

## R\_Recap\_02

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## Prepare your R session

```
setwd("~/Google_Drive/github/R/R_Recap/session_02")  
library(dplyr)  
library(ggplot2)
```

# Iris dataset

1. sepal length in cm
2. sepal width in cm
3. petal length in cm
4. petal width in cm
5. class: – Iris Setosa – Iris Versicolour – Iris Virginica

Source: <https://archive.ics.uci.edu/ml/datasets/Iris>

## Loading the Iris dataset

```
glimpse(iris)
```

```
## Observations: 150
```

```
## Variables: 5
```

```
## $ Sepal.Length <dbl> 5.1, 4.9, 4.7, 4.6, 5.0, 5.4, 4.6,
```

```
## $ Sepal.Width <dbl> 3.5, 3.0, 3.2, 3.1, 3.6, 3.9, 3.4,
```

```
## $ Petal.Length <dbl> 1.4, 1.4, 1.3, 1.5, 1.4, 1.7, 1.4,
```

```
## $ Petal.Width <dbl> 0.2, 0.2, 0.2, 0.2, 0.2, 0.4, 0.3,
```

```
## $ Species <fctr> setosa, setosa, setosa, setosa, se
```

## Boston Housing data

1. CRIM per capita crime rate by town
2. ZN proportion of residential land zoned for lots over 25,000 sq.ft.
3. INDUS proportion of non-retail business acres per town
4. CHAS Charles River dummy variable (= 1 if tract bounds river; 0 otherwise)
5. NOX nitric oxides concentration (parts per 10 million)
6. RM average number of rooms per dwelling
7. AGE proportion of owner-occupied units built prior to 1940
8. DIS weighted distances to five Boston employment centres
9. RAD index of accessibility to radial highways
10. TAX full-value property-tax rate per \$10,000
11. PTRATIO pupil-teacher ratio by town
12.  $B = 1000(B_k - 0.63)^2$  where  $B_k$  is the proportion of blacks by town
13. LSTAT % lower status of the population
14. MEDV Median value of owner-occupied homes in \$1000's

