# RBasics 2

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List elements can be any data type and any dimensions Each element can be given a name

Arrays - are n-dimensional data structures

## Heterogeneous structure

List are one- dimension data is not one time only

```
my_list <- c(6, TRUE, "hello")
str(my_list)
```

```
##  chr [1:3] "6" "TRUE" "hello"
```

```
my_list <- list(6, TRUE, "hello")
str(my_list)
```

```
## List of 3
##  $ : num 6
##  $ : logi TRUE
##  $ : chr "hello"
```

vector- homogeneous sa data structure nga type

Data is read into the matrix down the columns, starting left and moving right.

Named list elements can be accessed by using $

```
new_list <- list(
scalar = c("Hello", "Goodbye"),
matrix = matrix(1:4, nrow=2, ncol=2)
)
str(new_list)
```

```
## List of 2
##  $ scalar: chr [1:2] "Hello" "Goodbye"
##  $ matrix: int [1:2, 1:2] 1 2 3 4
```

```
new_list$matrix
```

```
##      [,1] [,2]
## [1,]    1    3
## [2,]    2    4
```

Data frames most used data structure, named list of vectors of the same length with each vector as a column

similar to database table, google sheet, excel

two vectors of different types but same length

```
names <- c("John", "Ayesha")
ages <- c(31, 24)
(df <- data.frame(names, ages)) #create dataframe
```

```
##    names ages
## 1   John   31
## 2 Ayesha   24
```

```
str(df) #get two types of columns
```

```
## 'data.frame':    2 obs. of  2 variables:
##  $ names: chr  "John" "Ayesha"
##  $ ages : num  31 24
```

```
dim(df) #get dimensions
```

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

```
names <- c("John", "Ayesha")
ages <- c(31, 24)
(df <- data.frame(names, ages))
```

```
##    names ages
## 1   John   31
## 2 Ayesha   24
```

```
str(df)
```

```
## 'data.frame':    2 obs. of  2 variables:
##  $ names: chr  "John" "Ayesha"
##  $ ages : num  31 24
```

```
dim(df)
```

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

dataframe most commonly used by data analyst

to work with data in R, usually need to pull it in from an outside source into a dataframe

R data sets

r facilitates numerous ways of importing, databases

The read.csv() function can accept a URL address of the file if it is online

```
# url of dataset
url <- "https://raw.githubusercontent.com/msuiitdmsgabriel/datasets-regression/main/salespeople.csv"
# load the data set and store it as a dataframe called salespeople
salespeople <- read.csv(url)
View(salespeople)
```

read downloaded file

read.csv("salespeople.csv") salespeople_local <- read.csv("salespeople.csv")

we can view dimensions, and if it is too big to display, we can use the head() function to display just the first few rows

```
dim(salespeople)
```

```
## [1] 351   4
```

```
# hundreds of rows, so view first few
head(salespeople)
```

```
##   promoted sales customer_rate performance
## 1        0   594          3.94           2
## 2        0   446          4.06           3
## 3        1   674          3.83           4
## 4        0   525          3.62           2
## 5        1   657          4.40           3
## 6        1   918          4.54           2
```

view a specific view by using $ sign and use

```
salespeople$sales
```

```
##   [1] 594 446 674 525 657 918 318 364 342 387 527 716 557 450 344 372 258 338
##  [19] 410 937 702 469 535 342 819 736 330 274 341 717 478 487 239 825 400 728
##  [37] 773 425 943 510 389 270 945 497 329 389 475 383 432 619 578 411 445 440
##  [55] 359 419 840 393 754 441 803 444 753 688 431 511 464 473 532 280 342 320
##  [73] 531 373 547 611 825 431 401 517 803 586 444 693 659 416 423 756 245 419
##  [91] 757 617 909 516 317 425 528 416 645 390 393 394 387 450 487 607 369 489
## [109] 324 417 694 651 395 442 422 404 381 501 944 753 591 735 538 451 477 436
## [127] 738 902 464 944 285 453 382 414 335 935 203 348 800 436 360 674 425 901
## [145] 453 350 362 486 471 459 506 262 825 291 464 802 818 736 364 308 862 349
## [163] 375 423 938 456 517 373 898 777 470 545 699 697 300 677 497 669 596 492
## [181] 346 590 592 780 432 418 662 678 716 330 414 416 403 362 284 363 655 597
## [199] 794 818 409 681 606 489 475 590 396 420 857 371 421 828 594 533 462 392
## [217] 475 752 659 650 496 211 898 388 383 455 319 756 377 940 757 469 394 484
## [235] 491 547 519 739 479 943 742 357 432 584 595 401 460 753 466 362 361 338
## [253] 882 293 922 793 787 400 516 295 307 151 441 406 270 680 662 347 453 309
```

```
## [271] 592 540 886 420 718 284 323 513 841 362 842 321 516 428 383 521 358 489
## [289] 252 720 610 871 594 522 379 454 450 317 835 297 516 355 858 305 410 707
## [307] 798 265 576 448 590 456 930 412 286 440 546 385 544 505 732 506 394 674
## [325] 458 251 429 348 789 795 509 754 580 289 390 787 241 522 412 359 489 940
## [343] 592 796 653 459 586 401 500 373  NA
```

```
salespeople$sales[6]
```

```
## [1] 918
```

