Data Analysis & Visualisation

CSC3062

BEng (CS & SE), MEng (CS & SE), BIT & CIT

Dr Reza Rafiee

Semester 1 – 2019/2020

QUEEN'S UNIVERSITY BELFAST

SCHOOL OF ELECTRONICS, ELECTRICAL ENGNIEERING AND COMPUTER SCIENCE

This is R

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R Programming; Revision

Revision

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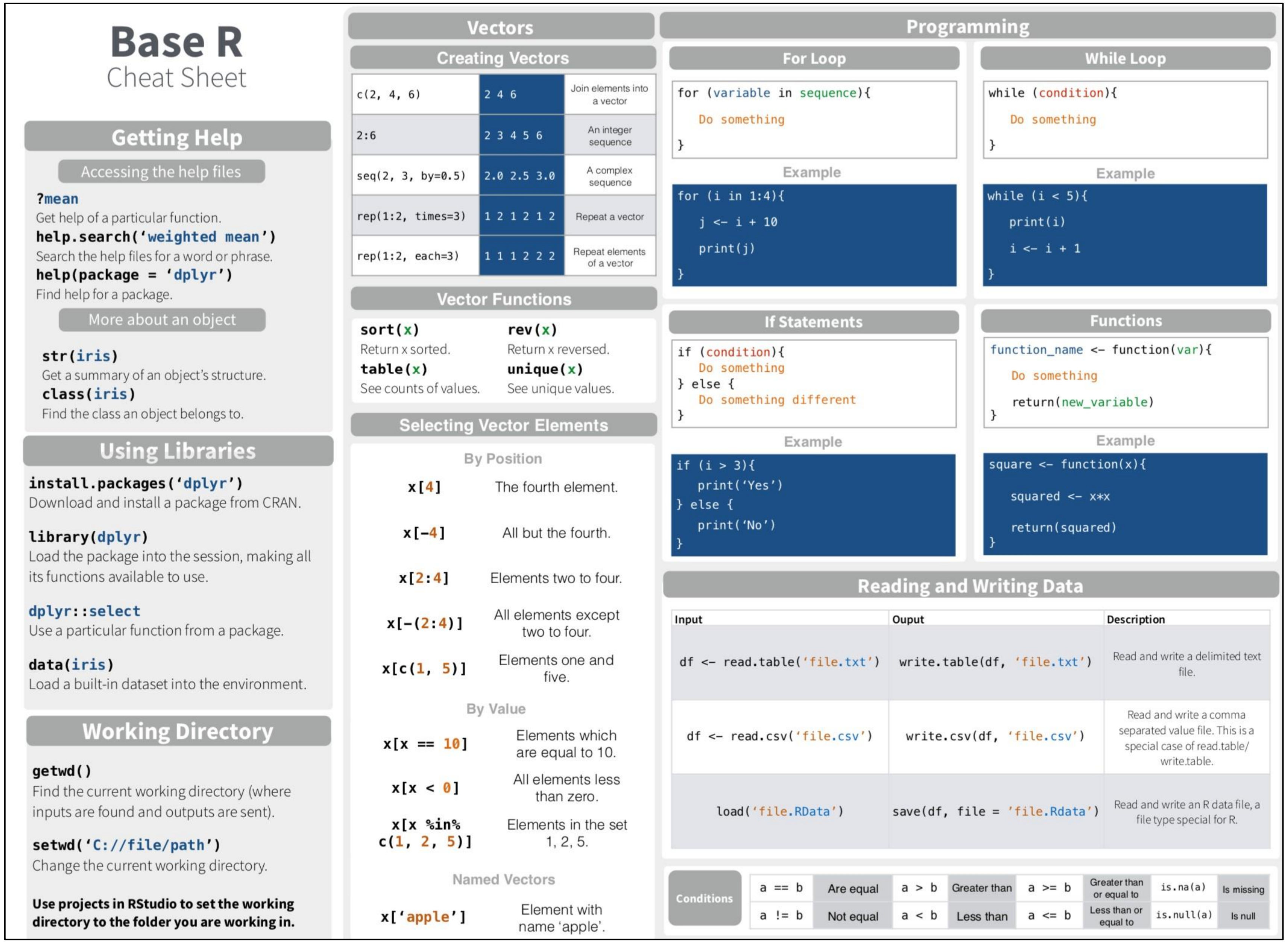

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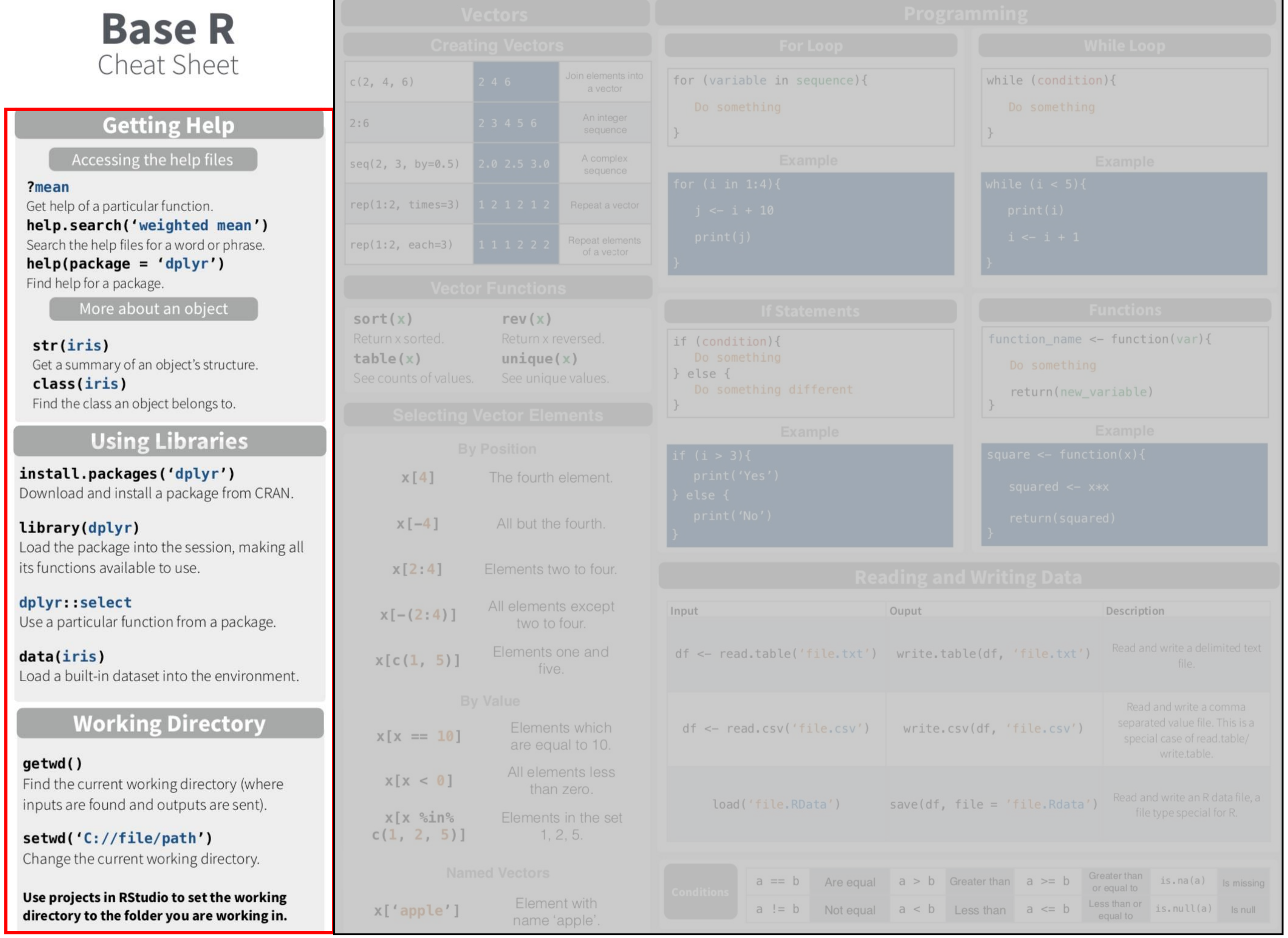