Source: <http://archive.ics.uci.edu/ml/datasets/Housing>

## Loading the Boston dataset

```
library(MASS)
glimpse(Boston)
```

```
## Observations: 506
```

```
## Variables: 14
```

```
## $ crim      <dbl> 0.00632, 0.02731, 0.02729, 0.03237, 0.06995, 0.02128, 0.01831, 0.01881, 0.02188, 0.03683, 0.05283, 0.07548, 0.02835, 0.07185, 0.03163, 0.01961, 0.01293, 0.02985, 0.02606, 0.03178, 0.01717, 0.03436, 0.03339, 0.03415, 0.03841, 0.04037, 0.03992, 0.04996, 0.05023, 0.05208, 0.06185, 0.06421, 0.06444, 0.06516, 0.06813, 0.07083, 0.0729, 0.07541, 0.07705, 0.07904, 0.08329, 0.08663, 0.08997, 0.09148, 0.09518, 0.09718, 0.10016, 0.10331, 0.10565, 0.10761, 0.11052, 0.11297, 0.11545, 0.11827, 0.1215, 0.12451, 0.12729, 0.13059, 0.13322, 0.1366, 0.13981, 0.14323, 0.14695, 0.15066, 0.15427, 0.1579, 0.16126, 0.16515, 0.16887, 0.17255, 0.17648, 0.1801, 0.18379, 0.18718, 0.19054, 0.1938, 0.19713, 0.20047, 0.20378, 0.2071, 0.21046, 0.21378, 0.21708, 0.22041, 0.22371, 0.22704, 0.23035, 0.23368, 0.237, 0.2403, 0.24363, 0.24691, 0.25023, 0.25354, 0.25685, 0.26015, 0.26348, 0.26678, 0.2701, 0.27341, 0.27671, 0.28, 0.28329, 0.28659, 0.28989, 0.29318, 0.29648, 0.29978, 0.30308, 0.30638, 0.30968, 0.31298, 0.31628, 0.31958, 0.32288, 0.32618, 0.32948, 0.33278, 0.33608, 0.33938, 0.34268, 0.34598, 0.34928, 0.35258, 0.35588, 0.35918, 0.36248, 0.36578, 0.36908, 0.37238, 0.37568, 0.37898, 0.38228, 0.38558, 0.38888, 0.39218, 0.39548, 0.39878, 0.40208, 0.40538, 0.40868, 0.41198, 0.41528, 0.41858, 0.42188, 0.42518, 0.42848, 0.43178, 0.43508, 0.43838, 0.44168, 0.44498, 0.44828, 0.45158, 0.45488, 0.45818, 0.46148, 0.46478, 0.46808, 0.47138, 0.47468, 0.47798, 0.48128, 0.48458, 0.48788, 0.49118, 0.49448, 0.49778, 0.50108, 0.50438, 0.50768, 0.51098, 0.51428, 0.51758, 0.52088, 0.52418, 0.52748, 0.53078, 0.53408, 0.53738, 0.54068, 0.54398, 0.54728, 0.55058, 0.55388, 0.55718, 0.56048, 0.56378, 0.56708, 0.57038, 0.57368, 0.57698, 0.58028, 0.58358, 0.58688, 0.59018, 0.59348, 0.59678, 0.60008, 0.60338, 0.60668, 0.60998, 0.61328, 0.61658, 0.61988, 0.62318, 0.62648, 0.62978, 0.63308, 0.63638, 0.63968, 0.64298, 0.64628, 0.64958, 0.65288, 0.65618, 0.65948, 0.66278, 0.66608, 0.66938, 0.67268, 0.67598, 0.67928, 0.68258, 0.68588, 0.68918, 0.69248, 0.69578, 0.69908, 0.70238, 0.70568, 0.70898, 0.71228, 0.71558, 0.71888, 0.72218, 0.72548, 0.72878, 0.73208, 0.73538, 0.73868, 0.74198, 0.74528, 0.74858, 0.75188, 0.75518, 0.75848, 0.76178, 0.76508, 0.76838, 0.77168, 0.77498, 0.77828, 0.78158, 0.78488, 0.78818, 0.79148, 0.79478, 0.79808, 0.80138, 0.80468, 0.80798, 0.81128, 