Pedigrees and kinship analysis in forensic genetics

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Exercise set I. Pedigrees and measures of relatedness

The following software is used in these exercises:

- **QuickPed**: Online app available at https://magnusdv.shinyapps.io/quickped.
- **R/pedsuite**: To check that the pedsuite is installed, open RStudio and load it:

```
library(pedsuite)   # if error, run `install.packages("pedsuite")` and try again
```

Exercise I-1

Draw pedigrees by hand illustrating the following relationships.

a) Grandaunt – grandnephew.
b) Half first cousins once removed.

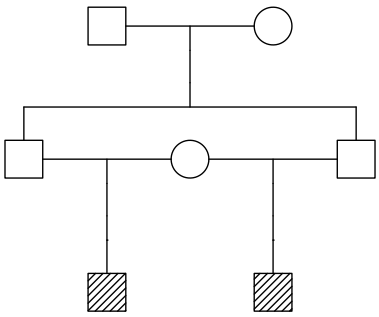
Exercise I-2

In a case of incest a man had a child by his own granddaughter.

a) Draw the pedigree (with QuickPed or R).
b) Compute the inbreeding coefficient of the child.

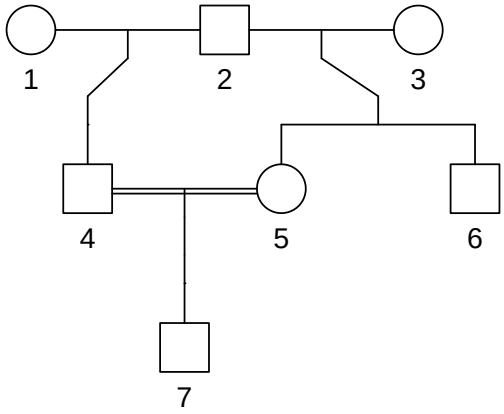
Exercise I-3

Consider the following pedigree:



a) Describe the relationship between the children. Are they inbred?
b) Show (with QuickPed or R) that their IBD coefficients are $\kappa = (\frac{3}{8}, \frac{1}{2}, \frac{1}{8})$.
c) Show the relationship in the IBD triangle.
d) This relationship is sometimes called *3/4-siblings*. Why?

Exercise I-4



a) Create the above pedigree in QuickPed. (Hint: Start with `Half siblings (pat)`.)
b) Describe the relationship between 6 and 7.
c) What is the kinship coefficient between 6 and 7?
d) What is the inbreeding coefficient of individual 7?
e) Click on the "R code" button and verify that the code produces the same pedigree in R.

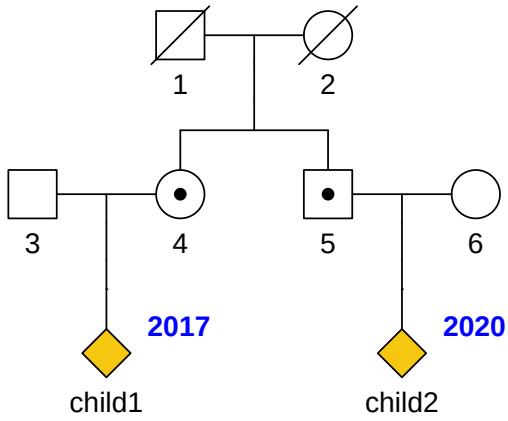
Exercise I-5

a) What is the definition of the kinship coefficient φ between two individuals?
b) What is the kinship coefficient between monozygotic twins?
c) Give examples of relationships where $\varphi \geq 0.5$.
d) Discuss: Describe a relationship with $\varphi = 1$. How can this be achieved in practice? (Hint: It is best to imagine other species than humans for this one!)

Bonus exercises (if you have time)

Exercise I-6

Recreate the following pedigree plot in QuickPed as accurately as possible:



Exercise I-7

Draw your own family tree in QuickPed.