use [row, column] index to get a specific entry in the dataframe

salespeople[34,4]

```
salespeople[34,4] #access specific row and column
```

```
## [1] 3
```

```
salespeople[34,] #access the whole row
```

```
##    promoted sales customer_rate performance
## 34        1   825          3.32           3
```

```
salespeople[,4] #access the whole column
```

```
##   [1]  2  3  4  2  3  2  3  1  3  3  3  3  2  3  2  3  1  4  2  2  4  2  2  1  2
##  [26]  4  2  1  2  2  2  1  4  3  2  3  3  1  4  3  4  2  4  3  3  4  3  2  3  3
##  [51]  4  4  3  2  1  3  4  1  3  2  3  2  4  2  4  2  3  2  1  2  2  3  4  2  1
##  [76]  4  2  3  2  3  3  1  4  3  1  3  3  4  2  2  3  1  3  1  1  3  2  1  2  4
## [101]  1  2  3  3  3  4  1  2  3  1  2  4  2  1  3  3  4  4  2  3  4  4  3  2  3
## [126]  2  3  4  1  4  3  2  2  2  3  3  2  3  2  3  1  3  3  3  2  3  2  1  2  3
## [151]  3  2  3  2  3  2  3  3  3  1  4  4  2  3  3  1  2  1  4  3  3  4  4  3  2
## [176]  3  1  4  2  3  2  2  3  4  2  2  4  3  3  1  1  2  1  3  3  1  3  3  3  1
## [201]  1  1  3  2  3  3  2  2  2  2  3  4  1  2  2  3  3  2  2  2  3  1  3  1  2
## [226]  3  4  3  3  3  3  3  1  2  4  2  4  3  2  4  2  1  3  2  2  3  2  2  2  2
## [251]  2  3  3  2  1  2  3  2  4  2  1  2  2  1  2  4  2  3  1  1  2  4  3  4  4
## [276]  2  3  3  4  1  3  1  3  4  3  1  2  3  2  3  4  2  3  2  3  2  2  2  1  4
## [301]  3  2  3  3  3  1  3  2  3  1  3  3  4  2  1  1  1  3  1  1  2  3  4  2  4
## [326]  2  1  3  3  1  3  4  1  3  3  1  2  2  2  2  3  4  4  3  3  3  2  3  2  1
## [351] NA
```

look at datatypes using str

```
str(salespeople)
```

```
## 'data.frame':    351 obs. of  4 variables:
##  $ promoted     : int  0 0 1 0 1 1 0 0 0 0 ...
##  $ sales        : int  594 446 674 525 657 918 318 364 342 387 ...
##  $ customer_rate: num  3.94 4.06 3.83 3.62 4.4 4.54 3.09 4.89 3.74 3 ...
##  $ performance  : int  2 3 4 2 3 2 3 1 3 3 ...
```

see statistical summary of each column by using summary(), which tells us various statistics depending on the type of the column

```
summary(salespeople)
```

```
##     promoted          sales       customer_rate    performance
##  Min.   :0.0000   Min.   :151.0   Min.   :1.000   Min.   :1.0
##  1st Qu.:0.0000   1st Qu.:389.2   1st Qu.:3.000   1st Qu.:2.0
##  Median :0.0000   Median :475.0   Median :3.620   Median :3.0
##  Mean   :0.3219   Mean   :527.0   Mean   :3.608   Mean   :2.5
##  3rd Qu.:1.0000   3rd Qu.:667.2   3rd Qu.:4.290   3rd Qu.:3.0
##  Max.   :1.0000   Max.   :945.0   Max.   :5.000   Max.   :4.0
##                   NA's   :1       NA's   :1       NA's   :1
```

note that there are missing data in this dataframe(NA)

missing data denoted as NA

function is.na() look at all values in a vector or dataframe and return TRUE, False