0.81458, 0.81788, 0.82118, 0.82448, 0.82778, 0.83108, 0.83438, 0.83768, 0.84098, 0.84428, 0.84758, 0.85088, 0.85418, 0.85748, 0.86078, 0.86408, 0.86738, 0.87068, 0.87398, 0.87728, 0.88058, 0.88388, 0.88718, 0.89048, 0.89378, 0.89708, 0.90038, 0.90368, 0.90698, 0.91028, 0.91358, 0.91688, 0.92018, 0.92348, 0.92678, 0.93008, 0.93338, 0.93668, 0.93998, 0.94328, 0.94658, 0.94988, 0.95318, 0.95648, 0.95978, 0.96308, 0.96638, 0.96968, 0.97298, 0.97628, 0.97958, 0.98288, 0.98618, 0.98948, 0.99278, 0.99608, 1.0001, 1.0041, 1.0081, 1.0121, 1.0161, 1.0201, 1.0241, 1.0281, 1.0321, 1.0361, 1.0401, 1.0441, 1.0481, 1.0521, 1.0561, 1.0601, 1.0641, 1.0681, 1.0721, 1.0761, 1.0801, 1.0841, 1.0881, 1.0921, 1.0961, 1.1001, 1.1041, 1.1081, 1.1121, 1.1161, 1.1201, 1.1241, 1.1281, 1.1321, 1.1361, 1.1401, 1.1441, 1.1481, 1.1521, 1.1561, 1.1601, 1.1641, 1.1681, 1.1721, 1.1761, 1.1801, 1.1841, 1.1881, 1.1921, 1.1961, 1.2001, 1.2041, 1.2081, 1.2121, 1.2161, 1.2201, 1.2241, 1.2281, 1.2321, 1.2361, 1.2401, 1.2441, 1.2481, 1.2521, 1.2561, 1.2601, 1.2641, 1.2681, 1.2721, 1.2761, 1.2801, 1.2841, 1.2881, 1.2921, 1.2961, 1.3001, 1.3041, 1.3081, 1.3121, 1.3161, 1.3201, 1.3241, 1.3281, 1.3321, 1.3361, 1.3401, 1.3441, 1.3481, 1.3521, 1.3561, 1.3601, 1.3641, 1.3681, 1.3721, 1.3761, 1.3801, 1.3841, 1.3881, 1.3921, 1.3961, 1.4001, 1.4041, 1.4081, 1.4121, 1.4161, 1.4201, 1.4241, 1.4281, 1.4321, 1.4361, 1.4401, 1.4441, 1.4481, 1.4521, 1.4561, 1.4601, 1.4641, 1.4681, 1.4721, 1.4761, 1.4801, 1.4841, 1.4881, 1.4921, 1.4961, 1.5001, 1.5041, 1.5081, 1.5121, 1.5161, 1.5201, 1.5241, 1.5281, 1.5321, 1.5361, 1.5401, 1.5441, 1.5481, 1.5521, 1.5561, 1.5601, 1.5641, 1.5681, 1.5721, 1.5761, 1.5801, 1.5841, 1.5881, 1.5921, 1.5961, 1.6001, 1.6041, 1.6081, 1.6121, 1.6161, 1.6201, 1.6241, 1.6281, 1.6321, 1.6361, 1.6401, 1.6441, 1.6481, 1.6521, 1.6561, 1.6601, 1.6641, 1.6681, 1.6721, 1.6761, 1.6801, 1.6841, 1.6881, 1.6921, 1.6961, 1.7001, 1.7041, 1.7081, 1.7121, 1.7161, 1.7201, 1.7241, 1.7281, 1.7321, 1.7361, 1.7401, 1.7441, 1.7481, 1.7521, 1.7561, 1.7601, 1.7641, 1.7681, 1.7721, 1.7761, 1.7801, 1.7841, 1.7881, 1.7921, 1.7961, 1.8001, 1.8041, 1.8081, 1.8121, 1.8161, 1.8201, 1.8241, 1.8281, 1.8321, 1.8361, 1.8401, 1.8441, 1.8481, 1.8521, 1.8561, 1.8601, 1.8641, 1.8681, 1.8721, 1.8761, 1.8801, 1.8841, 1.8881, 1.8921, 1.8961, 1.9001, 1.9041, 1.9081, 1.9121, 1.9161, 1.9201, 1.9241, 1.9281, 1.9321, 1.9361, 1.9401, 1.9441, 1.9481, 1.9521, 1.9561, 1.9601, 1.9641, 1.9681, 1.9721, 1.9761, 1.9801, 1.9841, 1.9881, 1.9921, 1.9961, 2.0001, 2.0041, 2.0081, 2.0121, 2.0161, 2.0201, 