R Objects

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Atomic Vectors

```
die <- 1:6
is.vector(die)
```

```
## [1] TRUE
```

```
five <- 5
is.vector(five)
```

```
## [1] TRUE
```

```
length(five)
```

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

```
length(die)
```

```
## [1] 6
```

```
int <- 1L
text <- "ace"
int <- c(1L, 5L)
text <- c("ace", "hearts")
sum(int)
```

```
## [1] 6
```

```
# sum(text)
```

Integers

```
int <- c(-1L, 2L, 4L)
typeof(int)
```

```
## [1] "integer"
```

```
die <- 1:6
die2 <- c(1, 2, 3, 4, 5, 6)
die == die2
```

```
## [1] TRUE TRUE TRUE TRUE TRUE TRUE
```

```
identical(die, die2)
```

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

```
die3 <- c(1L, 2L, 3L, 4L, 5L, 6L)
die == die3
```

```
## [1] TRUE TRUE TRUE TRUE TRUE TRUE
```

```
identical(die, die3)
```

```
## [1] TRUE
```

```
typeof(die)
```

```
## [1] "integer"
```

```
typeof(die2)
```

```
## [1] "double"
```

```
typeof(die3)
```

```
## [1] "integer"
```

Doubles

```
pi
```

```
## [1] 3.141593
```

```
sqrt(2)^2 - 2
```

```
## [1] 4.440892e-16
```

```
die2
```

```
## [1] 1 2 3 4 5 6
```

Characters

```
text <- c("Hello", "World")
text
```

```
## [1] "Hello" "World"
```

```
typeof(text)
```

```
## [1] "character"
```

```
typeof("Hello")
```

```
## [1] "character"
```

Logicals

```
3 > 2
```

```
## [1] TRUE
```

```
1:3 > c(2, 1, 3)
```

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

```
logic <- c(TRUE, FALSE, TRUE)
logic
```

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

```
typeof(logic)
```

```
## [1] "logical"
```

```
typeof(F)
```

```
## [1] "logical"
```

```
typeof(FALSE)
```

```
## [1] "logical"
```

Complex and Raw

```
comp <- c(1 + 1i, 1 + 2i, 1 + 3i)
comp
```

```
## [1] 1+1i 1+2i 1+3i
```

```
typeof(comp)
```

```
## [1] "complex"
```

```
raw(3)
```

```
## [1] 00 00 00
```

```
typeof(raw(3))
```

```
## [1] "raw"
```

```
hand <- c("ace", "king", "queen", "jack", "ten")
hand
```

```
## [1] "ace"   "king"  "queen" "jack"  "ten"
```

```
typeof(hand)
```

```
## [1] "character"
```

Attributes

```
attributes(die)
```

```
## NULL
```

Names

```
names(die)
```

```
## NULL
```

```
names(die) <- c("one", "two", "three", "four", "five", "six")
die
```

```
##   one   two three  four  five   six
##     1     2     3     4     5     6
```

```
names(die)
```

```
## [1] "one"   "two"   "three" "four"  "five"  "six"
```

```
attributes(die)
```

```
## $names
## [1] "one"   "two"   "three" "four"  "five"  "six"
```

```
# names(die) <- NULL
```

Dim

```
dim(die) <- c(2, 3)
die
```

```
##      [,1] [,2] [,3]
## [1,]    1    3    5
## [2,]    2    4    6
```

```
dim(die) <- 1:3
die
```

```
## , , 1
##
##      [,1] [,2]
## [1,]    1    2
##
## , , 2
##
##      [,1] [,2]
## [1,]    3    4
##
## , , 3
##
##      [,1] [,2]
## [1,]    5    6
```

```
attributes(die)
```

```
## $dim
## [1] 1 2 3
```

Matrices

```
m <- matrix(die, nrow = 2)
m
```

```
##      [,1] [,2] [,3]
## [1,]    1    3    5
## [2,]    2    4    6
```

```
m <- matrix(die, nrow = 2, byrow = TRUE)
m
```

```
##      [,1] [,2] [,3]
## [1,]    1    2    3
## [2,]    4    5    6
```

Arrays

```
ar <- array(c(11:14, 21:24, 31:34),
            dim = c(2, 2, 3))
ar
```

```
## , , 1
##
##      [,1] [,2]
## [1,]   11   13
## [2,]   12   14
##
## , , 2
##
##      [,1] [,2]
## [1,]   21   23
## [2,]   22   24
##
## , , 3
##
##      [,1] [,2]
## [1,]   31   33
## [2,]   32   34
```