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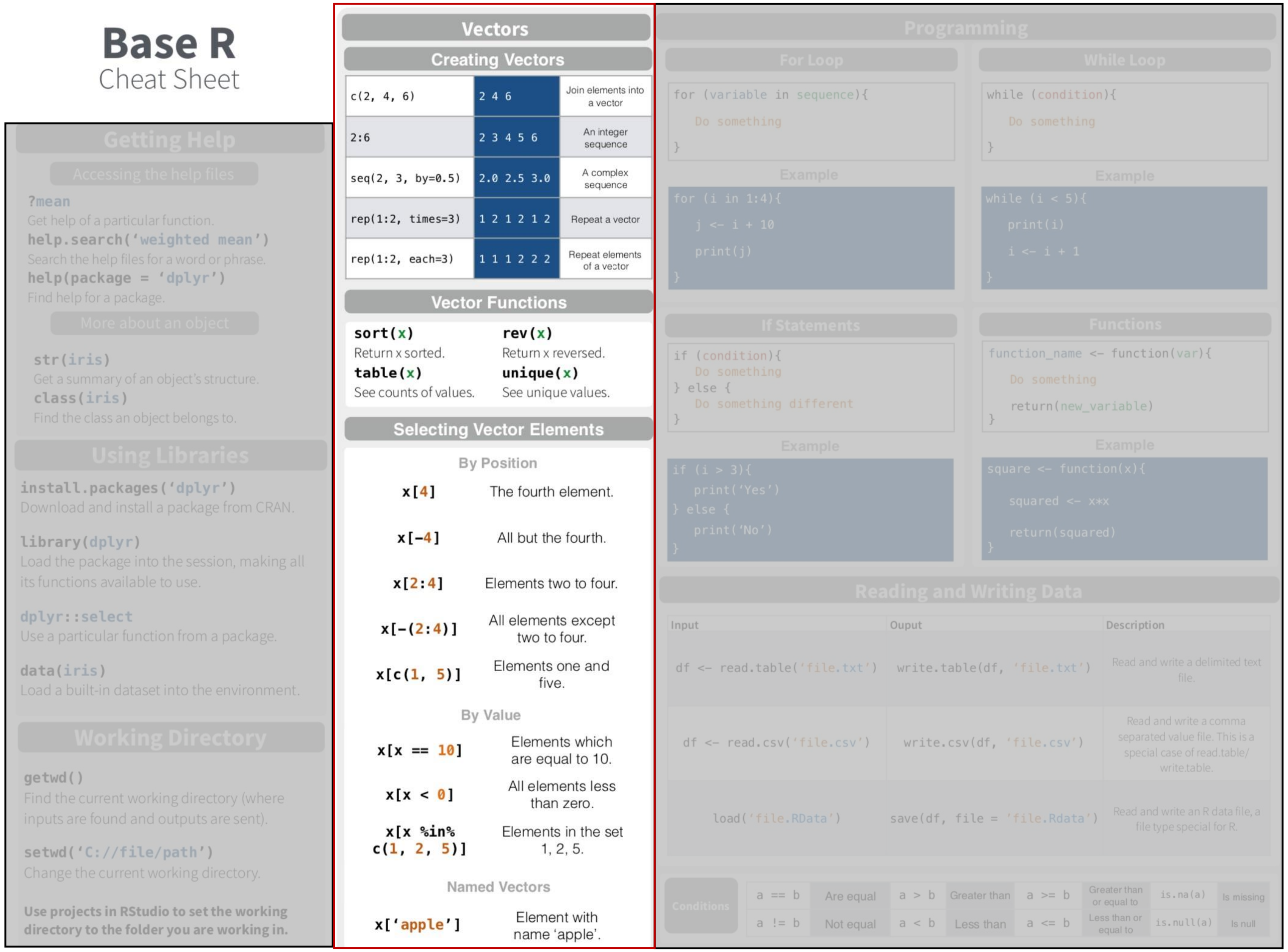