by adding sum() function, counts NA as 1

counts how many missing data in dataframe

```
is.na(salespeople$sales)
```

```
##   [1] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [13] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [25] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [37] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [49] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [61] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [73] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [85] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [97] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [109] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [121] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [133] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [145] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [157] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [169] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [181] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [193] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [205] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [217] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [229] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [241] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [253] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [265] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [277] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [289] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [301] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [313] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [325] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [337] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [349] FALSE FALSE  TRUE
```

```
is.na(salespeople)
```

```
##        promoted sales customer_rate performance
##   [1,]    FALSE FALSE         FALSE       FALSE
##   [2,]    FALSE FALSE         FALSE       FALSE
##   [3,]    FALSE FALSE         FALSE       FALSE
##   [4,]    FALSE FALSE         FALSE       FALSE
##   [5,]    FALSE FALSE         FALSE       FALSE
##   [6,]    FALSE FALSE         FALSE       FALSE
##   [7,]    FALSE FALSE         FALSE       FALSE
##   [8,]    FALSE FALSE         FALSE       FALSE
##   [9,]    FALSE FALSE         FALSE       FALSE
##  [10,]    FALSE FALSE         FALSE       FALSE
##  [11,]    FALSE FALSE         FALSE       FALSE
##  [12,]    FALSE FALSE         FALSE       FALSE
##  [13,]    FALSE FALSE         FALSE       FALSE
##  [14,]    FALSE FALSE         FALSE       FALSE
##  [15,]    FALSE FALSE         FALSE       FALSE
##  [16,]    FALSE FALSE         FALSE       FALSE
##  [17,]    FALSE FALSE         FALSE       FALSE
##  [18,]    FALSE FALSE         FALSE       FALSE
##  [19,]    FALSE FALSE         FALSE       FALSE
##  [20,]    FALSE FALSE         FALSE       FALSE
##  [21,]    FALSE FALSE         FALSE       FALSE
##  [22,]    FALSE FALSE         FALSE       FALSE
##  [23,]    FALSE FALSE         FALSE       FALSE
##  [24,]    FALSE FALSE         FALSE       FALSE
##  [25,]    FALSE FALSE         FALSE       FALSE
##  [26,]    FALSE FALSE         FALSE       FALSE
##  [27,]    FALSE FALSE         FALSE       FALSE
##  [28,]    FALSE FALSE         FALSE       FALSE
##  [29,]    FALSE FALSE         FALSE       FALSE
##  [30,]    FALSE FALSE         FALSE       FALSE
##  [31,]    FALSE FALSE         FALSE       FALSE
##  [32,]    FALSE FALSE         FALSE       FALSE
##  [33,]    FALSE FALSE         FALSE       FALSE
##  [34,]    FALSE FALSE         FALSE       FALSE
##  [35,]    FALSE FALSE         FALSE       FALSE
##  [36,]    FALSE FALSE         FALSE       FALSE
##  [37,]    FALSE FALSE         FALSE       FALSE
##  [38,]    FALSE FALSE         FALSE       FALSE
##  [39,]    FALSE FALSE         FALSE       FALSE
##  [40,]    FALSE FALSE         FALSE       FALSE
##  [41,]    FALSE FALSE         FALSE       FALSE
##  [42,]    FALSE FALSE         FALSE       FALSE
##  [43,]    FALSE FALSE         FALSE       FALSE
##  [44,]    FALSE FALSE         FALSE       FALSE
##  [45,]    FALSE FALSE         FALSE       FALSE
##  [46,]    FALSE FALSE         FALSE       FALSE
##  [47,]    FALSE FALSE         FALSE       FALSE
##  [48,]    FALSE FALSE         FALSE       FALSE
##  [49,]    FALSE FALSE         FALSE       FALSE
##  [50,]    FALSE FALSE         FALSE       FALSE
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##  [51,]    FALSE FALSE         FALSE       FALSE
##  [52,]    FALSE FALSE         FALSE       FALSE
##  [53,]    FALSE FALSE         FALSE       FALSE
##  [54,]    FALSE FALSE         FALSE       FALSE
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##  [61,]    FALSE FALSE         FALSE       FALSE
##  [62,]    FALSE FALSE         FALSE       FALSE
##  [63,]    FALSE FALSE         FALSE       FALSE
##  [64,]    FALSE FALSE         FALSE       FALSE
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##  [68,]    FALSE FALSE         FALSE       FALSE
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## [100,]    FALSE FALSE         FALSE       FALSE
## [101,]    FALSE FALSE         FALSE       FALSE
## [102,]    FALSE FALSE         FALSE       FALSE
## [103,]    FALSE FALSE         FALSE       FALSE
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## [105,]    FALSE FALSE         FALSE       FALSE
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## [262,]    FALSE FALSE         FALSE       FALSE
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## [267,]    FALSE FALSE         FALSE       FALSE
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## [303,]    FALSE FALSE         FALSE       FALSE
## [304,]    FALSE FALSE         FALSE       FALSE
## [305,]    FALSE FALSE         FALSE       FALSE
## [306,]    FALSE FALSE         FALSE       FALSE
## [307,]    FALSE FALSE         FALSE       FALSE
## [308,]    FALSE FALSE         FALSE       FALSE
## [309,]    FALSE FALSE         FALSE       FALSE
## [310,]    FALSE FALSE         FALSE       FALSE
## [311,]    FALSE FALSE         FALSE       FALSE
## [312,]    FALSE FALSE         FALSE       FALSE
## [313,]    FALSE FALSE         FALSE       FALSE
## [314,]    FALSE FALSE         FALSE       FALSE
## [315,]    FALSE FALSE         FALSE       FALSE
## [316,]    FALSE FALSE         FALSE       FALSE
## [317,]    FALSE FALSE         FALSE       FALSE
## [318,]    FALSE FALSE         FALSE       FALSE
## [319,]    FALSE FALSE         FALSE       FALSE
## [320,]    FALSE FALSE         FALSE       FALSE
```

```
## [321,]    FALSE FALSE         FALSE       FALSE
## [322,]    FALSE FALSE         FALSE       FALSE
## [323,]    FALSE FALSE         FALSE       FALSE
## [324,]    FALSE FALSE         FALSE       FALSE
## [325,]    FALSE FALSE         FALSE       FALSE
## [326,]    FALSE FALSE         FALSE       FALSE
## [327,]    FALSE FALSE         FALSE       FALSE
## [328,]    FALSE FALSE         FALSE       FALSE
## [329,]    FALSE FALSE         FALSE       FALSE
## [330,]    FALSE FALSE         FALSE       FALSE
## [331,]    FALSE FALSE         FALSE       FALSE
## [332,]    FALSE FALSE         FALSE       FALSE
## [333,]    FALSE FALSE         FALSE       FALSE
## [334,]    FALSE FALSE         FALSE       FALSE
## [335,]    FALSE FALSE         FALSE       FALSE
## [336,]    FALSE FALSE         FALSE       FALSE
## [337,]    FALSE FALSE         FALSE       FALSE
## [338,]    FALSE FALSE         FALSE       FALSE
## [339,]    FALSE FALSE         FALSE       FALSE
## [340,]    FALSE FALSE         FALSE       FALSE
## [341,]    FALSE FALSE         FALSE       FALSE
## [342,]    FALSE FALSE         FALSE       FALSE
## [343,]    FALSE FALSE         FALSE       FALSE
## [344,]    FALSE FALSE         FALSE       FALSE
## [345,]    FALSE FALSE         FALSE       FALSE
## [346,]    FALSE FALSE         FALSE       FALSE
## [347,]    FALSE FALSE         FALSE       FALSE
## [348,]    FALSE FALSE         FALSE       FALSE
## [349,]    FALSE FALSE         FALSE       FALSE
## [350,]    FALSE FALSE         FALSE       FALSE
## [351,]    FALSE  TRUE          TRUE        TRUE
```

```
sum(is.na(salespeople))
```

```
## [1] 3
```