Class

```
dim(die) <- c(2, 3)
typeof(die)
```

```
## [1] "integer"
```

```
class(die)
```

```
## [1] "matrix"
```

```
attributes(die)
```

```
## $dim
## [1] 2 3
```

```
class("Hello")
```

```
## [1] "character"
```

```
class(5)
```

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

```
class(5L)
```

```
## [1] "integer"
```

Dates and Times

```
today <- Sys.Date()
now <- Sys.time()
today
```

```
## [1] "2020-04-08"
```

```
now
```

```
## [1] "2020-04-08 16:37:54 KST"
```

```
typeof(today)
```

```
## [1] "double"
```

```
typeof(now)
```

```
## [1] "double"
```

```
class(today)
```

```
## [1] "Date"
```

```
class(now)
```

```
## [1] "POSIXct" "POSIXt"
```

```
unclass(now)
```

```
## [1] 1586331475
```

```
unclass(Sys.time())
```

```
## [1] 1586331475
```

```
mil <- 1000000
mil
```

```
## [1] 1e+06
```

```
class(mil) <- c("POSIXct", "POSIXt")
mil
```

```
## [1] "1970-01-12 22:46:40 KST"
```

Factors

```
gender <- factor(c("male", "female", "female", "male"))
typeof(gender)
```

```
## [1] "integer"
```

```
attributes(gender)
```

```
## $levels
## [1] "female" "male"
##
## $class
## [1] "factor"
```

```
unclass(gender)
```

```
## [1] 2 1 1 2
## attr(,"levels")
## [1] "female" "male"
```

```
gender
```

```
## [1] male   female female male
## Levels: female male
```

```
as.character(gender)
```

```
## [1] "male"   "female" "female" "male"
```

```
gender2 <- factor(c("male", "female", "female", "male"),
                  levels = c("male", "female"))
str(gender2)
```

```
##  Factor w/ 2 levels "male","female": 1 2 2 1
```

Coercion

```
card <- c("ace", "hearts", 1)
card
```

```
## [1] "ace"    "hearts" "1"
```

```
str(card)
```

```
##  chr [1:3] "ace" "hearts" "1"
```

```
sum(c(TRUE, TRUE, FALSE, FALSE))
```

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

```
as.character(1)
```

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

```
as.logical(1)
```

```
## [1] TRUE
```

```
as.numeric(FALSE)
```

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

Lists

```
list1 <- list(100:130,
              "R",
              list(TRUE, FALSE))
list1
```

```
## [[1]]
##  [1] 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
## [20] 119 120 121 122 123 124 125 126 127 128 129 130
##
## [[2]]
## [1] "R"
##
## [[3]]
## [[3]][[1]]
## [1] TRUE
##
## [[3]][[2]]
## [1] FALSE
```

```
list1[[3]][[2]]
```

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

```
list1[[3]]
```

```
## [[1]]
## [1] TRUE
##
## [[2]]
## [1] FALSE
```

```
attributes(list1)
```

```
## NULL
```

```
list2 <- list(number = 100:130,
              char = "R",
              logical = list(TRUE, FALSE))
list2
```

```
## $number
##  [1] 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
## [20] 119 120 121 122 123 124 125 126 127 128 129 130
##
## $char
## [1] "R"
##
## $logical
## $logical[[1]]
## [1] TRUE
##
## $logical[[2]]
## [1] FALSE
```

```
list2$logical[[1]]
```

```
## [1] TRUE
```

```
list2$logical
```

```
## [[1]]
## [1] TRUE
##
## [[2]]
## [1] FALSE
```

```
attributes(list2)
```

```
## $names
## [1] "number"  "char"    "logical"
```

```
list2$char
```

```
## [1] "R"
```

```
list2[[2]]
```

```
## [1] "R"
```

```
list2[[3]]
```

```
## [[1]]
## [1] TRUE
##
## [[2]]
## [1] FALSE
```

