Intro to Data Frames in R

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Data frame definition

A **data frame** is used for storing data tables. It a list a vector of equal length.

When we import data to R, data frame is the preferred way for storing the data because columns can have different modes (character, numeric, integer, logical, complex).

Data frame built-in example

Let's look into a built-in data frame from package "datasets" - cars. The data give the speed of cars and the distances taken to stop.

```
cars
```

```
##    speed dist
## 1      4    2
## 2      4   10
## 3      7    4
## 4      7   22
## 5      8   16
## 6      9   10
## 7     10   18
## 8     10   26
## 9     10   34
## 10    11   17
## 11    11   28
## 12    12   14
## 13    12   20
## 14    12   24
## 15    12   28
## 16    13   26
## 17    13   34
## 18    13   34
## 19    13   46
## 20    14   26
## 21    14   36
## 22    14   60
## 23    14   80
## 24    15   20
## 25    15   26
## 26    15   54
## 27    16   32
## 28    16   40
## 29    17   32
```

```
## 30    17   40
## 31    17   50
## 32    18   42
## 33    18   56
## 34    18   76
## 35    18   84
## 36    19   36
## 37    19   46
## 38    19   68
## 39    20   32
## 40    20   48
## 41    20   52
## 42    20   56
## 43    20   64
## 44    22   66
## 45    23   54
## 46    24   70
## 47    24   92
## 48    24   93
## 49    24  120
## 50    25   85
```

Note that it has 2 columns and 50 rows.

Data frame columns

Suppose you want just the column speed. How would you access that data?

```
cars$speed
```

```
##  [1]  4  4  7  7  8  9 10 10 10 11 11 12 12 12 12 13 13 13 13 14 14 14 14 15 15
## [26] 15 16 16 17 17 17 18 18 18 18 19 19 19 20 20 20 20 20 22 23 24 24 24 24 25
```

```
cars$speed
```

```
##  [1]  4  4  7  7  8  9 10 10 10 11 11 12 12 12 12 13 13 13 13 14 14 14 14 15 15
## [26] 15 16 16 17 17 17 18 18 18 18 19 19 19 20 20 20 20 20 22 23 24 24 24 24 25
```

How would you store it on another object?

```
car_speed <- cars$speed
car_speed
```

```
##  [1]  4  4  7  7  8  9 10 10 10 11 11 12 12 12 12 13 13 13 13 14 14 14 14 15 15
## [26] 15 16 16 17 17 17 18 18 18 18 19 19 19 20 20 20 20 20 22 23 24 24 24 24 25
```

```
car_speed <- cars$speed
car_speed
```

```
##  [1]  4  4  7  7  8  9 10 10 10 11 11 12 12 12 12 13 13 13 13 14 14 14 14 15 15
## [26] 15 16 16 17 17 17 18 18 18 18 19 19 19 20 20 20 20 20 22 23 24 24 24 24 25
```

Transforming object in a data frame

Is the new object you create a data frame?

```
#Option 1
class(car_speed)
```

```
## [1] "numeric"
```

```
#Option 1
class(car_speed)
```

```
## [1] "numeric"
```

```
#Option 2
is.data.frame(car_speed)
```

```
## [1] FALSE
```

How could you make it a data frame?

```
#Option 2
is.data.frame(car_speed)
```

```
## [1] FALSE
```

```
#Option 2
is.data.frame(car_speed)
```

```
## [1] FALSE
```

```
df_car_speed <- as.data.frame(car_speed)
df_car_speed
```

```
##    car_speed
## 1          4
## 2          4
## 3          7
## 4          7
## 5          8
## 6          9
## 7         10
## 8         10
## 9         10
## 10        11
## 11        11
## 12        12
## 13        12
## 14        12
## 15        12
## 16        13
## 17        13
## 18        13
## 19        13
## 20        14
## 21        14
## 22        14
## 23        14
## 24        15
## 25        15
## 26        15
## 27        16
## 28        16
## 29        17
## 30        17
```

```
## 31        17
## 32        18
## 33        18
## 34        18
## 35        18
## 36        19
## 37        19
## 38        19
## 39        20
## 40        20
## 41        20
## 42        20
## 43        20
## 44        22
## 45        23
## 46        24
## 47        24
## 48        24
## 49        24
## 50        25
```

```
class(df_car_speed)
```

```
## [1] "data.frame"
```

```
df_car_speed <- as.data.frame(car_speed)
df_car_speed
```

```
##    car_speed
## 1          4
## 2          4
## 3          7
## 4          7
## 5          8
## 6          9
## 7         10
## 8         10
## 9         10
## 10        11
## 11        11
## 12        12
## 13        12
## 14        12
## 15        12
## 16        13
## 17        13
## 18        13
## 19        13
## 20        14
## 21        14
## 22        14
## 23        14
## 24        15
## 25        15
## 26        15
```

```
## 27        16
## 28        16
## 29        17
## 30        17
## 31        17
## 32        18
## 33        18
## 34        18
## 35        18
## 36        19
## 37        19
## 38        19
## 39        20
## 40        20
## 41        20
## 42        20
## 43        20
## 44        22
## 45        23
## 46        24
## 47        24
## 48        24
## 49        24
## 50        25
```

```
class(df_car_speed)
```

```
## [1] "data.frame"
```

