2. R Foundations - Lists

Data Science for OR - J. Duggan

Recap - R Data Types

	Homogenous	Heterogenous
1d	Atomic Vector	**List**
2d	Matrix	Data Frame/Tibble
nd	Array	

- Lists are different from atomic vectors because their elements can be of any type, including lists.
- list() creates a list, instead of c()

Creating a list

```
x <- list(1:3, "a", c(T,F,T), c(1.2, 1.3, 1.4))
str(x)
```

```
## List of 4
##  $ : int [1:3] 1 2 3
##  $ : chr "a"
##  $ : logi [1:3] TRUE FALSE TRUE
##  $ : num [1:3] 1.2 1.3 1.4
```

Subsetting Lists

- Works in the same way as subsetting an atomic vector
- Using [will always return a list
- [[and $ pull out the contents of a list
- If list x is a train carrying objects, then x[[5]] is the object in car 5, x[4:6] is a train of cars 4-6" @RLangTip

Figure 1: A list and its contents

Example

```
x <- list(1:3, c(T,F,T))
x[1]
```

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

```
str(x[1])
```

```
## List of 1
##  $ : int [1:3] 1 2 3
```

```
x[[1]]
```

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

```
str(x[[1]])
```

```
##  int [1:3] 1 2 3
```

Naming list elements

```
x <- list(el1=1:3, el2=c(T,F,T))
x
```

```
## $el1
## [1] 1 2 3
##
## $el2
## [1]  TRUE FALSE  TRUE
```

The $ operator

- $ is a shorthand operator, where x$y is equivalent to x[[“y”,exact=FALSE]]
- Often used to access variables in a data frame
- $ does partial matching

```
x
```

```
## $el1
## [1] 1 2 3
##
## $el2
## [1]  TRUE FALSE  TRUE
```

```
x$el1
```

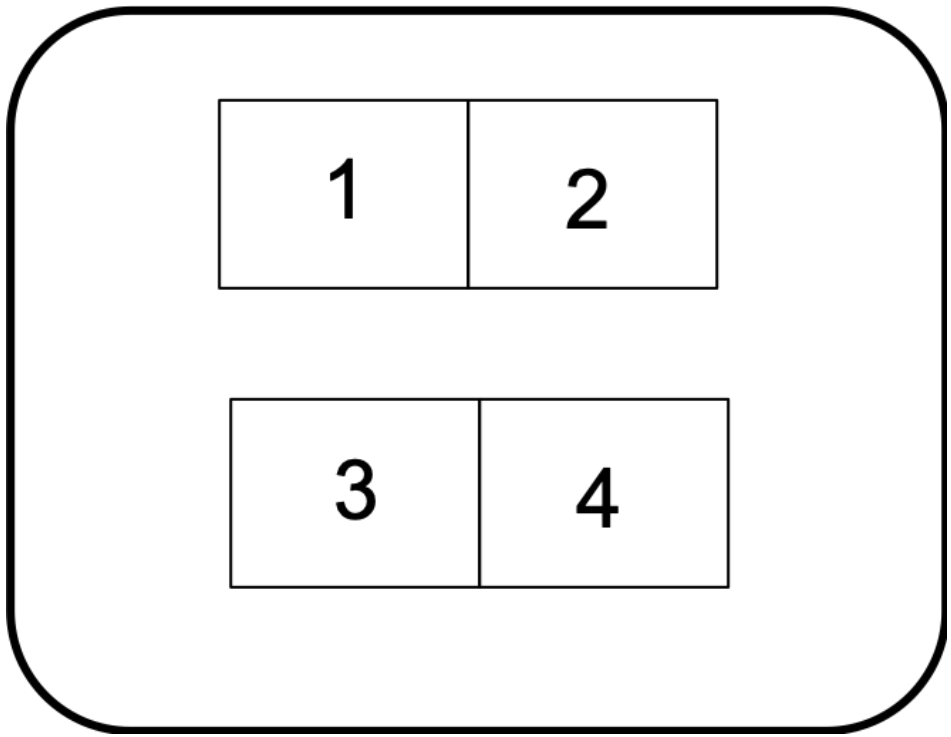
```
## [1] 1 2 3
```

```
x$el2
```

Visualising Lists

- Lists have rounded corners.
- Atomic vectors have square corners
- Children are drawn inside their parent, and have a slightly darker background

