SQL and R

Unit V

Data Analysis Using R Programming

SQL

- SQL stands for Structured Query Language.
- SQL queries are used for interacting with a database.
- Using SQL queries we can access and manipulate data stored in the database.

CRUD

- With the help of SQL queries, we can create, read, update and delete data on databases and perform lots more operations on the database.

SQL : R Database Interface (DBI)

- The DBI package helps connecting R to database management systems (DBMS).
- DBI separates the connectivity to the DBMS into a “front-end” and a “back-end”.

- The interface defines a small set of classes and methods similar in spirit to Perl’s DBI, Java’s JDBC, Python’s DB-API, and Microsoft’s ODBC. It supports the following operations:
- connect/disconnect to the DBMS
- create and execute statements in the DBMS
- extract results/output from statements
- error/exception handling
- information (meta-data) from database objects
- transaction management (optional)

SQL : R Database Interface (DBI)

- Most users who want to access a database do not need to install DBI directly. It will be installed automatically when you install one of the database backends:

- RPostgres for PostgreSQL,
- RMariaDB for MariaDB or MySQL,
- RSQLite for SQLite,
- odbc for databases that you can access via ODBC,
- bigrquery,

R Database Interface (DBI) Installation

- You can install the released version of DBI from CRAN with:

```
install.packages("DBI“)
```

The following example illustrates some of the DBI capabilities:

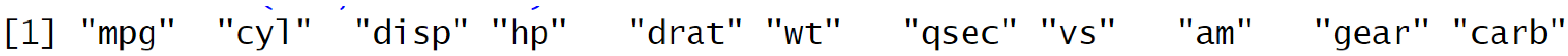
```
#Connection using DBI
library(DBI)
# Create an ephemeral in-memory RSQLite database
con <- dbConnect(RSQLite::SQLite(), dbname = ":memory:")

# Listing of tables in DB
dbListTables(con)
# Create of tables in DB
dbWriteTable(con, "mtcars", mtcars)
dbListTables(con)
```