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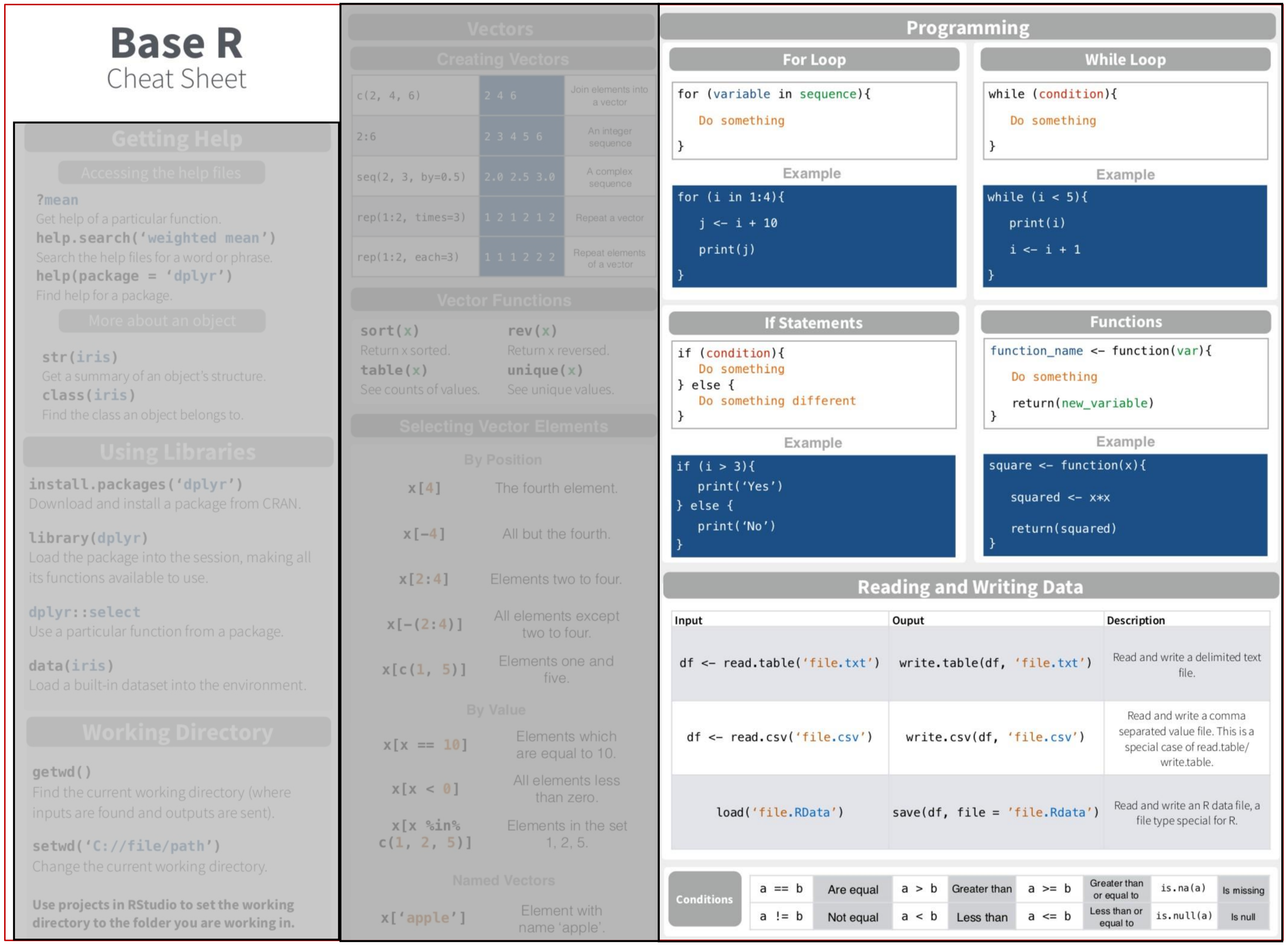

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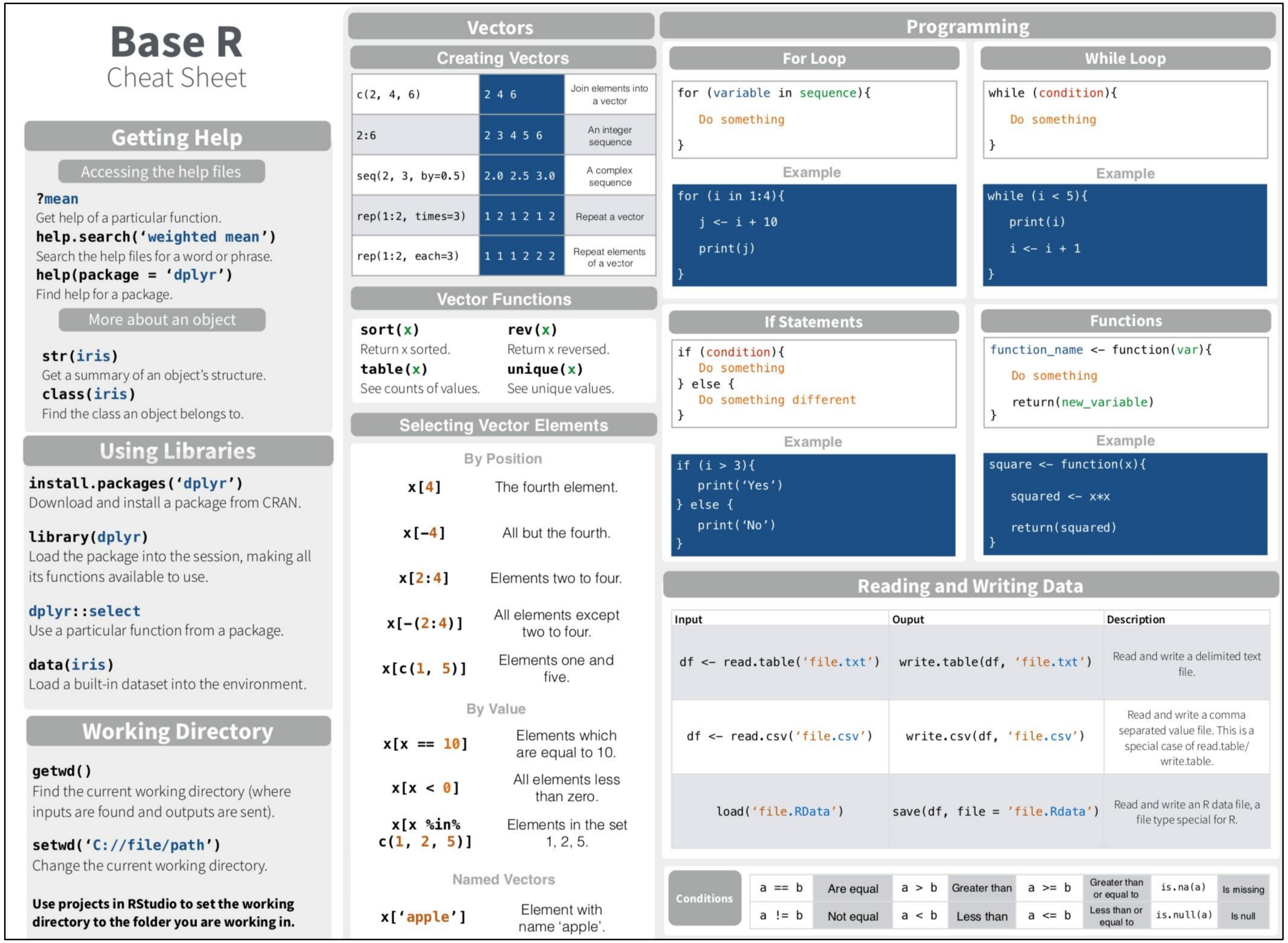