complete.cases identify rows without NAs

```
salespeople <- salespeople[complete.cases(salespeople),] #override the content of the first object with
complete.cases(salespeople)
```

```
##   [1] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [16] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [31] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [46] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [61] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [76] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [91] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [106] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [121] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [136] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [151] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
```

```
## [166] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [181] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [196] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [211] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [226] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [241] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [256] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [271] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [286] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [301] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [316] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [331] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [346] TRUE TRUE TRUE TRUE TRUE
```

```
sum(is.na(salespeople)) #confirm no NAs
```

```
## [1] 0
```

```
salespeople[complete.cases(salespeople),] #only the complete cases
```

```
##     promoted sales customer_rate performance
## 1          0   594          3.94           2
## 2          0   446          4.06           3
## 3          1   674          3.83           4
## 4          0   525          3.62           2
## 5          1   657          4.40           3
## 6          1   918          4.54           2
## 7          0   318          3.09           3
## 8          0   364          4.89           1
## 9          0   342          3.74           3
## 10         0   387          3.00           3
## 11         0   527          2.43           3
## 12         1   716          3.16           3
## 13         0   557          3.51           2
## 14         0   450          3.21           3
## 15         0   344          3.02           2
## 16         0   372          3.87           3
## 17         0   258          2.49           1
## 18         0   338          2.66           4
## 19         0   410          3.14           2
## 20         1   937          5.00           2
## 21         1   702          3.53           4
## 22         0   469          4.24           2
## 23         0   535          4.47           2
## 24         0   342          3.60           1
## 25         1   819          4.45           2
## 26         1   736          3.94           4
## 27         0   330          2.54           2
## 28         0   274          4.06           1
## 29         0   341          4.47           2
## 30         1   717          2.98           2
## 31         0   478          3.48           2
## 32         0   487          3.74           1
```

```
## 33          0   239          2.47          4
## 34          1   825          3.32          3
## 35          0   400          3.53          2
## 36          1   728          2.66          3
## 37          1   773          4.89          3
## 38          0   425          3.62          1
## 39          1   943          4.40          4
## 40          0   510          2.56          3
## 41          0   389          3.34          4
## 42          0   270          2.56          2
## 43          1   945          4.31          4
## 44          0   497          3.02          3
## 45          0   329          2.86          3
## 46          0   389          2.98          4
## 47          0   475          3.39          3
## 48          0   383          2.36          2
## 49          1   432          2.33          3
## 50          1   619          1.94          3
## 51          1   578          4.17          4
## 52          0   411          3.07          4
## 53          0   445          3.00          3
## 54          0   440          3.62          2
## 55          0   359          3.92          1
## 56          0   419          3.85          3
## 57          1   840          5.00          4
## 58          0   393          4.49          1
## 59          1   754          3.74          3
## 60          0   441          4.75          2
## 61          1   803          4.89          3
## 62          0   444          4.15          2
## 63          1   753          5.00          4
## 64          1   688          4.29          2
## 65          0   431          4.29          4
## 66          0   511          3.74          2
## 67          0   464          2.22          3
## 68          0   473          3.57          2
## 69          0   532          3.74          1
## 70          0   280          3.41          2
## 71          0   342          3.71          2
## 72          0   320          2.15          3
## 73          0   531          3.41          4
## 74          0   373          2.01          2
## 75          0   547          4.40          1
## 76          1   611          4.03          4
## 77          1   825          4.66          2
## 78          0   431          3.62          3
## 79          0   401          3.69          2
## 80          0   517          4.20          3
## 81          1   803          4.15          3
## 82          0   586          5.00          1
## 83          0   444          3.21          4
## 84          1   693          3.80          3
## 85          1   659          4.20          1
## 86          0   416          3.87          3
```

```
## 87          0   423          2.75          3
## 88          1   756          3.55          4
## 89          0   245          2.52          2
## 90          0   419          3.76          2
## 91          1   757          3.11          3
## 92          1   617          4.33          1
## 93          1   909          3.21          3
## 94          0   516          2.47          1
## 95          0   317          1.51          1
## 96          0   425          3.53          3
## 97          0   528          4.63          2
## 98          0   416          3.37          1
## 99          1   645          4.08          2
## 100         0   390          3.16          4
## 101         0   393          3.76          1
## 102         0   394          3.07          2
## 103         0   387          3.87          3
## 104         0   450          3.62          3
## 105         0   487          3.46          3
## 106         1   607          2.49          4
## 107         0   369          2.22          1
## 108         0   489          4.98          2
## 109         0   324          3.05          3
## 110         0   417          4.47          1
## 111         1   694          1.90          2
## 112         1   651          5.00          4
## 113         0   395          3.46          2
## 114         0   442          2.29          1
## 115         0   422          4.54          3
## 116         0   404          4.06          3
## 117         0   381          3.37          4
## 118         0   501          4.77          4
## 119         1   944          5.00          2
## 120         1   753          4.43          3
## 121         0   591          4.93          4
## 122         1   735          4.03          4
## 123         1   538          3.05          3
## 124         0   451          4.49          2
## 125         0   477          3.87          3
## 126         0   436          4.13          2
## 127         1   738          3.05          3
## 128         1   902          5.00          4
## 129         0   464          3.90          1
## 130         1   944          3.92          4
## 131         0   285          3.53          3
## 132         0   453          4.68          2
## 133         0   382          3.51          2
## 134         0   414          2.03          2
## 135         0   335          3.71          3
## 136         1   935          5.00          3
## 137         0   203          2.72          2
## 138         0   348          5.00          3
## 139         1   800          4.24          2
## 140         0   436          3.51          3
```

```