df

OUTPUT

```
[1] "mtcars"
```

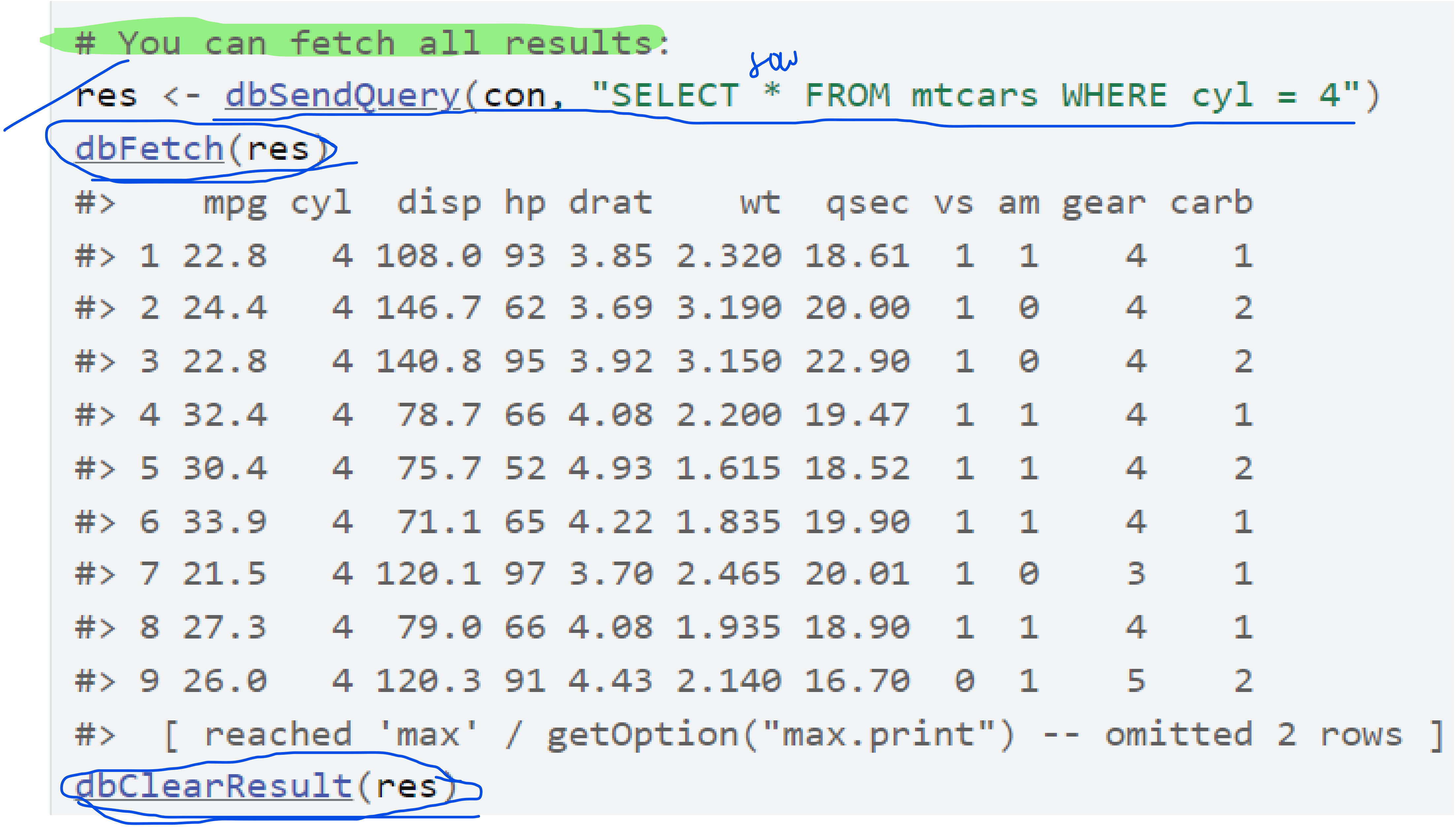
```
dbListFields(con, "mtcars")
```



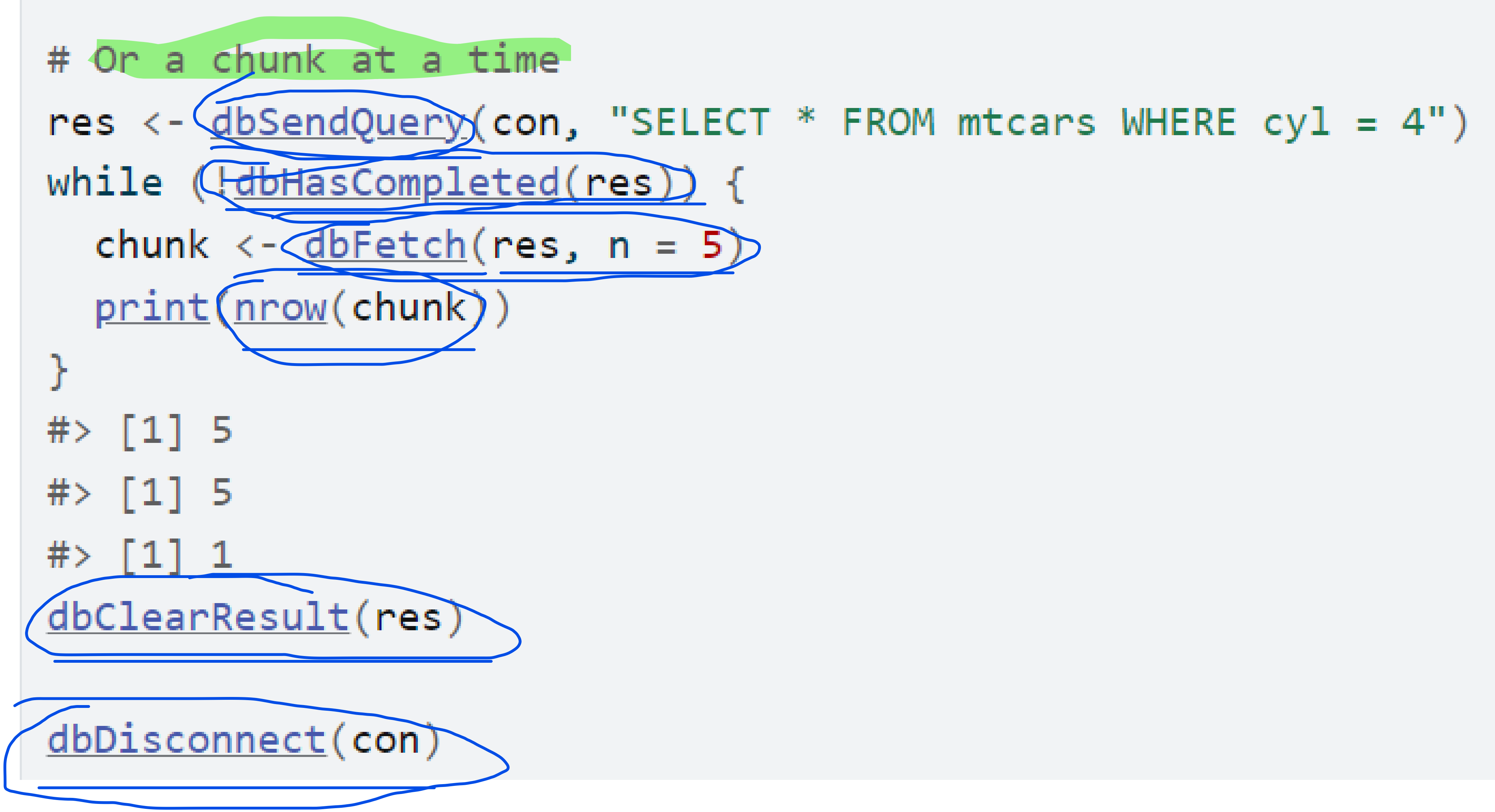
```
[1] "mpg"  "cyl"  "disp" "hp"   "drat" "wt"   "qsec" "vs"   "am"   "gear" "carb"
```

```
dbReadTable(con, "mtcars")
```

```
   mpg cyl  disp  hp drat    wt  qsec vs am gear carb
1 21.0   6 160.0 110 3.90 2.620 16.46  0  1    4    4
2 21.0   6 160.0 110 3.90 2.875 17.02  0  1    4    4
3 22.8   4 108.0  93 3.85 2.320 18.61  1  1    4    1
4 21.4   6 258.0 110 3.08 3.215 19.44  1  0    3    1
5 18.7   8 360.0 175 3.15 3.440 17.02  0  0    3    2
6 18.1   6 225.0 105 2.76 3.460 20.22  1  0    3    1
7 14.3   8 360.0 245 3.21 3.570 15.84  0  0    3    4
8 24.4   4 146.7  62 3.69 3.190 20.00  1  0    4    2
```



```
# You can fetch all results:
res <- dbSendQuery(con, "SELECT * FROM mtcars WHERE cyl = 4")
dbFetch(res)
#>     mpg cyl  disp hp drat    wt  qsec vs am gear carb
#> 1 22.8   4 108.0 93 3.85 2.320 18.61  1  1    4    1
#> 2 24.4   4 146.7 62 3.69 3.190 20.00  1  0    4    2
#> 3 22.8   4 140.8 95 3.92 3.150 22.90  1  0    4    2