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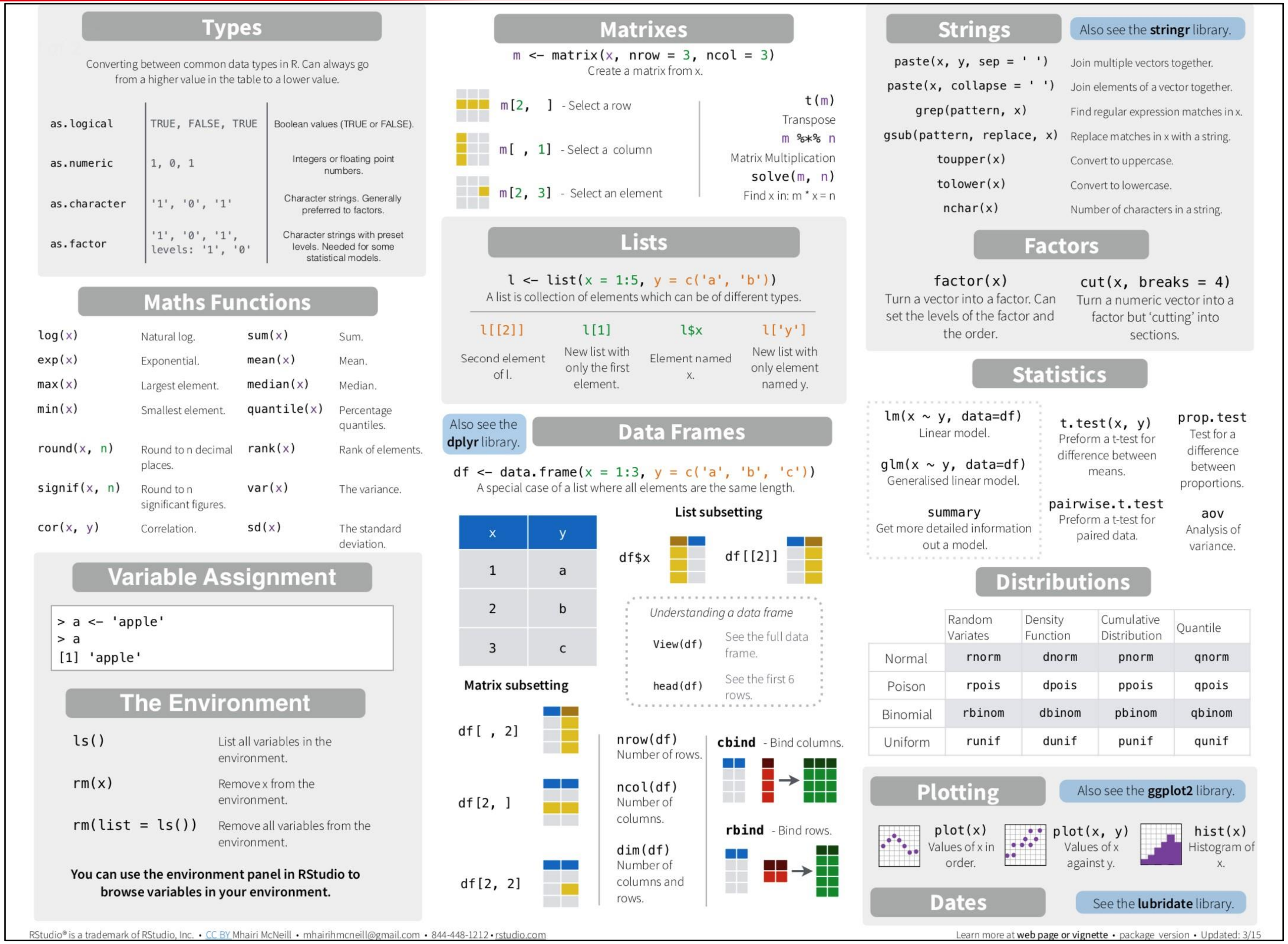

Types

Converting between common data types in R. Can always go from a higher value in the table to a lower value.

as.logical	TRUE, FALSE, TRUE	Boolean values (TRUE or FALSE).
as.numeric	1, 0, 1	Integers or floating point numbers.
as.character	'1', '0', '1'	Character strings. Generally preferred to factors.
as.factor	'1', '0', '1', levels: '1', '0'	Character strings with preset levels. Needed for some statistical models.

Maths Functions

log(x)	Natural log.	sum(x)	Sum.
exp(x)	Exponential.	mean(x)	Mean.
max(x)	Largest element.	median(x)	Median.
min(x)	Smallest element.	quantile(x)	Percentage quantiles.
round(x, n)	Round to n decimal places.	rank(x)	Rank of elements.
signif(x, n)	Round to n significant figures.	var(x)	The variance.
cor(x, y)	Correlation.	sd(x)	The standard deviation.

Variable Assignment

```
> a <- 'apple'
> a
[1] 'apple'
```

The Environment

ls()	List all variables in the environment.
rm(x)	Remove x from the environment.
rm(list = ls())	Remove all variables from the environment.

You can use the environment panel in RStudio to browse variables in your environment.

Matrixes

`m <- matrix(x, nrow = 3, ncol = 3)`
Create a matrix from x.

m[2,] - Select a row	t(m) Transpose
m[, 1] - Select a column	m %*% n Matrix Multiplication
m[2, 3] - Select an element	solve(m, n) Find x in: m * x = n

Lists

`l <- list(x = 1:5, y = c('a', 'b'))`
A list is collection of elements which can be of different types.

l[[2]]	l[1]	l$x	l['y']
Second element of l.	New list with only the first element.	Element named x.	New list with only element named y.

