Exercise 1 - Brief introduction to R, Combinatorics

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First we will go through some basics of R.

Brief introduction to R

In [1]:
```
# simple arithmetic operations
2+4
5/2
```

6

2.5

In [2]:
```
# BEWARE of brackets! Only round ones are used for counting!
# Square and compound have a different role in R.!
(((10+2)*(340-33))-2)/3
```

1227.33333333333

In [3]:
```
# combination number, factorials
choose(10,2)
factorial(4)
```

45

24

In [4]:
```
# data types ->numeric, character, logical,(complex)
# the class function determines the type of the object
a=2+3
class(a)
```

'numeric'

In [5]:
```
b="some text"
class(b)
```

'character'

In [6]:
```
c=(1>3)
class(c)
```

'logical'

In [7]:
```
d=3+1i
class(d)
```

'complex'

data structures in R

- vector (column vector)
- factor (special case of vector)
- matrix (matrix with dimensions n x m)
- data.frame (data frame with columns representing diferent types of informations and rows representing single records)

In [8]:
```
# vector definition
```

```
a = c(3,4,6,7)
a <- c(3,4,6,7)
a[2]
```

4

In [9]:

```
# other options
rep(1,4) # creates a vector with four ones
```

1 · 1 · 1 · 1

In [10]:

```
seq(1,10,2) # sequence from 1 to 10 with step 2
```

1 · 3 · 5 · 7 · 9

In [11]:

```
1:10  # sequence from 1 to 10 with step 1
```

1 · 2 · 3 · 4 · 5 · 6 · 7 · 8 · 9 · 10

In [12]:

```
b=c("A","B","C","D")
b
```

'A' · 'B' · 'C' · 'D'

In [13]:

```
class(b)
```

'character'

In [14]:

```
# redefining an object to another type - eg as.vector, as.matrix, as.factor,...
b=as.factor(b)
b
```

A · B · C · D

▶ **Levels**:

In [15]:

```
# working with vectors - merging by columns/rows
cbind(a,b)
```

A matrix: 4 × 2 of type dbl

a	b
3	1
4	2
6	3
7	4

In [16]:

```
rbind(a,b)
```

A matrix: 2 × 4 of type dbl

a	3	4	6	7
b	1	2	3	4

In [17]:

```
c(a,b)
```

3 · 4 · 6 · 7 · 1 · 2 · 3 · 4

In [18]:
```
# matrix definition
A=matrix(c(3,4,6,7,3,2),nrow=2,ncol=3)
B=matrix(c(3,4,6,7,3,2),nrow=2,ncol=3,byrow=TRUE)
C=matrix(c(3,4,6,7,3,2),nrow=3,ncol=2)
```

In [19]:
```
A
B
```

A matrix:
2 × 3 of
type dbl

3	6	3
4	7	2

A matrix:
2 × 3 of
type dbl

3	4	6
7	3	2

In [20]:
```
B[1,3]
```

6

In [21]:
```
A[1,]
```

3 · 6 · 3

In [22]:
```
A[,2:3]
```

A
matrix:
2 × 2
of type
dbl

6	3
7	2

In [23]:
```
# diagonal matrix
diag(4)
```

A matrix: 4 ×
4 of type dbl

1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

In [24]:
```
diag(4,2)
```

A
matrix:
2 × 2
of type
dbl

4	0
0	4

In [25]:
```
# matrix operations - pay attention to matrix multiplication -> %*%
A+B
```

A matrix: 2 × 3 of type dbl

6	10	9
11	10	4

In [26]:
```
A-B
```

A matrix: 2 × 3 of type dbl

0	2	-3
-3	4	0

In [27]:
```
A*B
```

A matrix: 2 × 3 of type dbl

9	24	18
28	21	4

In [28]:
```
A%*%C
```

A matrix: 2 × 2 of type dbl

51	45
52	53