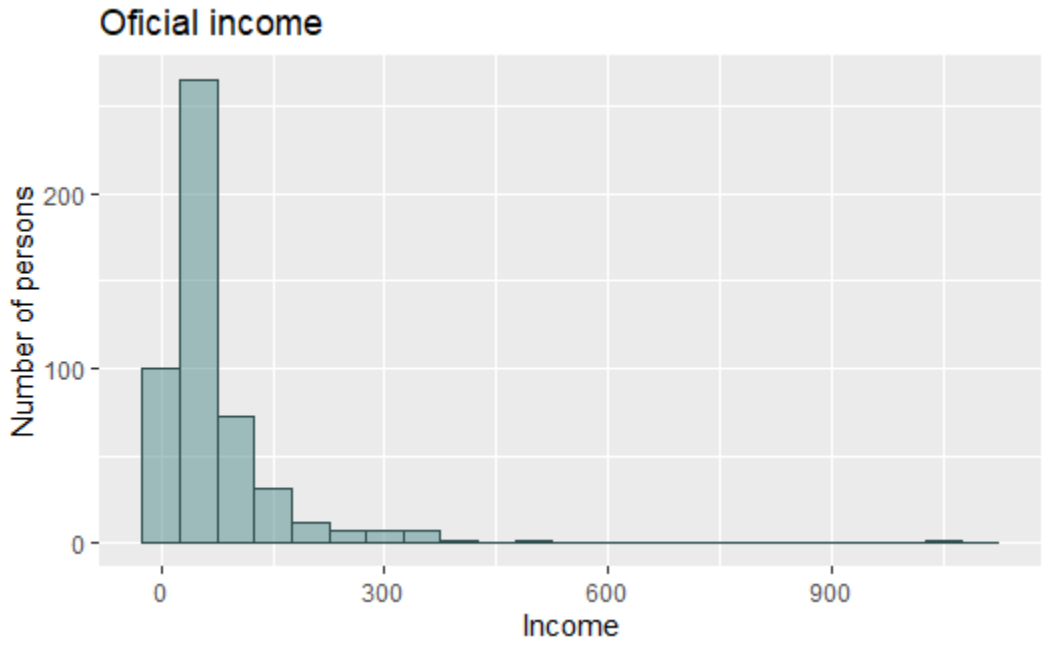

```
>
> histGraph+geom_histogram(binwidth = 100)
>
```



```
histGraph + geom_histogram(binwidth = 50,
        color="darkslategray", fill="darkslategray4",alpha=0.5)
```



```
histGraph + geom_histogram(binwidth = 50,
      color="darkslategray", fill="darkslategray4",alpha=0.5)+
    ggtitle("Oficial income")+
    labs(x= "Income",y="Number of persons")
```



Relative Frequency distribution

It is a summary of the frequency proportion in a collection of non-overlapping categories.

Weights (in kg)	Frequency	Relative Frequency
50	10	$\frac{10}{50}=0.2$
60	12	$\frac{12}{50}=0.24$
70	5	$\frac{5}{50}=0.1$
55	13	$\frac{13}{50}=0.26$
40	10	$\frac{10}{50}=0.2$
Total	50	

$$\text{Relative frequency} = \frac{\text{count of subgroup}}{\text{Total count}} \times 100$$

https://www.chegg.com/homework-help/definitions/relative-frequency-distribution-31

Relative Frequency distribution

relschooltable=schooltable/nrow(painters)

```
> relschooltable=schooltable/nrow(painters)
> relschooltable
school
         A          B          C          D          E
0.18518519 0.11111111 0.11111111 0.18518519 0.12962963
         F          G          H
0.07407407 0.12962963 0.07407407
> cbind(relschooltable)
  relschooltable
A     0.18518519
B     0.11111111
C     0.11111111
D     0.18518519
E     0.12962963
F     0.07407407
G     0.12962963
H     0.07407407
>
```

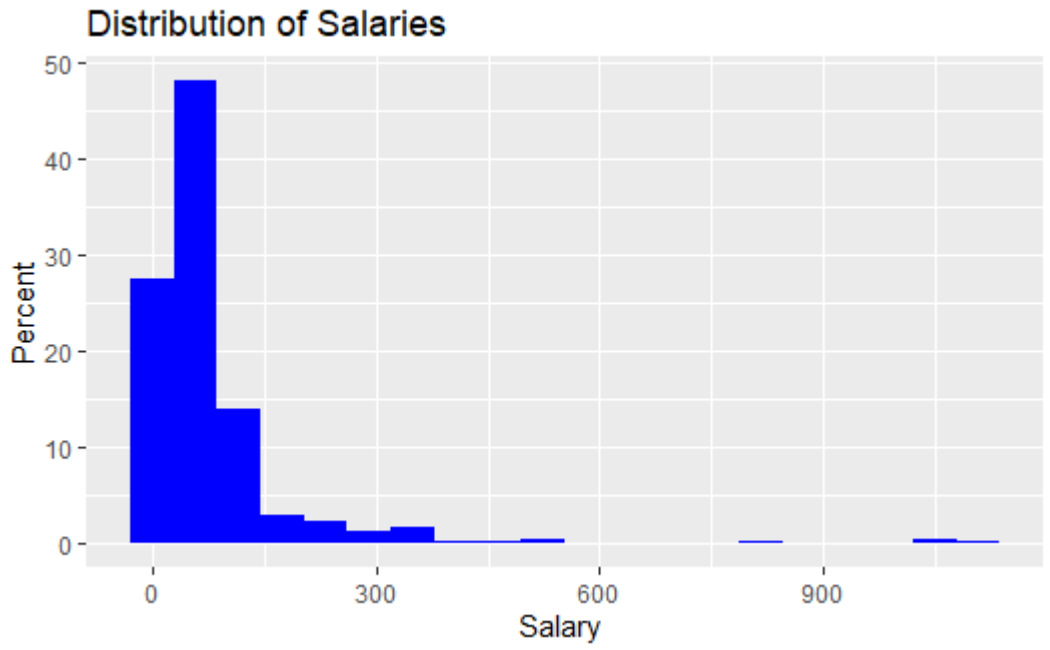
Relative frequency distribution

$$\text{Relative frequency} = \frac{\text{count of subgroup}}{\text{Total count}} \times 100$$

```
reltableSalary=tableSalary/nrow(mydata)
```