Also see the **dplyr** library.

Data Frames

`df <- data.frame(x = 1:3, y = c('a', 'b', 'c'))`
A special case of a list where all elements are the same length.

x	y
1	a
2	b
3	c

List subsetting

df$x   df[[2]]

Understanding a data frame

View(df)	See the full data frame.
head(df)	See the first 6 rows.

Matrix subsetting

df[, 2]

df[2,]

df[2, 2]

nrow(df)	Number of rows.
ncol(df)	Number of columns.
dim(df)	Number of columns and rows.

cbind - Bind columns.

rbind - Bind rows.

Strings

Also see the **stringr** library.

paste(x, y, sep = ' ')	Join multiple vectors together.
paste(x, collapse = ' ')	Join elements of a vector together.
grep(pattern, x)	Find regular expression matches in x.
gsub(pattern, replace, x)	Replace matches in x with a string.
toupper(x)	Convert to uppercase.
tolower(x)	Convert to lowercase.
nchar(x)	Number of characters in a string.

Factors

factor(x)	cut(x, breaks = 4)
Turn a vector into a factor. Can set the levels of the factor and the order.	Turn a numeric vector into a factor but 'cutting' into sections.

Statistics

lm(x ~ y, data=df) Linear model.	t.test(x, y) Preform a t-test for difference between means.	prop.test Test for a difference between proportions.
glm(x ~ y, data=df) Generalised linear model.	pairwise.t.test Preform a t-test for paired data.	aov Analysis of variance.
summary Get more detailed information out a model.		

Distributions

	Random Variates	Density Function	Cumulative Distribution	Quantile
Normal	rnorm	dnorm	pnorm	qnorm
Poison	rpois	dpois	ppois	qpois
Binomial	rbinom	dbinom	pbinom	qbinom
Uniform	runif	dunif	punif	qunif

Plotting

Also see the **ggplot2** library.

plot(x) Values of x in order.	plot(x, y) Values of x against y.	hist(x) Histogram of x.

Dates

See the **lubridate** library.

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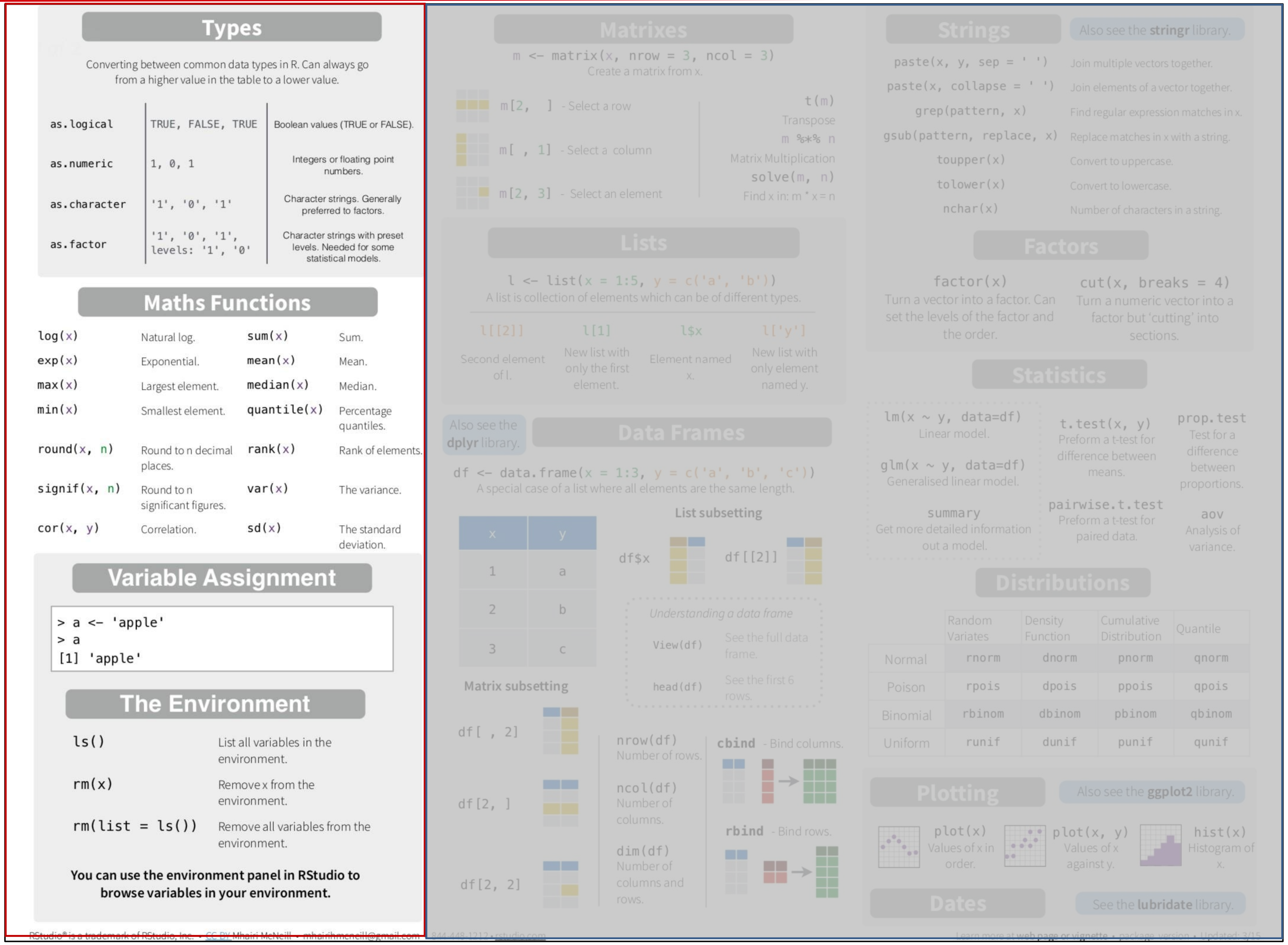

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> a <- 'apple'
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Create a matrix from x.

`m[2, ]` - Select a row	`t(m)` Transpose
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`l[[2]]`	`l[1]`	`l$x`	`l['y']`
Second element of l.	New list with only the first element.	Element named x.	New list with only element named y.