Data Frames

```
df1 <- data.frame(c("ace", "two", "six"),
                  rep("clubs", 3),
                  c(1, 2, 6))
str(df1)
```

```
## 'data.frame':    3 obs. of  3 variables:
##  $ c..ace....two....six..: Factor w/ 3 levels "ace","six","two": 1 3 2
##  $ rep..clubs...3.       : Factor w/ 1 level "clubs": 1 1 1
##  $ c.1..2..6.            : num  1 2 6
```

```
df <- data.frame(face = c("ace", "two", "six"),
                 suit = rep("clubs", 3),
                 value = c(1, 2, 6))
df
```

```
##   face  suit value
## 1  ace clubs     1
## 2  two clubs     2
## 3  six clubs     6
```

```
str(df)
```

```
## 'data.frame':    3 obs. of  3 variables:
##  $ face : Factor w/ 3 levels "ace","six","two": 1 3 2
##  $ suit : Factor w/ 1 level "clubs": 1 1 1
##  $ value: num  1 2 6
```

```
face <- c("ace", "two", "six")
suit <- rep("clubs", 3)
value <- c(1, 2, 6)
str(face)
```

```
##  chr [1:3] "ace" "two" "six"
```

```
df2 <- data.frame(face, suit, value,
                  stringsAsFactors = FALSE)
df2
```

```
##   face  suit value
## 1  ace clubs     1
## 2  two clubs     2
## 3  six clubs     6
```

```
str(df2)
```

```
## 'data.frame':    3 obs. of  3 variables:
##  $ face : chr  "ace" "two" "six"
##  $ suit : chr  "clubs" "clubs" "clubs"
##  $ value: num  1 2 6
```

```
df3 <- data.frame(Face = face,
                  Suit = suit,
                  Value = value)
df3
```

```
##   Face  Suit Value
## 1  ace clubs     1
## 2  two clubs     2
## 3  six clubs     6
```

```
typeof(df)
```

```
## [1] "list"
```

```
class(df)
```

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

```
attributes(df)
```

```
## $names
## [1] "face"  "suit"  "value"
##
## $class
## [1] "data.frame"
##
## $row.names
## [1] 1 2 3
```

```
str(df)
```

```
## 'data.frame':    3 obs. of  3 variables:
##  $ face : Factor w/ 3 levels "ace","six","two": 1 3 2
##  $ suit : Factor w/ 1 level "clubs": 1 1 1
##  $ value: num  1 2 6
```

```
df <- data.frame(face = c("ace", "two", "six"),
                 suit = c("clubs", "clubs", "clubs"),
                 value = c(1, 2, 6),
                 stringsAsFactors = FALSE)
str(df)
```

```
## 'data.frame':    3 obs. of  3 variables:
##  $ face : chr  "ace" "two" "six"
##  $ suit : chr  "clubs" "clubs" "clubs"
##  $ value: num  1 2 6
```

from URL

```
deck <- read.csv("https://gist.githubusercontent.com/garrettgman/9629323/raw/ee5dfc039fd581cb467cc69c226ea2524913c3d8/deck.csv")
str(deck)
```

```
## 'data.frame':    52 obs. of  3 variables:
##  $ face : Factor w/ 13 levels "ace","eight",..: 6 8 5 11 7 2 9 10 3 4 ...
##  $ suit : Factor w/ 4 levels "clubs","diamonds",..: 4 4 4 4 4 4 4 4 4 4 ...
##  $ value: int  13 12 11 10 9 8 7 6 5 4 ...
```

```
head(deck)
```

```
##    face   suit value
## 1  king spades    13
## 2 queen spades    12
## 3  jack spades    11
## 4   ten spades    10
## 5  nine spades     9
## 6 eight spades     8
```

```
tail(deck)
```

```
##     face   suit value
## 47   six hearts     6
## 48  five hearts     5
## 49  four hearts     4
## 50 three hearts     3
## 51   two hearts     2
## 52   ace hearts     1
```

```
deck <- read.csv("https://gist.githubusercontent.com/garrettgman/9629323/raw/ee5dfc039fd581cb467cc69c226ea2524913c3d8/deck.csv",
                 stringsAsFactors = FALSE)
str(deck)
```

```
## 'data.frame':    52 obs. of  3 variables:
##  $ face : chr  "king" "queen" "jack" "ten" ...
##  $ suit : chr  "spades" "spades" "spades" "spades" ...
##  $ value: int  13 12 11 10 9 8 7 6 5 4 ...
```

```
write.csv(deck, file = "../data/cards.csv")
write.csv(deck, file = "../data/cards.csv",
          row.names = FALSE)
ls()
```

```
##  [1] "ar"      "card"    "comp"    "deck"    "df"      "df1"     "df2"
##  [8] "df3"     "die"     "die2"    "die3"    "face"    "five"    "gender"
## [15] "gender2" "hand"    "int"     "list1"   "list2"   "logic"   "m"
## [22] "mil"     "now"     "suit"    "text"    "today"   "value"
```

```
save(list = ls(), file = "./r_objects.RData")
rm(list = ls())
ls()
```

```
## character(0)
```

```
load("./r_objects.RData")
ls()
```

```
##  [1] "ar"      "card"    "comp"    "deck"    "df"      "df1"     "df2"
##  [8] "df3"     "die"     "die2"    "die3"    "face"    "five"    "gender"
## [15] "gender2" "hand"    "int"     "list1"   "list2"   "logic"   "m"
## [22] "mil"     "now"     "suit"    "text"    "today"   "value"
```

```
rm(list = ls())
```