#> 4 32.4   4  78.7 66 4.08 2.200 19.47  1  1    4    1
#> 5 30.4   4  75.7 52 4.93 1.615 18.52  1  1    4    2
#> 6 33.9   4  71.1 65 4.22 1.835 19.90  1  1    4    1
#> 7 21.5   4 120.1 97 3.70 2.465 20.01  1  0    3    1
#> 8 27.3   4  79.0 66 4.08 1.935 18.90  1  1    4    1
#> 9 26.0   4 120.3 91 4.43 2.140 16.70  0  1    5    2
#>  [ reached 'max' / getOption("max.print") -- omitted 2 rows ]
dbClearResult(res)
```



```
# Or a chunk at a time
res <- dbSendQuery(con, "SELECT * FROM mtcars WHERE cyl = 4")
while (!dbHasCompleted(res)) {
  chunk <- dbFetch(res, n = 5)
  print(nrow(chunk))
}
#> [1] 5
#> [1] 5
#> [1] 1
dbClearResult(res)

dbDisconnect(con)
```

sqldf package

- We can also use sqldf package to run SQL queries in R.
- Sqldf is a convenient R tool that allows the execution of SQL operations on R data frames.
- The databases MySQL, PostgreSQL, H2, and SQLite can all be used with sqldf.
- We can run SQL queries in R using sqldf package.

```
install.packages("sqldf")
```

sqldf package

- Now after the installation of sqldf package we have to import it to use its functionalities.

```
library(sqldf)
```