Also see the **dplyr** library.

Data Frames

`df <- data.frame(x = 1:3, y = c('a', 'b', 'c'))`
A special case of a list where all elements are the same length.

x	y
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`df$x` `df[[2]]`

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`View(df)`	See the full data frame.
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Also see the **ggplot2** library.

`plot(x)` Values of x in order.	`plot(x, y)` Values of x against y.	`hist(x)` Histogram of x.

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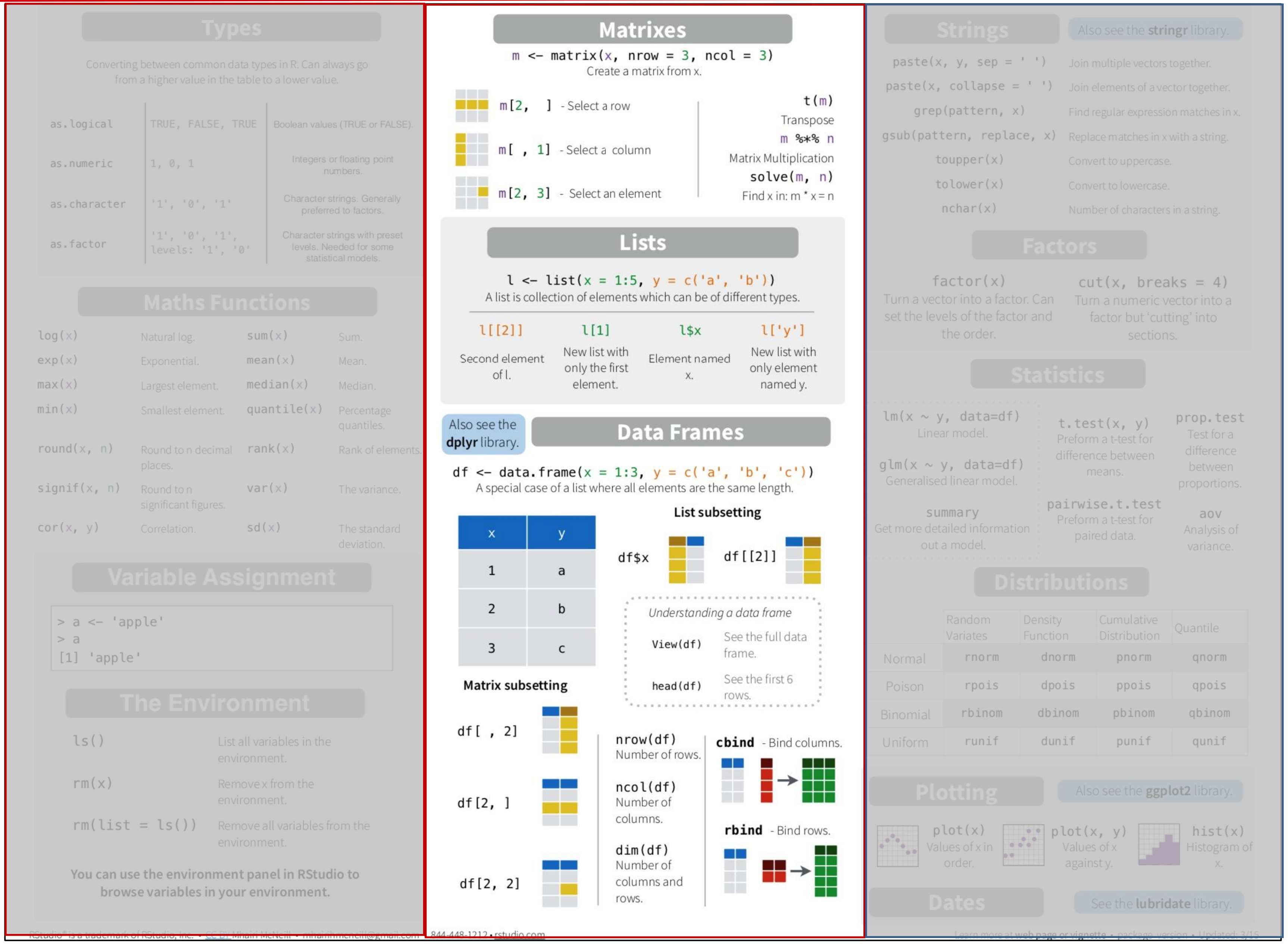