2.0241, 2.0281, 2.0321, 2.0361, 2.0401, 2.0441, 2.0481, 2.0521, 2.0561, 2.0601, 2.0641, 2.0681, 2.0721, 2.0761, 2.0801, 2.0841, 2.0881, 2.0921, 2.0961, 2.1001, 2.1041, 2.1081, 2.1121, 2.1161, 2.1201, 2.1241, 2.1281, 2.1321, 2.1361, 2.1401, 2.1441, 2.1481, 2.1521, 2.1561, 2.1601, 2.1641, 2.1681, 2.1721, 2.1761, 2.1801, 2.1841, 2.1881, 2.1921, 2.1961, 2.2001, 2.2041, 2.2081, 2.2121, 2.2161, 2.2201, 2.2241, 2.2281, 2.2321, 2.2361, 2.2401, 2.2441, 2.2481, 2.2521, 2.2561, 2.2601, 2.2641, 2.2681, 2.2721, 2.2761, 2.2801, 2.2841, 2.2881, 2.2921, 2.2961, 2.3001, 2.3041, 2.3081, 2.3121, 2.3161, 2.3201, 2.3241, 2.3281, 2.3321, 2.3361, 2.3401, 2.3441, 2.3481, 2.3521, 2.3561, 2.3601, 2.3641, 2.3681, 2.3721, 2.3761, 2.3801, 2.3841, 2.3881, 2.3921, 2.3961, 2.4001, 2.4041, 2.4081, 2.4121, 2.4161, 2.4201, 2.4241, 2.4281, 2.4321, 2.4361, 2.4401, 2.4441, 2.4481, 2.4521, 2.4561, 2.4601, 2.4641, 2.4681, 2.4721, 2.4761, 2.4801, 2.4841, 2.4881, 2.4921, 2.4961, 2.5001, 2.5041, 2.5081, 2.5121, 2.5161, 2.5201, 2.5241, 2.5281, 2.5321, 2.5361, 2.5401, 2.5441, 2.5481, 2.5521, 2.5561, 2.5601, 2.5641, 2.5681, 2.5721, 2.5761, 2.5801, 2.5841, 2.5881, 2.5921, 2.5961, 2.6001, 2.6041, 2.6081, 2.6121, 2.6161, 2.6201, 2.6241, 2.6281, 2.6321, 2.6361, 2.6401, 2.6441, 2.6481, 2.6521, 2.6561, 2.6601, 2.6641, 2.6681, 2.6721, 2.6761, 2.6801, 2.6841, 2.6881, 2.6921, 2.6961, 2.7001, 2.7041, 2.7081, 2.7121, 2.7161, 2.7201, 2.7241, 2.7281, 2.7321, 2.7361, 2.7401, 2.7441, 2.7481, 2.7521, 2.7561, 2.7601, 2.7641, 2.7681, 2.7721, 2.7761, 2.7801, 2.7841, 2.7881, 2.7921, 2.7961, 2.8001, 2.8041, 2.8081, 2.8121, 2.8161, 2.8201, 2.8241, 2.8281, 2.8321, 2.8361, 2.8401, 2.8441, 2.8481, 2.8521, 2.8561, 2.8601, 2.8641, 2.8681, 2.8721, 2.8761, 2.8801, 2.8841, 2.8881, 2.8921, 2.8961, 2.9001, 2.9041, 2.9081, 2.9121, 2.9161, 2.9201, 2.9241, 2.9281, 2.9321, 2.9361, 2.9401, 2.9441, 2.9481, 2.9521, 2.9561, 2.9601, 2.9641, 2.9681, 2.9721, 2.9761, 2.9801, 2.9841, 2.9881, 2.9921, 2.9961, 3.0001, 3.0041, 3.0081, 3.0121, 3.0161, 3.0201, 3.0241, 3.0281, 3.0321, 3.0361, 3.0401, 3.0441, 3.0481, 3.0521, 3.0561, 3.0601, 3.0641, 3.0681, 3.0721, 3.0761, 3.0801, 3.0841, 3.0881, 3.0921, 3.0961, 3.1001, 3.1041, 3.1081, 3.1121, 3.1161, 3.1201, 3.1241, 3.1281, 3.1321, 3.1361, 3.1401, 3.1441, 3.1481, 3.1521, 3.1561, 3.1601, 3.1641, 3.1681, 3.1721, 3.1761, 3.1801, 3.1841, 3.1881, 3.1921, 3.1961, 3.2001, 3.2041, 3.2081, 3.2121, 3.2161, 3.2201, 3.2241, 3.2281, 3.2321, 3.2361, 3.2401, 3.2441, 3.2481, 3.2521, 3.2561, 3.2601, 3.2641, 3.2681, 3.2721, 3.2761, 3.2801, 3.2841, 3.2881, 3.2921, 3.2961, 3.3001, 