Reading data using SQL query

- we are going to use the **SQL select command** to view the data of the data frame.
- First, we import the sqldf library, then read the CSV file and store it into a variable "df" as a data frame.
- **Select Statement**

```
df <- iris
head(df)
```

Reading data using SQL query

```
# Importing sqldf library
library(sqldf)
#Creating Dataframe
df <- iris
# Reading data from data frame using SQL select query
sqldf("select * from df")
```

all rows

Example

- In this example, we are going to read a particular column from the data frame by selecting a particular column using the SQL query

```
sqldf("select [sepal.length], [sepal.width], [Species] from df")
```

- we are using order by clause in SQL select statement due to which our data is displayed by sorting the data of the “sepal_length” column

```
sqldf("select * from df order by sepal_length")
```

Example

```
sqldf("select max(sepal_length) from df")
```

```
sqldf("select min(sepal_length) from df")
```

WHERE

- Conditional statements can be added via WHERE

```
sqldf(“select * from df  where species='Iris-virginica’”)
```

WHERE

- Both AND and OR are valid, along with paranthese to affect order of operations.

```
sqldf('SELECT * FROM rock WHERE (peri > 5000 AND shape < .05) OR
perm > 1000')
```

Example

```
# Deleting rows where species is Iris-virginica
df<-sqldf(c("delete from df where species='Iris-virginica'", "select * from df"))
print("After delete rows")
# Displaying data frame
sqldf("select * from df")
```

Example

```r
# Update species name from Iris-versicolor to versicolor
print("Before update")
sqldf("select * from df")
# Updating values
df <- sqldf(c("update df set species='versicolor'
            where species='Iris-versicolor'",
            "select * from df"))
print("After update")
sqldf("select * from df")
```

IN

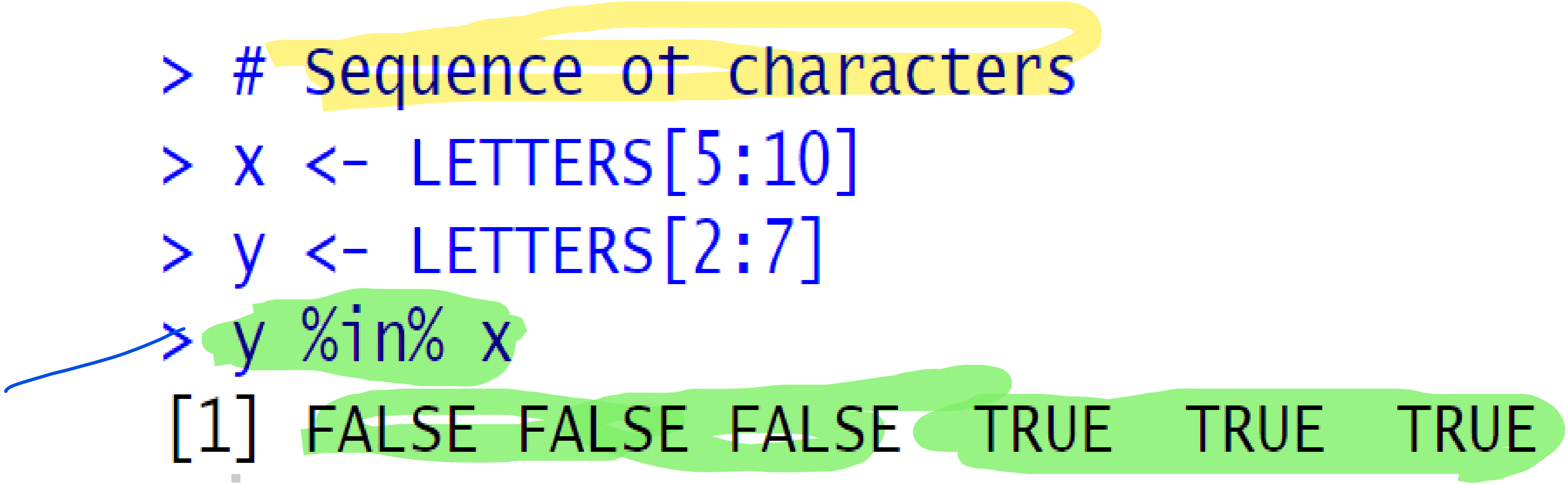
- %in% , is used to check if an element exists within a vector, list, or other data structure.
- It returns a logical vector indicating whether a match was found