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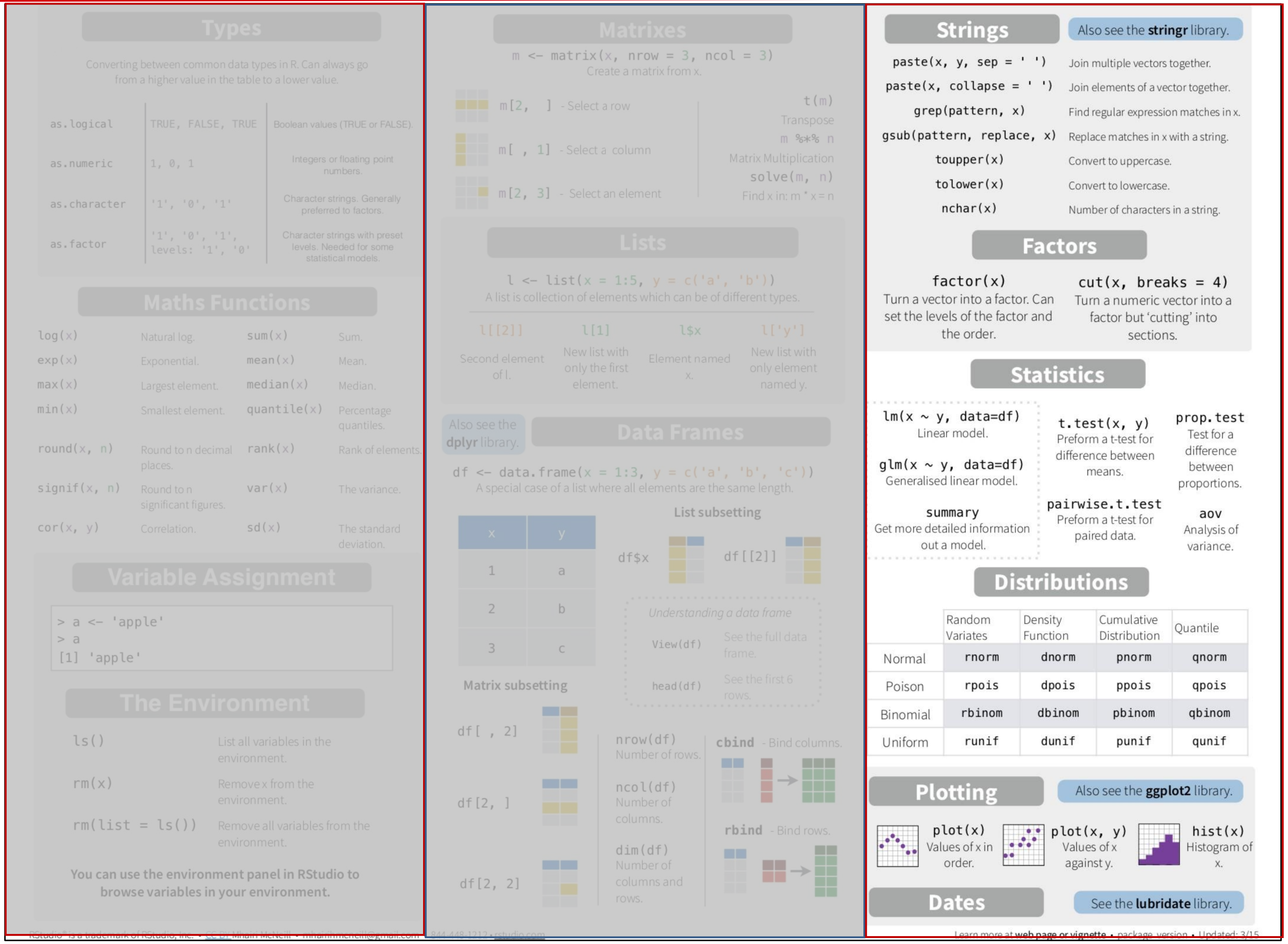

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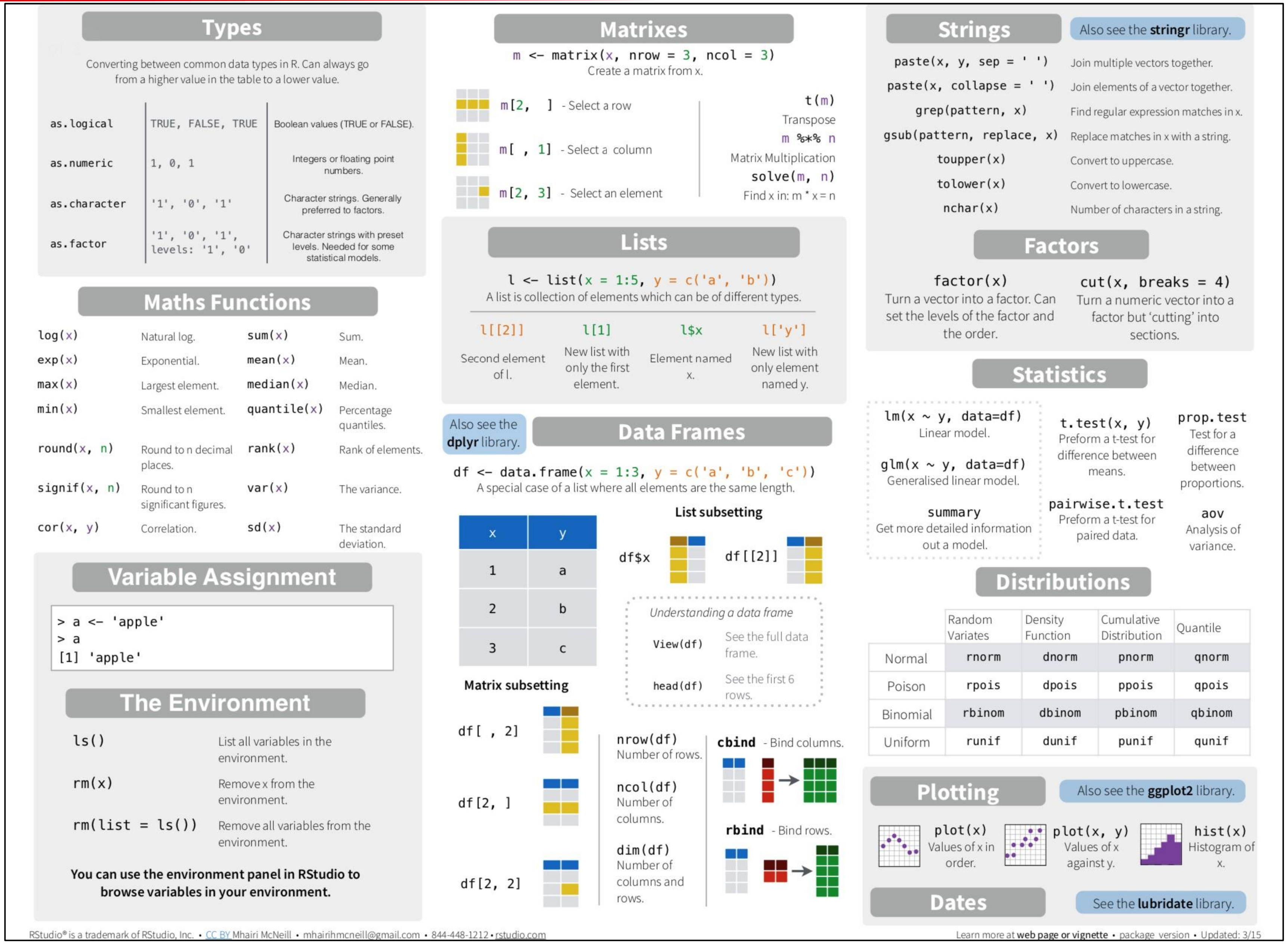