## 141        0   360         3.23          1
## 142        1   674         4.47          3
## 143        0   425         2.43          3
## 144        1   901         2.70          3
## 145        0   453         4.98          2
## 146        0   350         3.00          3
## 147        0   362         2.89          2
## 148        0   486         3.41          1
## 149        0   471         4.38          2
## 150        0   459         5.00          3
## 151        0   506         5.00          3
## 152        0   262         2.70          2
## 153        1   825         4.95          3
## 154        0   291         2.54          2
## 155        1   464         2.70          3
## 156        1   802         3.78          2
## 157        1   818         4.24          3
## 158        1   736         3.78          3
## 159        0   364         4.01          3
## 160        0   308         4.82          1
## 161        1   862         4.17          4
## 162        0   349         1.67          4
## 163        0   375         3.05          2
## 164        0   423         2.54          3
## 165        1   938         3.69          3
## 166        0   456         2.91          1
## 167        0   517         5.00          2
## 168        0   373         2.93          1
## 169        1   898         2.26          4
## 170        1   777         4.86          3
## 171        0   470         4.84          3
## 172        0   545         3.94          4
## 173        1   699         2.66          4
## 174        1   697         4.06          3
## 175        0   300         1.94          2
## 176        1   677         4.63          3
## 177        0   497         3.14          1
## 178        1   669         4.56          4
## 179        1   596         4.98          2
## 180        0   492         4.24          3
## 181        0   346         2.20          2
## 182        1   590         4.17          2
## 183        0   592         2.20          3
## 184        1   780         4.15          4
## 185        0   432         4.15          2
## 186        0   418         4.01          2
## 187        1   662         4.56          4
## 188        1   678         4.49          3
## 189        1   716         3.44          3
## 190        0   330         3.05          1
## 191        0   414         3.83          1
## 192        0   416         2.79          2
## 193        0   403         2.75          1
## 194        0   362         2.03          3
```

```
## 195        0   284          4.20          3
## 196        0   363          4.72          1
## 197        1   655          3.39          3
## 198        0   597          4.08          3
## 199        1   794          3.83          3
## 200        1   818          2.70          1
## 201        0   409          3.44          1
## 202        1   681          3.97          1
## 203        1   606          1.83          3
## 204        0   489          4.47          2
## 205        0   475          4.56          3
## 206        0   590          4.43          3
## 207        0   396          4.86          2
## 208        0   420          5.00          2
## 209        1   857          3.85          2
## 210        0   371          2.77          2
## 211        0   421          3.39          3
## 212        1   828          1.37          4
## 213        0   594          3.05          1
## 214        0   533          4.86          2
## 215        0   462          2.98          2
## 216        0   392          3.85          3
## 217        0   475          3.83          3
## 218        1   752          4.89          2
## 219        1   659          1.97          2
## 220        1   650          3.14          2
## 221        0   496          4.31          3
## 222        0   211          2.52          1
## 223        1   898          3.51          3
## 224        0   388          2.54          1
## 225        0   383          2.47          2
## 226        0   455          2.36          3
## 227        0   319          3.21          4
## 228        1   756          3.09          3
## 229        0   377          2.08          3
## 230        1   940          2.82          3
## 231        1   757          3.55          3
## 232        0   469          3.85          3
## 233        0   394          3.57          1
## 234        0   484          2.86          2
## 235        0   491          3.44          4
## 236        0   547          5.00          2
## 237        0   519          3.34          4
## 238        1   739          3.99          3
## 239        0   479          4.06          2
## 240        1   943          3.21          4
## 241        1   742          4.17          2
## 242        0   357          2.72          1
## 243        0   432          3.80          3
## 244        0   584          3.78          2
## 245        1   595          3.74          2
## 246        0   401          2.86          3
## 247        0   460          4.45          2
## 248        1   753          4.89          2
```

```
## 249        0   466          5.00          2
## 250        0   362          2.26          2
## 251        0   361          2.66          2
## 252        0   338          4.03          3
## 253        1   882          2.63          3
## 254        0   293          3.51          2
## 255        1   922          4.15          1
## 256        1   793          4.08          2
## 257        1   787          2.56          3
## 258        0   400          3.34          2
## 259        0   516          5.00          4
## 260        0   295          3.87          2
## 261        0   307          1.00          1
## 262        0   151          2.31          2
## 263        0   441          3.34          2
## 264        0   406          3.25          1
## 265        0   270          4.10          2
## 266        1   680          3.09          4
## 267        1   662          4.77          2
## 268        0   347          3.62          3
## 269        0   453          4.86          1
## 270        0   309          3.00          1
## 271        0   592          4.79          2
## 272        0   540          3.41          4
## 273        1   886          4.68          3
## 274        0   420          5.00          4
## 275        1   718          4.03          4
## 276        0   284          3.69          2
## 277        0   323          1.85          3
## 278        0   513          4.20          3
## 279        1   841          5.00          4
## 280        0   362          2.38          1
## 281        1   842          3.99          3
## 282        0   321          3.25          1
## 283        0   516          2.89          3
## 284        0   428          3.28          4
## 285        0   383          2.98          3
## 286        1   521          3.23          1
## 287        0   358          3.09          2
## 288        0   489          3.41          3
## 289        0   252          1.69          2
## 290        1   720          3.76          3
## 291        1   610          2.75          4
## 292        1   871          5.00          2
## 293        0   594          4.75          3
## 294        0   522          4.59          2
## 295        0   379          1.83          3
## 296        0   454          4.29          2
## 297        0   450          3.69          2
## 298        0   317          2.66          2
## 299        1   835          3.90          1
## 300        0   297          2.61          4
## 301        0   516          3.90          3
## 302        0   355          3.41          2
```

```
## 303        1   858          3.67           3
## 304        0   305          1.99           3
## 305        0   410          1.37           3
## 306        1   707          2.38           1
## 307        1   798          4.72           3
## 308        0   265          3.48           2
## 309        1   576          3.60           3
## 310        0   448          3.18           1
## 311        0   590          4.77           3
## 312        0   456          4.03           3
## 313        1   930          4.22           4
## 314        0   412          4.10           2
## 315        0   286          3.64           1
## 316        0   440          2.29           1
## 317        0   546          3.55           1
## 318        0   385          2.66           3
## 319        0   544          3.48           1
## 320        0   505          2.89           1
## 321        1   732          3.57           2
## 322        0   506          4.36           3
## 323        0   394          2.79           4
## 324        1   674          3.60           2
## 325        0   458          3.39           4
## 326        0   251          3.32           2
## 327        0   429          3.41           1
## 328        0   348          3.69           3
## 329        1   789          3.71           3
## 330        1   795          4.31           1
## 331        0   509          4.61           3
## 332        1   754          4.33           4
## 333        0   580          4.70           1
## 334        0   289          3.57           3
## 335        0   390          2.01           3
## 336        1   787          3.14           1
## 337        0   241          3.05           2
## 338        0   522          4.72           2
## 339        0   412          5.00           2
## 340        0   359          5.00           2
## 341        0   489          4.86           3
## 342        1   940          5.00           4
## 343        0   592          4.38           4
## 344        1   796          5.00           3
## 345        1   653          5.00           3
## 346        0   459          2.82           3
## 347        0   586          3.41           2
## 348        0   401          1.60           3
## 349        0   500          4.17           2
## 350        0   373          2.54           1
```