- # Check value in a Vector
- 67 %in% c(2,5,8,23,67,34)   TRUE

#Check one vector elements in another vector

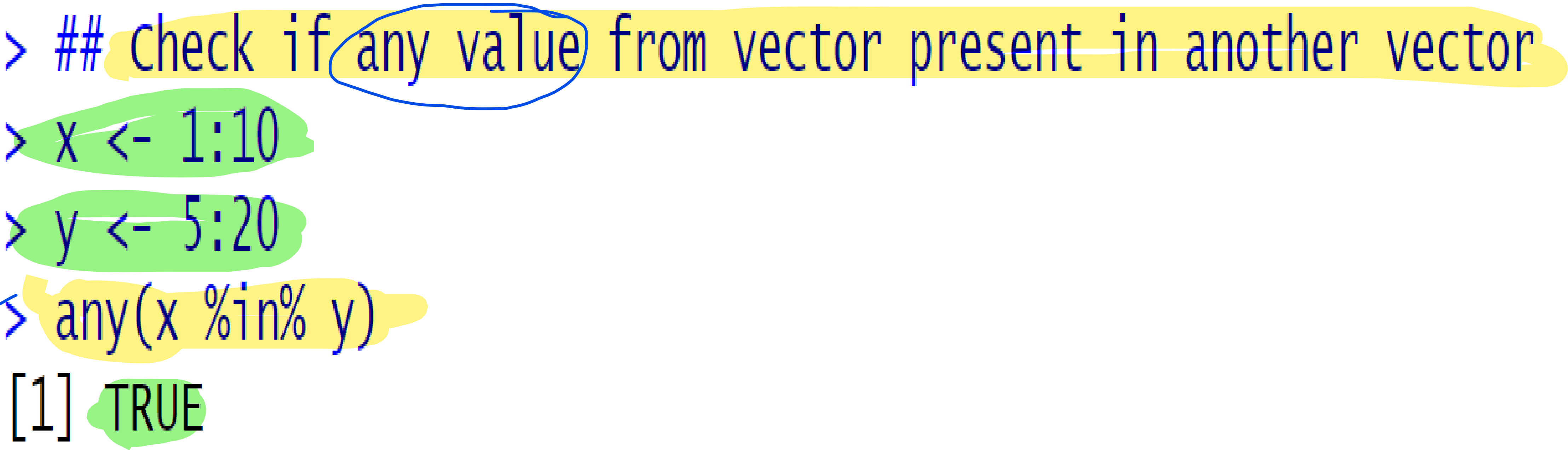
- vec1 <- c(2,5,8,23,67,34)
- vec2 <- c(1,2,8,34)
- vec2 %in% vec1

IN



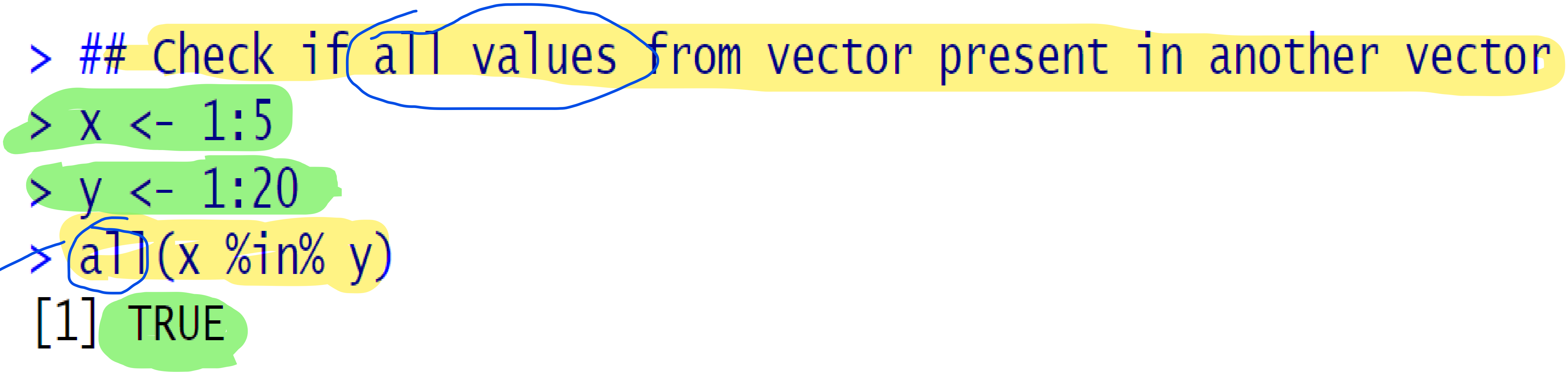
```
> # Sequence of characters
> x <- LETTERS[5:10]
> y <- LETTERS[2:7]
> y %in% x
[1] FALSE FALSE FALSE  TRUE  TRUE  TRUE
```