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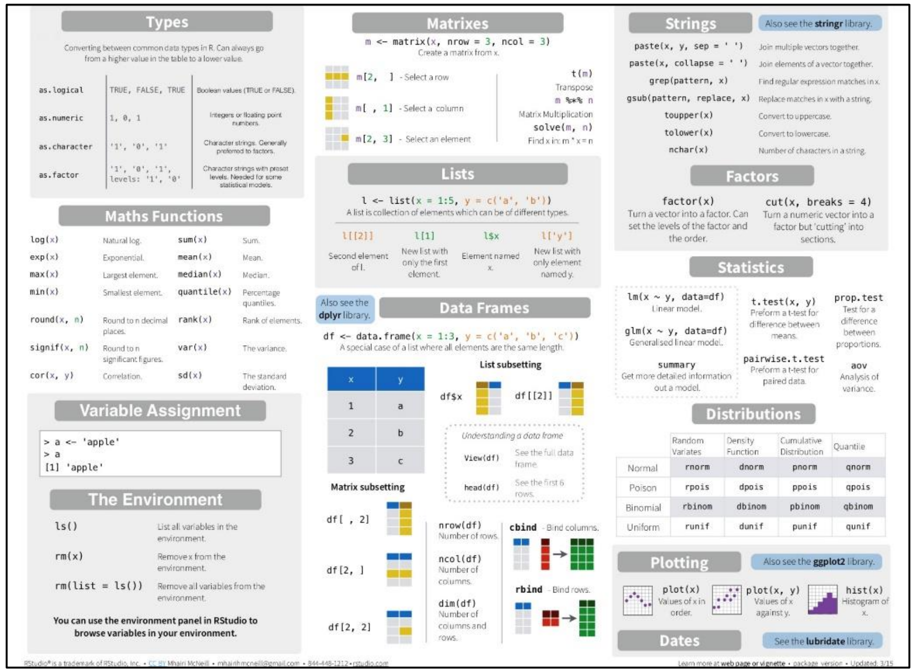

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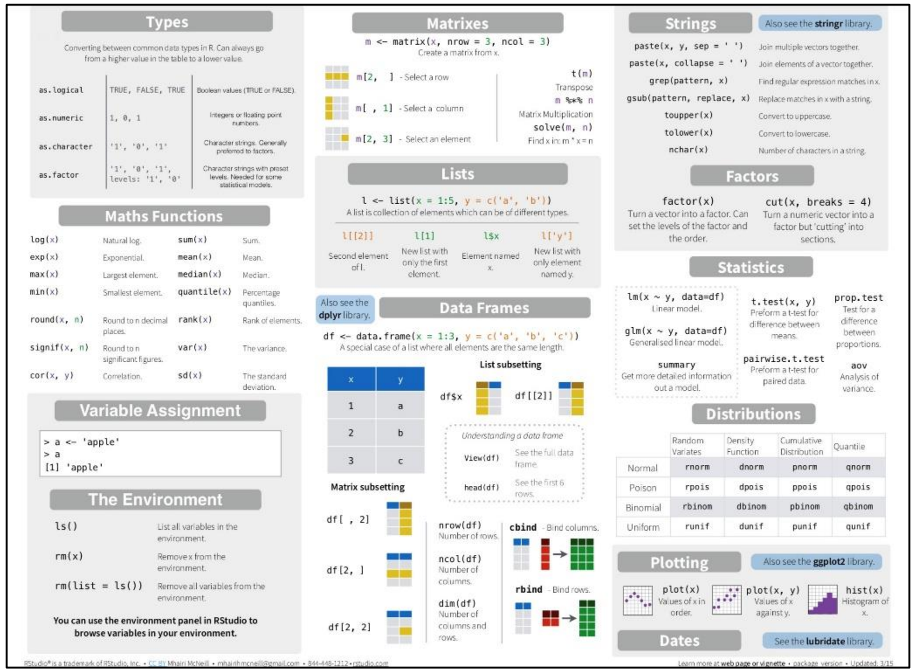

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signif(x, n) Round to n significant figures. var(x) The variance.
cor(x, y) Correlation. sd(x) The standard deviation.

Variable Assignment

> a <- 'apple'
> a
[1] 'apple'

The Environment

ls() List all variables in the environment.
rm(x) Remove x from the environment.
rm(list = ls()) Remove all variables from the environment.

You can use the environment panel in RStudio to browse variables in your environment.

Matrixes

m <- matrix(x, nrow = 3, ncol = 3)
Create a matrix from x.
m[2,] - Select a row
m[, 1] - Select a column
m[2, 3] - Select an element
t(m) Transpose
m %*% n Matrix Multiplication
solve(m, n) Find x in: m * x = n

Lists

l <- list(x = 1:5, y = c('a', 'b'))
A list is collection of elements which can be of different types.
l[[2]] Second element of l.
l[1] New list with only the first element.
l$x Element named x.
l['y'] New list with only element named y.

Also see the dplyr library.

Data Frames

df <- data.frame(x = 1:3, y = c('a', 'b', 'c'))
A special case of a list where all elements are the same length.
x y
1 a
2 b
3 c
List subsetting
df$x df[[2]]
Understanding a data frame
View(df) See the full data frame.
head(df) See the first 6 rows.
Matrix subsetting
df[, 2]
df[2,]
df[2, 2]
nrow(df) Number of rows.
ncol(df) Number of columns.
dim(df) Number of columns and rows.
cbind - Bind columns.
rbind - Bind rows.

Strings

Also see the stringr library.
paste(x, y, sep = ' ') Join multiple vectors together.
paste(x, collapse = ' ') Join elements of a vector together.
grep(pattern, x) Find regular expression matches in x.
gsub(pattern, replace, x) Replace matches in x with a string.
toupper(x) Convert to uppercase.
tolower(x) Convert to lowercase.
nchar(x) Number of characters in a string.

Factors

factor(x) Turn a vector into a factor. Can set the levels of the factor and the order.
cut(x, breaks = 4) Turn a numeric vector into a factor but 'cutting' into sections.

Statistics

lm(x ~ y, data=df) Linear model.
glm(x ~ y, data=df) Generalised linear model.
summary Get more detailed information out a model.
t.test(x, y) Preform a t-test for difference between means.
pairwise.t.test Preform a t-test for paired data.
prop.test Test for a difference between proportions.
aov Analysis of variance.

Distributions

Random Variates Density Function Cumulative Distribution Quantile
Normal rnorm dnorm pnorm qnorm
Poison rpois dpois ppois qpois
Binomial rbinom dbinom pbinom qbinom
Uniform runif dunif punif qunif

Plotting

Also see the ggplot2 library.
plot(x) Values of x in order.
plot(x, y) Values of x against y.
hist(x) Histogram of x.

Dates

See the lubridate library.

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Any Questions?