unique() function extract different values – unique(salespeople$performance)

```
unique(salespeople$performance)
```

```
## [1] 2 3 4 1
```

as.numeric() – change to numeric as.factor()

```
as.factor(salespeople$performance) #produce factor
```

```
##   [1] 2 3 4 2 3 2 3 1 3 3 3 3 2 3 2 3 1 4 2 2 4 2 2 1 2 4 2 1 2 2 2 1 4 3 2 3 3
##  [38] 1 4 3 4 2 4 3 3 4 3 2 3 3 4 4 3 2 1 3 4 1 3 2 3 2 4 2 4 2 3 2 1 2 2 3 4 2
##  [75] 1 4 2 3 2 3 3 1 4 3 1 3 3 4 2 2 3 1 3 1 1 3 2 1 2 4 1 2 3 3 3 4 1 2 3 1 2
## [112] 4 2 1 3 3 4 4 2 3 4 4 3 2 3 2 3 4 1 4 3 2 2 2 3 3 2 3 2 3 1 3 3 3 2 3 2 1
## [149] 2 3 3 2 3 2 3 2 3 3 3 1 4 4 2 3 3 1 2 1 4 3 3 4 4 3 2 3 1 4 2 3 2 2 3 4 2
## [186] 2 4 3 3 1 1 2 1 3 3 1 3 3 3 1 1 1 3 2 3 3 2 2 2 2 3 4 1 2 2 3 3 2 2 2 3 1
## [223] 3 1 2 3 4 3 3 3 3 3 1 2 4 2 4 3 2 4 2 1 3 2 2 3 2 2 2 2 2 3 3 2 1 2 3 2 4
## [260] 2 1 2 2 1 2 4 2 3 1 1 2 4 3 4 4 2 3 3 4 1 3 1 3 4 3 1 2 3 2 3 4 2 3 2 3 2
## [297] 2 2 1 4 3 2 3 3 3 1 3 2 3 1 3 3 4 2 1 1 1 3 1 1 2 3 4 2 4 2 1 3 3 1 3 4 1
## [334] 3 3 1 2 2 2 2 3 4 4 3 3 3 2 3 2 1
## Levels: 1 2 3 4
```

```
salespeople$performance <- as.factor(salespeople$performance) #override salespeople as factor
str(salespeople)
```

```
## 'data.frame':    350 obs. of  4 variables:
##  $ promoted     : int  0 0 1 0 1 1 0 0 0 0 ...
##  $ sales        : int  594 446 674 525 657 918 318 364 342 387 ...
##  $ customer_rate: num  3.94 4.06 3.83 3.62 4.4 4.54 3.09 4.89 3.74 3 ...
##  $ performance  : Factor w/ 4 levels "1","2","3","4": 2 3 4 2 3 2 3 1 3 3 ...
```

# Manipulating data frames

```
(sales_720 <- subset(salespeople, subset = sales == 720))
```

```
##     promoted sales customer_rate performance
## 290        1   720          3.76           3
```