IN



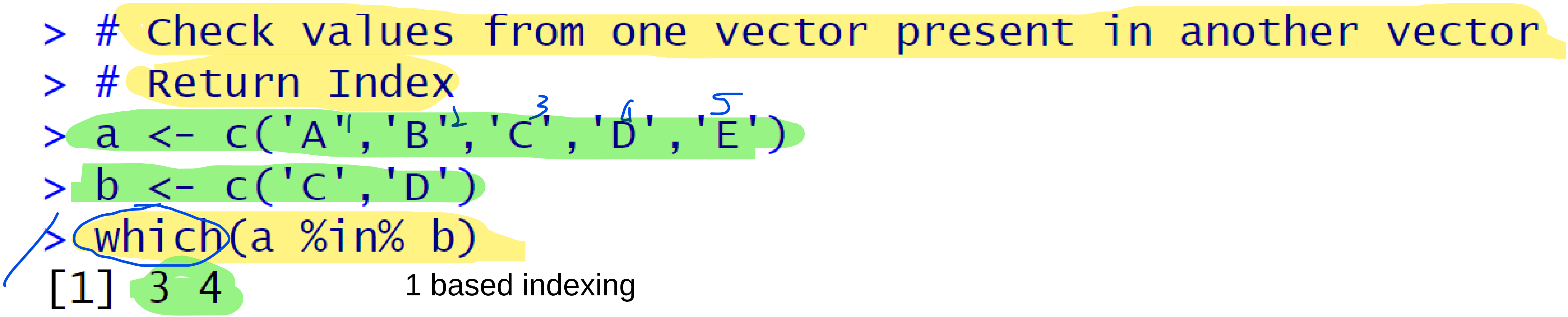
```
> ## Check if any value from vector present in another vector
> x <- 1:10
> y <- 5:20
> any(x %in% y)
[1] TRUE
```

IN



```
> ## Check if all values from vector present in another vector
> x <- 1:5
> y <- 1:20
> all(x %in% y)
[1] TRUE
```

IN

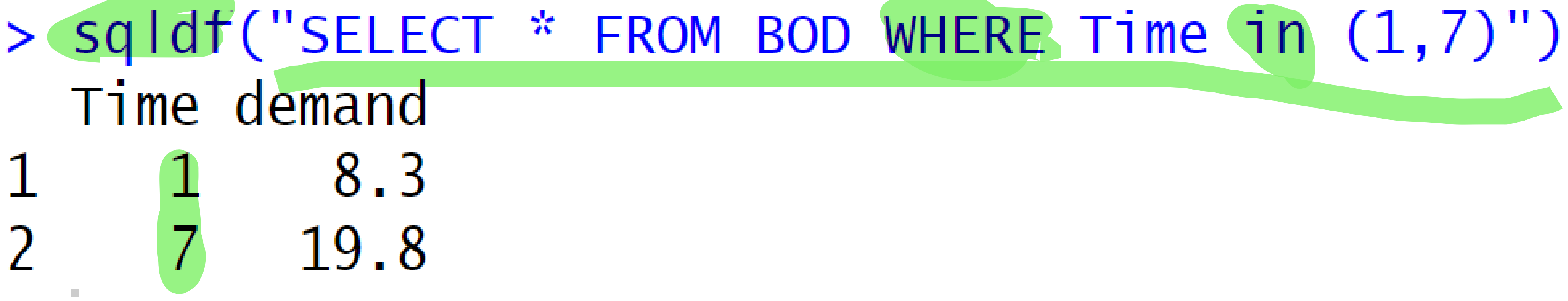


```
> # Check values from one vector present in another vector
> # Return Index
                  1    2    3    4    5
> a <- c('A','B','C','D','E')
> b <- c('C','D')
> which(a %in% b)
[1] 3 4
```

