Data Structures in R: Lists

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**single data type**

- Vector
- Matrix

**multiple data types**

- List
- Data Frame

**dimensions**

- 1D
- 2D
- nD

- non-atomic objects
R lists

A list is the most general data structure in R
Lists can contain any other type of data structure
Lists can even contain other lists
List of Vectors (of equal length)

List of Vectors (of different length)
List of various objects

vector

matrix

Other lists
R lists

Lists are a special type of vector

```r
lst <- vector(mode = "list")
```

Lists are vectors in the sense of being a one-dimensional object

Lists are NOT atomic structures
Subsetting and Indexing
Bracket Notation System

To extract values from R objects use brackets: [ ]

Inside the brackets specify vector(s) of indices

Use as many indices, separated by commas, as dimensions in the object

Vector(s) of indices can be numbers, logicals, and sometimes names
lst <- list(c(1, 2, 3),
matrix(1:9, nrow = 3, ncol = 3),
list(1:2, c(TRUE, FALSE), c("a", "b")))
access list element(s)

list[elem]
lst[1]

- vector
- matrix
- another list
lst[2]

vector

matrix

another list
$\text{lst}[3]$
access object of list element

\[ \text{list}[[\text{elem}]] \]
lst[[1]]

vector

matrix

another list
lst[[2]]

vector

matrix

another list
lst[[3]]

vector

matrix

another list
access object’s elements, of list element

\texttt{list[[elem]][obj]}
$\text{lst}[[1]][2]$
\texttt{lst[[2]][[1,1]]}
\texttt{lst[[2]][1, ]}

- vector
- matrix
- another list
\texttt{lst[[2]][ ,2]}

- **vector**
- **matrix**
- **another list**
lst[[3]][1]

vector

matrix

another list
access object’s elements, of list element

```python
list[[[elem]]][[[obj]]]
```
$\text{lst}[[3]][[1]]$

vector

matrix

another list
access element of object’s elements, of list element

\texttt{list[[elem]][[obj]][ind]}
lst[[[3]][[1]][1]]

vector

matrix

another list
\texttt{\textcolor{red}{l}st[[3]][[3]]\textcolor{orange}{c(1,2)}]
Dollar Notation
lst <- list(
  vec = c(1, 2, 3),
  mat = matrix(1:9, nrow = 3, ncol = 3),
  lis = list(1:2, c(TRUE, FALSE), c("a", "b"))
)
access list named element(s)

list$\text{name}$
lst$vec$

"vec"

"mat"

"lis"
list$mat

"vec"

"mat"

"lis"
lst$\text{lis}$

"vec"

"mat"

"lis"
access list named element(s)

`list$name[ind]`
\texttt{lst$vec[2]}
\texttt{lst$\texttt{mat}[1,1]}
lst$\textbf{lis}[[1]]$
Special list:
Data Frames
multiple data types

We’ll talk about data frames later