Relative frequency distribution

```
ggplot(data=mydata) +
  geom_histogram(mapping=aes(x=salary, y=..count../sum(..count..)*100), bins=20, fill="blue") +
  ggtitle("Distribution of Salaries") +
  xlab("Salary ") +
  ylab("Percent")
```



Cumulative frequency distribution

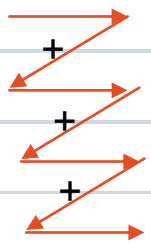
cumulative frequency distribution of a quantitative variable is a summary of data frequency below given levels.

Class Limits	Frequency	Cumulative Frequency
5-10	1	1
10-15	2	3
15-20	4	7
20-25	0	7
25-30	3	10
30-35	5	15
35-40	6	21

cumsum()

cumsum(tableSalary)

Class Limits	Frequency	Cumulative Frequency
5-10	1	1
10-15	2	3
15-20	4	7
20-25	0	7
25-30	3	10
30-35	5	15
35-40	6	21



Class Limits	Frequency	Cumulative Frequency
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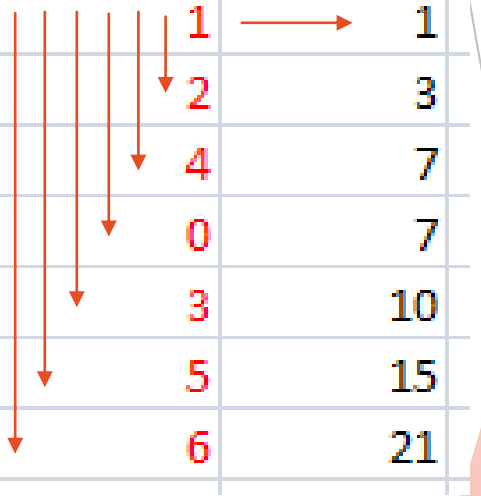
25-30	3	10
30-35	5	15
35-40	6	21

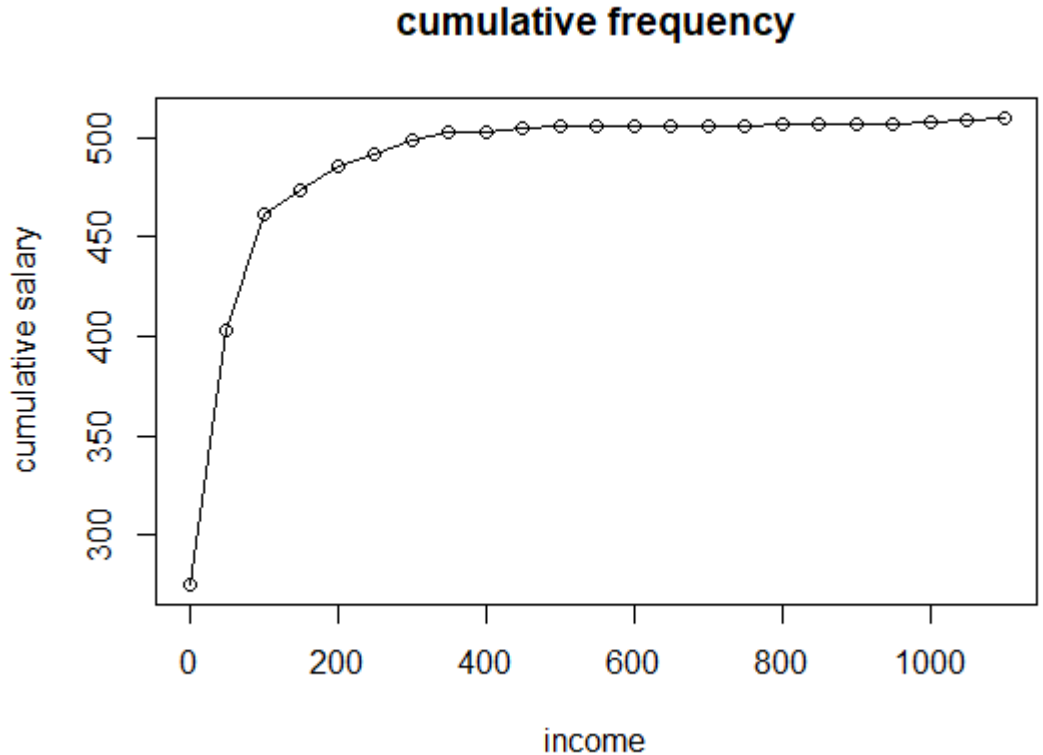


Cumulative frequency graph

cumulative frequency distribution of a quantitative variable is a summary of data frequency below given levels.

```
plot(breaks[1:23],cumtabSalary, main = "cumulative
frequency",xlab = "income", ylab = "cumulative
salary")

 lines(breaks[1:23],cumtabSalary)
```



Exercise

head(faithful)

?faithful

Find the cumulative relative frequency graph of the eruption durations in faithful.