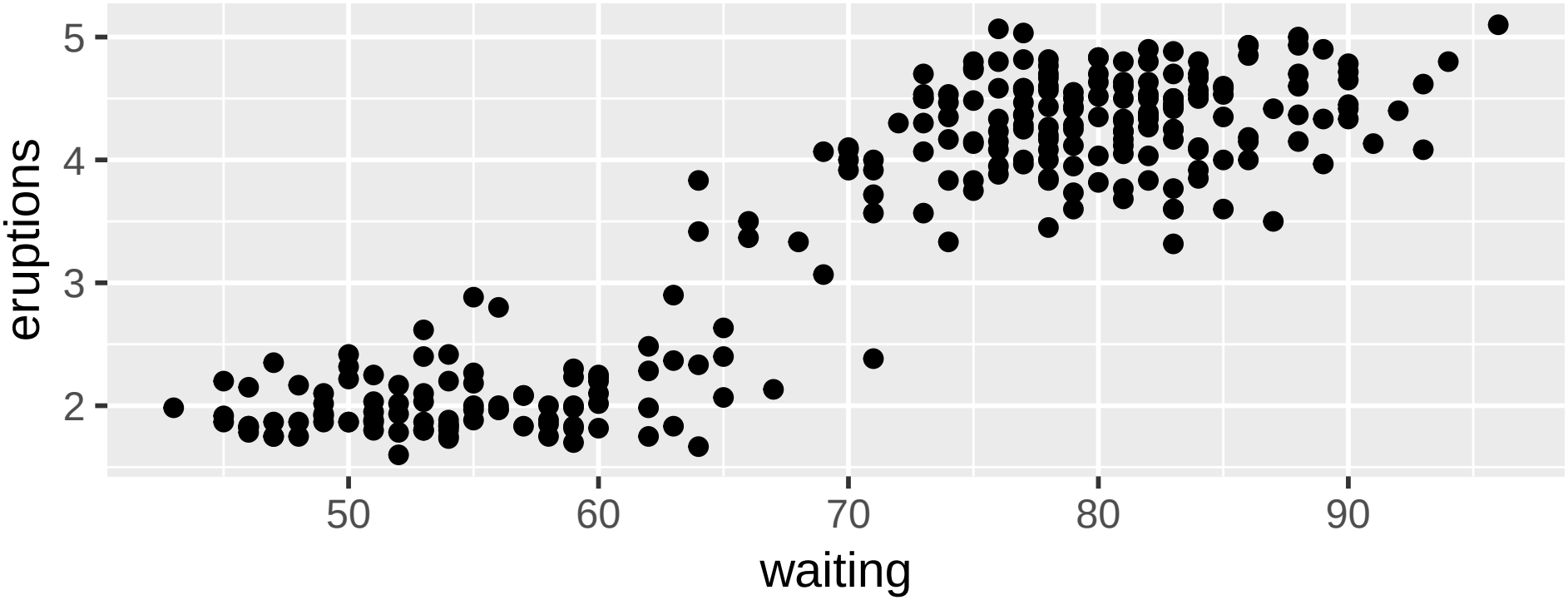
```
y <- list(c(1,2),c(3,4))
```



Using Lists

- Are the basis of many S3 objects that are returned from regression functions (e.g. linear regression)
- The basis for data frames (the $ operator identifies columns)

```
ggplot(data=faithful)+
 geom_point(aes(x=waiting,y=eruptions))
```



lm function - Returns a list of 12

```
mod <- lm(eruptions ~ waiting, data=faithful)
mod$coefficients
```

```
## (Intercept)     waiting
## -1.87401599  0.07562795
```

```
class(mod)
```

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

```
coefficients(mod)
```

```
## (Intercept)     waiting
## -1.87401599  0.07562795
```

```
str(coefficients(mod))
```

```
##  Named num [1:2] -1.874 0.0756
##  - attr(*, "names")= chr [1:2] "(Intercept)" "waiting"
```