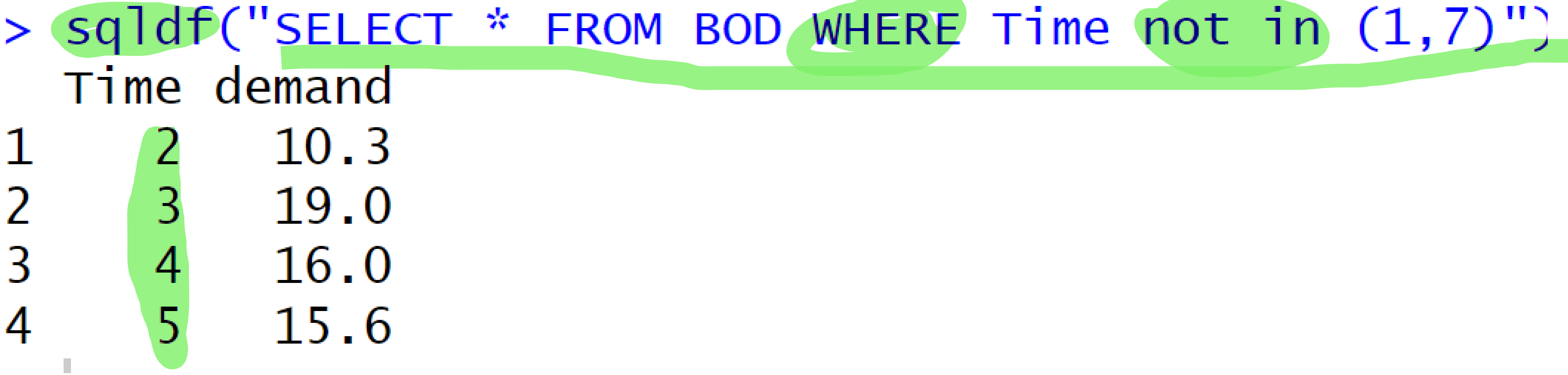
1 based indexing

WHERE --IN

- WHERE IN is used similar to R’s %in%. It also supports NOT



```
> sqldf("SELECT * FROM BOD WHERE Time in (1,7)")
  Time demand
1    1    8.3
2    7   19.8
```



```
> sqldf("SELECT * FROM BOD WHERE Time not in (1,7)")
  Time demand
1    2   10.3
2    3   19.0
3    4   16.0
4    5   15.6
```

WHERE --LIKE

- LIKE can be thought of as a weak regular expression command.
- It only allows the single wildcard % which matches any number of characters.
- For example, to extract the data where the feed ends and does not end with “bean”

```
sqldf('SELECT * FROM chickwts WHERE feed LIKE "%bean" LIMIT 5'
```

```
sqldf('SELECT * FROM chickwts WHERE feed NOT LIKE "%bean" LIMIT 5')
```

Sorting the data using SQL query (Order by Clause)

- To order variables, use the syntax

```
ORDER BY var1 {ASC/DESC}, var2 {ASC/DESC}
```

```
sqldf("SELECT * FROM Orange ORDER BY age ASC, circumference DESC
LIMIT 5")
```

LIMIT

- To control the number of results returned, use LIMIT #.

```
sqldf('SELECT * FROM iris LIMIT 10')
```

Aggregated data

- Select statements can create aggregated data using AVG, MEDIAN, MAX, MIN, and SUM as functions in the list of variables to select.
- The GROUP BY statement can be added to aggregate by groups.

```
sqldf("SELECT AVG(circumference) FROM Orange")
```

```
sqldf("SELECT max(circumference) AND min(circumference) FROM Orange")
```

```
sqldf("SELECT tree, AVG(circumference) AS meancirc FROM Orange GROUP BY tree")
```