## Inequality

select all rows that the value is greather than or equal to 700 show the first 6 rows exclude rows that has 720

```
high_sales <- subset(salespeople, subset = sales >= 700)
subset(salespeople, subset = sales != 700)
```

```
##     promoted sales customer_rate performance
## 1          0   594          3.94           2
## 2          0   446          4.06           3
## 3          1   674          3.83           4
## 4          0   525          3.62           2
## 5          1   657          4.40           3
## 6          1   918          4.54           2
## 7          0   318          3.09           3
## 8          0   364          4.89           1
```

```
## 9          0   342          3.74          3
## 10         0   387          3.00          3
## 11         0   527          2.43          3
## 12         1   716          3.16          3
## 13         0   557          3.51          2
## 14         0   450          3.21          3
## 15         0   344          3.02          2
## 16         0   372          3.87          3
## 17         0   258          2.49          1
## 18         0   338          2.66          4
## 19         0   410          3.14          2
## 20         1   937          5.00          2
## 21         1   702          3.53          4
## 22         0   469          4.24          2
## 23         0   535          4.47          2
## 24         0   342          3.60          1
## 25         1   819          4.45          2
## 26         1   736          3.94          4
## 27         0   330          2.54          2
## 28         0   274          4.06          1
## 29         0   341          4.47          2
## 30         1   717          2.98          2
## 31         0   478          3.48          2
## 32         0   487          3.74          1
## 33         0   239          2.47          4
## 34         1   825          3.32          3
## 35         0   400          3.53          2
## 36         1   728          2.66          3
## 37         1   773          4.89          3
## 38         0   425          3.62          1
## 39         1   943          4.40          4
## 40         0   510          2.56          3
## 41         0   389          3.34          4
## 42         0   270          2.56          2
## 43         1   945          4.31          4
## 44         0   497          3.02          3
## 45         0   329          2.86          3
## 46         0   389          2.98          4
## 47         0   475          3.39          3
## 48         0   383          2.36          2
## 49         1   432          2.33          3
## 50         1   619          1.94          3
## 51         1   578          4.17          4
## 52         0   411          3.07          4
## 53         0   445          3.00          3
## 54         0   440          3.62          2
## 55         0   359          3.92          1
## 56         0   419          3.85          3
## 57         1   840          5.00          4
## 58         0   393          4.49          1
## 59         1   754          3.74          3
## 60         0   441          4.75          2
## 61         1   803          4.89          3
## 62         0   444          4.15          2
```

```
## 63          1   753          5.00          4
## 64          1   688          4.29          2
## 65          0   431          4.29          4
## 66          0   511          3.74          2
## 67          0   464          2.22          3
## 68          0   473          3.57          2
## 69          0   532          3.74          1
## 70          0   280          3.41          2
## 71          0   342          3.71          2
## 72          0   320          2.15          3
## 73          0   531          3.41          4
## 74          0   373          2.01          2
## 75          0   547          4.40          1
## 76          1   611          4.03          4
## 77          1   825          4.66          2
## 78          0   431          3.62          3
## 79          0   401          3.69          2
## 80          0   517          4.20          3
## 81          1   803          4.15          3
## 82          0   586          5.00          1
## 83          0   444          3.21          4
## 84          1   693          3.80          3
## 85          1   659          4.20          1
## 86          0   416          3.87          3
## 87          0   423          2.75          3
## 88          1   756          3.55          4
## 89          0   245          2.52          2
## 90          0   419          3.76          2
## 91          1   757          3.11          3
## 92          1   617          4.33          1
## 93          1   909          3.21          3
## 94          0   516          2.47          1
## 95          0   317          1.51          1
## 96          0   425          3.53          3
## 97          0   528          4.63          2
## 98          0   416          3.37          1
## 99          1   645          4.08          2
## 100         0   390          3.16          4
## 101         0   393          3.76          1
## 102         0   394          3.07          2
## 103         0   387          3.87          3
## 104         0   450          3.62          3
## 105         0   487          3.46          3
## 106         1   607          2.49          4
## 107         0   369          2.22          1
## 108         0   489          4.98          2
## 109         0   324          3.05          3
## 110         0   417          4.47          1
## 111         1   694          1.90          2
## 112         1   651          5.00          4
## 113         0   395          3.46          2
## 114         0   442          2.29          1
## 115         0   422          4.54          3
## 116         0   404          4.06          3
```

```
## 117        0   381          3.37          4
## 118        0   501          4.77          4
## 119        1   944          5.00          2
## 120        1   753          4.43          3
## 121        0   591          4.93          4
## 122        1   735          4.03          4
## 123        1   538          3.05          3
## 124        0   451          4.49          2
## 125        0   477          3.87          3
## 126        0   436          4.13          2
## 127        1   738          3.05          3
## 128        1   902          5.00          4
## 129        0   464          3.90          1
## 130        1   944          3.92          4
## 131        0   285          3.53          3
## 132        0   453          4.68          2
## 133        0   382          3.51          2
## 134        0   414          2.03          2
## 135        0   335          3.71          3
## 136        1   935          5.00          3
## 137        0   203          2.72          2
## 138        0   348          5.00          3
## 139        1   800          4.24          2
## 140        0   436          3.51          3
## 141        0   360          3.23          1
## 142        1   674          4.47          3
## 143        0   425          2.43          3
## 144        1   901          2.70          3
## 145        0   453          4.98          2
## 146        0   350          3.00          3
## 147        0   362          2.89          2
## 148        0   486          3.41          1
## 149        0   471          4.38          2
## 150        0   459          5.00          3
## 151        0   506          5.00          3
## 152        0   262          2.70          2
## 153        1   825          4.95          3
## 154        0   291          2.54          2
## 155        1   464          2.70          3
## 156        1   802          3.78          2
## 157        1   818          4.24          3
## 158        1   736          3.78          3
## 159        0   364          4.01          3
## 160        0   308          4.82          1
## 161        1   862          4.17          4
## 162        0   349          1.67          4
## 163        0   375          3.05          2
## 164        0   423          2.54          3
## 165        1   938          3.69          3
## 166        0   456          2.91          1
## 167        0   517          5.00          2
## 168        0   373          2.93          1
## 169        1   898          2.26          4
## 170        1   777          4.86          3
```

```
## 171        0   470          4.84          3
## 172        0   545          3.94          4
## 173        1   699          2.66          4
## 174        1   697          4.06          3
## 175        0   300          1.94          2
## 176        1   677          4.63          3
## 177        0   497          3.14          1
## 178        1   669          4.56          4
## 179        1   596          4.98          2
## 180        0   492          4.24          3
## 181        0   346          2.20          2
## 182        1   590          4.17          2
## 183        0   592          2.20          3
## 184        1   780          4.15          4
## 185        0   432          4.15          2
## 186        0   418          4.01          2
## 187        1   662          4.56          4
## 188        1   678          4.49          3
## 189        1   716          3.44          3
## 190        0   330          3.05          1
## 191        0   414          3.83          1
## 192        0   416          2.79          2
## 193        0   403          2.75          1
## 194        0   362          2.03          3
## 195        0   284          4.20          3
## 196        0   363          4.72          1
## 197        1   655          3.39          3
## 198        0   597          4.08          3
## 199        1   794          3.83          3
## 200        1   818          2.70          1
## 201        0   409          3.44          1
## 202        1   681          3.97          1
## 203        1   606          1.83          3
## 204        0   489          4.47          2
## 205        0   475          4.56          3
## 206        0   590          4.43          3
## 207        0   396          4.86          2
## 208        0   420          5.00          2
## 209        1   857          3.85          2
## 210        0   371          2.77          2
## 211        0   421          3.39          3
## 212        1   828          1.37          4
## 213        0   594          3.05          1
## 214        0   533          4.86          2
## 215        0   462          2.98          2
## 216        0   392          3.85          3
## 217        0   475          3.83          3
## 218        1   752          4.89          2
## 219        1   659          1.97          2
## 220        1   650          3.14          2
## 221        0   496          4.31          3
## 222        0   211          2.52          1
## 223        1   898          3.51          3
## 224        0   388          2.54          1
```

```
## 225        0   383         2.47          2
## 226        0   455         2.36          3
## 227        0   319         3.21          4
## 228        1   756         3.09          3
## 229        0   377         2.08          3
## 230        1   940         2.82          3
## 231        1   757         3.55          3
## 232        0   469         3.85          3
## 233        0   394         3.57          1
## 234        0   484         2.86          2
## 235        0   491         3.44          4
## 236        0   547         5.00          2
## 237        0   519         3.34          4
## 238        1   739         3.99          3
## 239        0   479         4.06          2
## 240        1   943         3.21          4
## 241        1   742         4.17          2
## 242        0   357         2.72          1
## 243        0   432         3.80          3
## 244        0   584         3.78          2
## 245        1   595         3.74          2
## 246        0   401         2.86          3
## 247        0   460         4.45          2
## 248        1   753         4.89          2
## 249        0   466         5.00          2
## 250        0   362         2.26          2
## 251        0   361         2.66          2
## 252        0   338         4.03          3
## 253        1   882         2.63          3
## 254        0   293         3.51          2
## 255        1   922         4.15          1
## 256        1   793         4.08          2
## 257        1   787         2.56          3
## 258        0   400         3.34          2
## 259        0   516         5.00          4
## 260        0   295         3.87          2
## 261        0   307         1.00          1
## 262        0   151         2.31          2
## 263        0   441         3.34          2
## 264        0   406         3.25          1
## 265        0   270         4.10          2
## 266        1   680         3.09          4
## 267        1   662         4.77          2
## 268        0   347         3.62          3
## 269        0   453         4.86          1
## 270        0   309         3.00          1
## 271        0   592         4.79          2
## 272        0   540         3.41          4
## 273        1   886         4.68          3
## 274        0   420         5.00          4
## 275        1   718         4.03          4
## 276        0   284         3.69          2
## 277        0   323         1.85          3
## 278        0   513         4.20          3
```

```
## 279        1   841          5.00          4
## 280        0   362          2.38          1
## 281        1   842          3.99          3
## 282        0   321          3.25          1
## 283        0   516          2.89          3
## 284        0   428          3.28          4
## 285        0   383          2.98          3
## 286        1   521          3.23          1
## 287        0   358          3.09          2
## 288        0   489          3.41          3
## 289        0   252          1.69          2
## 290        1   720          3.76          3
## 291        1   610          2.75          4
## 292        1   871          5.00          2
## 293        0   594          4.75          3
## 294        0   522          4.59          2
## 295        0   379          1.83          3
## 296        0   454          4.29          2
## 297        0   450          3.69          2
## 298        0   317          2.66          2
## 299        1   835          3.90          1
## 300        0   297          2.61          4
## 301        0   516          3.90          3
## 302        0   355          3.41          2
## 303        1   858          3.67          3
## 304        0   305          1.99          3
## 305        0   410          1.37          3
## 306        1   707          2.38          1
## 307        1   798          4.72          3
## 308        0   265          3.48          2
## 309        1   576          3.60          3
## 310        0   448          3.18          1
## 311        0   590          4.77          3
## 312        0   456          4.03          3
## 313        1   930          4.22          4
## 314        0   412          4.10          2
## 315        0   286          3.64          1
## 316        0   440          2.29          1
## 317        0   546          3.55          1
## 318        0   385          2.66          3
## 319        0   544          3.48          1
## 320        0   505          2.89          1
## 321        1   732          3.57          2
## 322        0   506          4.36          3
## 323        0   394          2.79          4
## 324        1   674          3.60          2
## 325        0   458          3.39          4
## 326        0   251          3.32          2
## 327        0   429          3.41          1
## 328        0   348          3.69          3
## 329        1   789          3.71          3
## 330        1   795          4.31          1
## 331        0   509          4.61          3
## 332        1   754          4.33          4
```

```
## 333        0   580          4.70           1
## 334        0   289          3.57           3
## 335        0   390          2.01           3
## 336        1   787          3.14           1
## 337        0   241          3.05           2
## 338        0   522          4.72           2
## 339        0   412          5.00           2
## 340        0   359          5.00           2
## 341        0   489          4.86           3
## 342        1   940          5.00           4
## 343        0   592          4.38           4
## 344        1   796          5.00           3
## 345        1   653          5.00           3
## 346        0   459          2.82           3
## 347        0   586          3.41           2
## 348        0   401          1.60           3
## 349        0   500          4.17           2
## 350        0   373          2.54           1
```

```
head(high_sales)
```

```
##    promoted sales customer_rate performance
## 6         1   918          4.54           2
## 12        1   716          3.16           3
## 20        1   937          5.00           2
## 21        1   702          3.53           4
## 25        1   819          4.45           2
## 26        1   736          3.94           4
```

