ISFG summer school - virtual edition 2021

Pedigree analysis in R
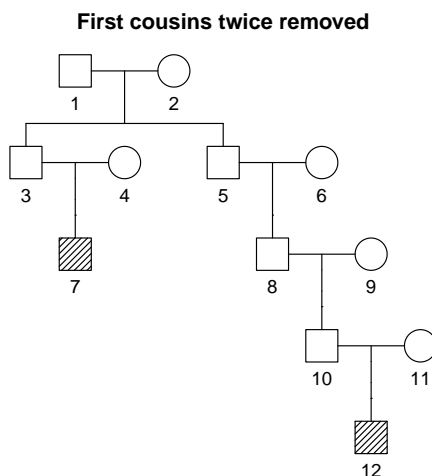
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Solutions for exercise set I

Note: In some cases the answers are given in the exercises and therefore omitted here.
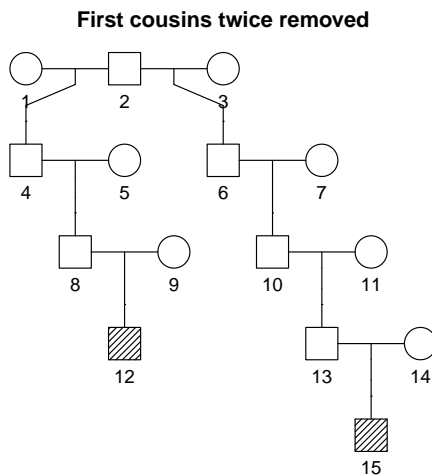
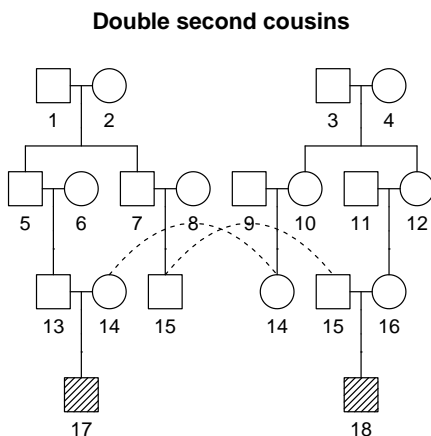### Exercise I-1

R code for producing the pedigrees is given below.

a)
```
library(pedtools)
x1 = cousinPed(1, removal = 2)
plot(x1, hatched = leaves, title = "First cousins twice removed")
```

First cousins twice removed

b)
```
x2 = halfCousinPed(2, removal = 1)
plot(x2, hatched = leaves, title = "Half second cousins once removed")
```

First cousins twice removed

1

c)
```
x3 = doubleCousins(degree1 = 2, degree2 = 2)
plot(x3, hatched = leaves, title = "Double second cousins")
```

Double second cousins

Exercise I-2

a) Adrian and Belinda are half first cousins.

b) With the new information, Adrian and Belinda are simultaneous (maternal) half siblings and first half cousins. The pedigree can be produced as follows:

```
x = halfSibStack(2)
x = swapSex(x, 8)
plot(x, hatched = leaves, labs = c(Adrian = 7, Belinda = 8), margin = c(1,1,1,1))
```
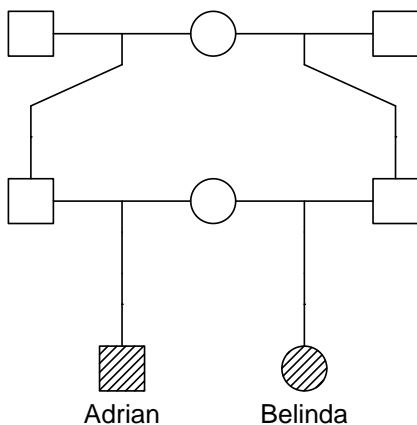

Exercise I-3

a) The marker is an autosomal STR marker. Reasons: allele labels; more than two alleles.
b) Five alleles (13, 14, 15, 21 and 2) are observed. The alleles names indicate the number of repeats.
c) Both 4 and 5 has genotype 13/14 (because of their parents).
d) Individual 3 has genotype 21/22 (because his children must have gotten 13 from their mother).
e) The possible genotypes are 13/13, 13/14, 13/15 and 14/15, each with probability $\frac{1}{4}$.

Exercise I-4

a)
```r
2 - 4 / 2 + 3 ^ 2
```

```
## [1] 9
```

b)
```r
1:4 + 1 + c(0, 0, 0, 10)
```

```
## [1]  2  3  4 15
```

c)
```r
sqrt(c(1,4,9,16))
```

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

```r
10^(1:3)
```

```
## [1]   10  100 1000
```

```r
log10(1000)
```

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

```r
exp(1)
```

```
## [1] 2.718282
```

d)
```r
x = 0
y = 1:5
z = seq(from = 6, to = 10)
c(x, y, z)
```

```
##  [1]  0  1  2  3  4  5  6  7  8  9 10
```

e)
```r
y = list(a = 1:3, b = "foo")
y$a = c(y$a, 4:6)
y$b = c(y$b, "bar")
y$c = c(T, F)
y
```

```
## $a
## [1] 1 2 3 4 5 6
##
## $b
## [1] "foo" "bar"
##
## $c
## [1]  TRUE FALSE
```
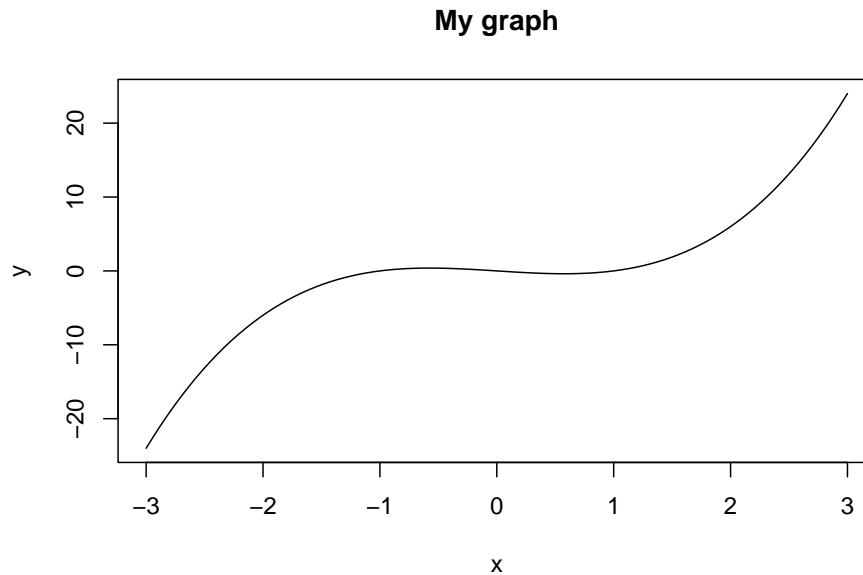
Exercise I-5

```r
x = seq(-3, 3, length = 100)
y = x^3 - x
plot(x, y, type = "l", main = "My graph")
```

My graph

Exercise I-6

(Answer omitted.)

Exercise I-7

a) B (forced inheritance from the mother).
b) A/B (deduced from her children 5 and 6).
c) A/B. (She got B from her father, but has given an A to her son individual 10). She inherited A from her mother.
d) Neither genotype is possible to determine from the data.
e) 10 and 11 are maternal half siblings. 5 is the (maternal) uncle of 11. 4 and 9 are unrelated.