3.3041, 3.3081, 3.3121, 3.3161, 3.3201, 3.3241, 3.3281, 3.3321, 3.3361, 3.3401, 3.3441, 3.3481, 3.3521, 3.3561, 3.3601, 3.3641, 3.3681, 3.3721, 3.3761, 3.3801, 3.3841, 3.3881, 3.3921, 3.3961, 3.4001, 3.4041, 3.4081, 3.4121, 3.4161, 3.4201, 3.4241, 3.4281, 3.4321, 3.4361, 3.4401, 3.4441, 3.4481, 3.4521, 3.4561, 3.4601, 3.4641, 3.4681, 3.4721, 3.4761, 3.4801, 3.4841, 3.4881, 3.4921, 3.4961, 3.5001, 3.5041, 3.5081, 3.5121, 3.5161, 3.5201, 3.5241, 3.5281, 3.5321, 3.5361, 3.5401, 3.5441, 3.5481, 3.5521, 3.5561, 3.5601, 3.5641, 3.5681, 3.5721, 3.5761, 3.5801, 3.5841, 3.5881, 3.5921, 3.5961, 3.6001, 3.6041, 3.6081, 3.6121, 3.6161, 3.6201, 3.6241, 3.6281, 3.6321, 3.6361, 3.6401, 3.6441, 3.6481, 3.6521, 3.6561, 3.6601, 3.6641, 3.6681, 3.6721, 3.6761, 3.6801, 3.6841, 3.6881, 3.6921, 3.6961, 3.7001, 3.7041, 3.7081, 3.7121, 3.7161, 3.7201, 3.7241, 3.7281, 3.7321, 3.7361, 3.7401, 3.7441, 3.7481, 3.7521, 3.7561, 3.7601, 3.7641, 3.7681, 3.7721, 3.7761, 3.7801, 3.7841, 3.7881, 3.7921, 3.7961, 3.8001, 3.8041, 3.8081, 3.8121, 3.8161, 3.8201, 3.8241, 3.8281, 3.8321, 3.8361, 3.8401, 3.8441, 3.8481, 3.8521, 3.8561, 3.8601, 3.8641, 3.8681, 3.8721, 3.8761, 3.8801, 3.8841, 3.8881, 3.8921, 3.8961, 3.9001, 3.9041, 3.9081, 3.9121, 3.9161, 3.9201, 3.9241, 3.9281, 3.9321, 3.9361, 3.9401, 3.9441, 3.9481, 3.9521, 3.9561, 3.9601, 3.9641, 3.9681, 3.9721, 3.9761, 3.9801, 3.9841, 3.9881, 3.9921, 3.9961, 4.0001, 4.0041, 4.0081, 4.0121, 4.0161, 4.0201, 4.0241, 4.0281, 4.0321, 4.0361, 4.0401, 4.0441, 4.0481, 4.0521, 4.0561, 4.0601, 4.0641, 4.0681, 4.0721, 4.0761, 4.0801, 4.0841, 4.0881, 4.0921, 4.0961, 4.1001, 4.1041, 4.1081, 4.1121, 4.1161, 4.1201, 4.1241, 4.1281, 4.1321, 4.1361, 4.1401, 4.1441, 4.1481, 4.1521, 4.1561, 4.1601, 4.1641, 4.1681, 4.1721, 4.1761, 4.1801, 4.1841, 4.1881, 4.1921, 4.1961, 4.2001, 4.2041, 4.2081, 4.2121, 4.2161, 4.2201, 4.2241, 4.2281, 4.2321, 4.2361, 4.2401, 4.2441, 4.2481, 4.2521, 4.2561, 4.2601, 4.2641, 4.2681, 4.2721, 4.2761, 4.2801, 4.2841, 4.2881, 4.2921, 4.2961, 4.3001, 4.3041, 4.3081, 4.3121, 4.3161, 4.3201, 4.3241, 4.3281, 4.3321, 4.3361, 4.3401, 4.3441, 4.3481, 4.3521, 4.3561, 4.3601, 4.3641, 4.3681, 4.3721, 4.3761, 4.3801, 4.3841, 4.3881, 4.3921, 4.3961, 4.4001, 4.4041, 4.4081, 4.4121, 4.4161, 4.4201, 4.4241, 4.4281, 4.4321, 4.4361, 4.4401, 4.4441, 4.4481, 4.4521, 4.4561, 4.4601, 4.4641, 4.4681, 4.4721, 4.4761, 4.4801, 4.4841, 4.4881, 4.4921, 4.4961, 4.5001, 4.5041, 4.5081, 4.5121, 4.5161, 4.5201, 4.5241, 4.5281, 4.5321, 4.5361, 4.5401, 4.5441, 4.5481, 4.5521, 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