select specific columns using select argument

```
salespeople_sales_perf <- subset(salespeople, select = c("sales", "performance"))
head(salespeople_sales_perf)
```

```
##   sales performance
## 1   594           2
## 2   446           3
## 3   674           4
## 4   525           2
## 5   657           3
## 6   918           2
```

two dataframes with thje same name can be combined

```
low_sales <- subset(salespeople, subset = sales < 400)
#bind the rows of low_sales and high_sales together
low_and_high_sales = rbind(low_sales, high_sales) #combined low and high sales together
head(low_and_high_sales)
```

```
##    promoted sales customer_rate performance
## 7         0   318          3.09           3
```

```
## 8         0   364          4.89           1
## 9         0   342          3.74           3
## 10        0   387          3.00           3
## 15        0   344          3.02           2
## 16        0   372          3.87           3
```

```
#two dataframes with columns each
sales_perf <- subset(salespeople, select = c("sales", "performance"))
prom_custrate <- subset(salespeople, select = c("promoted", "customer_rate"))
#bind the columns to create a dataframe with four columns
full_df <- cbind(sales_perf, prom_custrate)
head(full_df)
```

```
##   sales performance promoted customer_rate
## 1   594           2        0          3.94
## 2   446           3        0          4.06
## 3   674           4        1          3.83
## 4   525           2        0          3.62
## 5   657           3        1          4.40
## 6   918           2        1          4.54
```

cbind makes data apad

rbind is below

## Functions and

head() subset() rbind() - combine row wise

exist to perform common operations

head() displays the 6 rows with one required the name of the dataframe default value n= 6

```
head(full_df, n=10)
```

```
##    sales performance promoted customer_rate
## 1    594           2        0          3.94
## 2    446           3        0          4.06
## 3    674           4        1          3.83
## 4    525           2        0          3.62
## 5    657           3        1          4.40
## 6    918           2        1          4.54
## 7    318           3        0          3.09
## 8    364           1        0          4.89
## 9    342           3        0          3.74
## 10   387           3        0          3.00
```

```
?head
```

```
## starting httpd help server ... done
```

```
head(x = full_df, n = 10)
```

```
##    sales performance promoted customer_rate
## 1    594           2        0          3.94
## 2    446           3        0          4.06
## 3    674           4        1          3.83
## 4    525           2        0          3.62
## 5    657           3        1          4.40
## 6    918           2        1          4.54
## 7    318           3        0          3.09
## 8    364           1        0          4.89
## 9    342           3        0          3.74
## 10   387           3        0          3.00
```

```
head(full_df, n = 10)
```

```
##    sales performance promoted customer_rate
## 1    594           2        0          3.94
## 2    446           3        0          4.06
## 3    674           4        1          3.83
## 4    525           2        0          3.62
## 5    657           3        1          4.40
## 6    918           2        1          4.54
## 7    318           3        0          3.09
## 8    364           1        0          4.89
## 9    342           3        0          3.74
## 10   387           3        0          3.00
```

```
#see the headspeople
head(salespeople,3) #3 is used to override the default value 6
```

```
##   promoted sales customer_rate performance
## 1        0   594          3.94           2
## 2        0   446          4.06           3
## 3        1   674          3.83           4
```

```
#if you don't know the right order of the name your arguments and you can put them in any order
head(n = 3, x = salespeople)
```

```
##   promoted sales customer_rate performance
## 1        0   594          3.94           2
## 2        0   446          4.06           3
## 3        1   674          3.83           4
```

## Help Functions

```
help(head)
?head
```

open help browser and do the search there

help: examples required and optional arguments data type of input and output

### Writing yopur own functions

functions are not limited in package in R write own functions helpful in their Don't Repeat yourself(DRY) write the same code numerous times for practice

generates a report on a Dataframe

```
#create df_report function
df_report <- function(df) {
  paste("This dataframe contains", nrow(df),
  "rows and", ncol(df),
  "columns. There are", sum(is.na(df)),
  "NA entries"
  )
}
```

```
df_report(salespeople)
```

```
## [1] "This dataframe contains 350 rows and 4 columns. There are 0 NA entries"
```

```
df_report(sales_720)
```

```
## [1] "This dataframe contains 1 rows and 4 columns. There are 0 NA entries"
```

```
df_report(low_and_high_sales)
```

```
## [1] "This dataframe contains 173 rows and 4 columns. There are 0 NA entries"
```

```
#df_report(salespeople_local) (?)
```