Adding columns to a data frame

How could you add columns to *df_car_speed*?

```
car_dist <- cars$dist

#Option 1
df <- cbind(df_car_speed,car_dist)  #similarly rows could be added using rbind()
class(df)
```

```
## [1] "data.frame"
```

```
df
```

```
##    car_speed car_dist
## 1          4        2
## 2          4       10
## 3          7        4
## 4          7       22
## 5          8       16
## 6          9       10
## 7         10       18
## 8         10       26
## 9         10       34
## 10        11       17
## 11        11       28
## 12        12       14
## 13        12       20
```

```
## 14        12       24
## 15        12       28
## 16        13       26
## 17        13       34
## 18        13       34
## 19        13       46
## 20        14       26
## 21        14       36
## 22        14       60
## 23        14       80
## 24        15       20
## 25        15       26
## 26        15       54
## 27        16       32
## 28        16       40
## 29        17       32
## 30        17       40
## 31        17       50
## 32        18       42
## 33        18       56
## 34        18       76
## 35        18       84
## 36        19       36
## 37        19       46
## 38        19       68
## 39        20       32
## 40        20       48
## 41        20       52
## 42        20       56
## 43        20       64
## 44        22       66
## 45        23       54
## 46        24       70
## 47        24       92
## 48        24       93
## 49        24      120
## 50        25       85
```

```
#Or Option 2 - transform into a data frame before binding
df_car_dist <- as.data.frame(car_dist)  #op2
df_opt2 <- cbind(df_car_speed,df_car_dist)
class(df_opt2)
```

```
## [1] "data.frame"
```

```
df_opt2
```

```
##    car_speed car_dist
## 1          4        2
## 2          4       10
## 3          7        4
## 4          7       22
## 5          8       16
## 6          9       10
## 7         10       18
## 8         10       26
```

```
## 9         10       34
## 10        11       17
## 11        11       28
## 12        12       14
## 13        12       20
## 14        12       24
## 15        12       28
## 16        13       26
## 17        13       34
## 18        13       34
## 19        13       46
## 20        14       26
## 21        14       36
## 22        14       60
## 23        14       80
## 24        15       20
## 25        15       26
## 26        15       54
## 27        16       32
## 28        16       40
## 29        17       32
## 30        17       40
## 31        17       50
## 32        18       42
## 33        18       56
## 34        18       76
## 35        18       84
## 36        19       36
## 37        19       46
## 38        19       68
## 39        20       32
## 40        20       48
## 41        20       52
## 42        20       56
## 43        20       64
## 44        22       66
## 45        23       54
## 46        24       70
## 47        24       92
## 48        24       93
## 49        24      120
## 50        25       85
```

```
car_dist <- cars$dist

#Option 1
df <- cbind(df_car_speed,car_dist) #similarly rows could be added using rbind()
class(df)
```

```
## [1] "data.frame"
```

```
df
```

```
##    car_speed car_dist
## 1          4        2
## 2          4       10
```

```
## 3          7        4
## 4          7       22
## 5          8       16
## 6          9       10
## 7         10       18
## 8         10       26
## 9         10       34
## 10        11       17
## 11        11       28
## 12        12       14
## 13        12       20
## 14        12       24
## 15        12       28
## 16        13       26
## 17        13       34
## 18        13       34
## 19        13       46
## 20        14       26
## 21        14       36
## 22        14       60
## 23        14       80
## 24        15       20
## 25        15       26
## 26        15       54
## 27        16       32
## 28        16       40
## 29        17       32
## 30        17       40
## 31        17       50
## 32        18       42
## 33        18       56
## 34        18       76
## 35        18       84
## 36        19       36
## 37        19       46
## 38        19       68
## 39        20       32
## 40        20       48
## 41        20       52
## 42        20       56
## 43        20       64
## 44        22       66
## 45        23       54
## 46        24       70
## 47        24       92
## 48        24       93
## 49        24      120
## 50        25       85
```

```
#Or Option 2 - transform into a data frame before binding
df_car_dist <- as.data.frame(car_dist) #op2
df_opt2 <- cbind(df_car_speed,df_car_dist)
class(df_opt2)
```

```
## [1] "data.frame"
```

```
df_opt2
```

```
##    car_speed car_dist
## 1          4        2
## 2          4       10
## 3          7        4
## 4          7       22
## 5          8       16
## 6          9       10
## 7         10       18
## 8         10       26
## 9         10       34
## 10        11       17
## 11        11       28
## 12        12       14
## 13        12       20
## 14        12       24
## 15        12       28
## 16        13       26
## 17        13       34
## 18        13       34
## 19        13       46
## 20        14       26
## 21        14       36
## 22        14       60
## 23        14       80
## 24        15       20
## 25        15       26
## 26        15       54
## 27        16       32
## 28        16       40
## 29        17       32
## 30        17       40
## 31        17       50
## 32        18       42
## 33        18       56
## 34        18       76
## 35        18       84
## 36        19       36
## 37        19       46
## 38        19       68
## 39        20       32
## 40        20       48
## 41        20       52
## 42        20       56
## 43        20       64
## 44        22       66
## 45        23       54
## 46        24       70
## 47        24       92
## 48        24       93
## 49        24      120
## 50        25       85
```

Note that when we transformed the vector in a data frame the name of the vector became the column name.

```
colnames(df)  #or simply names()
```

```
## [1] "car_speed" "car_dist"
```

```
names(df)
```

```
## [1] "car_speed" "car_dist"
```

```
colnames(df) #or simply names()
```

```
## [1] "car_speed" "car_dist"
```

```
names(df)
```

```
## [1] "car_speed" "car_dist"
```

Creating a data frame

How would you create a data frame?

```
#useful function data.frame()
create_df <- data.frame("speed"=car_speed,"dist"=car_dist)
create_df
```

```
##    speed dist
## 1      4    2
## 2      4   10
## 3      7    4
## 4      7   22
## 5      8   16
## 6      9   10
## 7     10   18
## 8     10   26
## 9     10   34
## 10    11   17
## 11    11   28
## 12    12   14
## 13    12   20
## 14    12   24
## 15    12   28
## 16    13   26
## 17    13   34
## 18    13   34
## 19    13   46
## 20    14   26
## 21    14   36
## 22    14   60
## 23    14   80
## 24    15   20
## 25    15   26
## 26    15   54
## 27    16   32
## 28    16   40
## 29    17   32
## 30    17   40
## 31    17   50
```

```
## 32    18   42
## 33    18   56
## 34    18   76
## 35    18   84
## 36    19   36
## 37    19   46
## 38    19   68
## 39    20   32
## 40    20   48
## 41    20   52
## 42    20   56
## 43    20   64
## 44    22   66
## 45    23   54
## 46    24   70
## 47    24   92
## 48    24   93
## 49    24  120
## 50    25   85
```

```
#useful function data.frame()
create_df <- data.frame("speed"=car_speed,"dist"=car_dist)
create_df
```

```
##    speed dist
## 1      4    2
## 2      4   10
## 3      7    4
## 4      7   22
## 5      8   16
## 6      9   10
## 7     10   18
## 8     10   26
## 9     10   34
## 10    11   17
## 11    11   28
## 12    12   14
## 13    12   20
## 14    12   24
## 15    12   28
## 16    13   26
## 17    13   34
## 18    13   34
## 19    13   46
## 20    14   26
## 21    14   36
## 22    14   60
## 23    14   80
## 24    15   20
## 25    15   26
## 26    15   54
## 27    16   32
## 28    16   40
## 29    17   32
## 30    17   40
```

```
## 31    17   50
## 32    18   42
## 33    18   56
## 34    18   76
## 35    18   84
## 36    19   36
## 37    19   46
## 38    19   68
## 39    20   32
## 40    20   48
## 41    20   52
## 42    20   56
## 43    20   64
## 44    22   66
## 45    23   54
## 46    24   70
## 47    24   92
## 48    24   93
## 49    24  120
## 50    25   85
```

Data frame functions

Some useful functions to use with data frames.

```
ncol(df)
```

```
## [1] 2
```

```
nrow(df)
```

```
## [1] 50
```

```
length(df)  #same as ncol
```

```
## [1] 2
```

```
summary(df)
```

```
##    car_speed       car_dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

```
head(df) #show the first 6 rows of df
```

```
##   car_speed car_dist
## 1         4        2
## 2         4       10
## 3         7        4
## 4         7       22
## 5         8       16
## 6         9       10
```

```r
#If you know the number of the column you want you can refer to that to access column
df[,1]
```

```
##  [1]  4  4  7  7  8  9 10 10 10 11 11 12 12 12 12 13 13 13 13 14 14 14 14 15 15
## [26] 15 16 16 17 17 17 18 18 18 18 19 19 19 20 20 20 20 20 22 23 24 24 24 24 25
```

```r
#you could also use this notation to delete columns
df <- df[,-2]
df
```

```
##  [1]  4  4  7  7  8  9 10 10 10 11 11 12 12 12 12 13 13 13 13 14 14 14 14 15 15
## [26] 15 16 16 17 17 17 18 18 18 18 19 19 19 20 20 20 20 20 22 23 24 24 24 24 25
```