

# Kinship and pedigree analysis: Methods and applications

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## Exercise set II. Measures of relatedness

Most of these exercises can be solved in either QuickPed, R, or by hand (if you want to show off!)

QuickPed: <https://magnusdv.shinyapps.io/quickped/>

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### Exercise II-1

Find the kinship coefficient of the following relationships:

- Uncle – niece.
- Half first cousins.

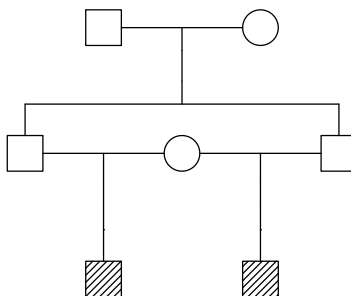
### Exercise II-2

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

- Draw the pedigree (in R or QuickPed).
- Compute the inbreeding coefficient of the child.

### Exercise II-3

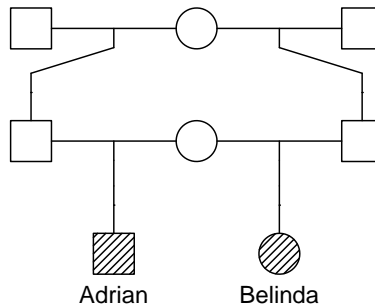
Consider the following pedigree:



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

**Exercise II-4**

Recall the relationship between Adrian and Belinda from the previous exercise set:



- Compute the kinship coefficient between Adrian and Belinda.
- Compute their IBD coefficients ( $\kappa_0, \kappa_1, \kappa_2$ ).
- Plot the corresponding point in the IBD triangle.
- (For the mathematically inclined) Explain why Adrian and Belinda may be called *5/8-siblings*.

**Exercise II-5**

- What is the kinship coefficient between monozygotic twins?
- Can you think of a relationship with kinship coefficient  $\varphi = 1$ ?

**Exercise II-6**

Consider a pair of siblings whose parents are (outbred) full siblings.

- Find the identity coefficients of the relationship.
- Verify that all 9 coefficients are non-zero. (This is the simplest example of a relationship with this property!)
- Compare the value of  $\Delta_9$  (“no IBD”) with the value  $\kappa_0 = 0.25$  for *outbred* siblings. Comment the result.

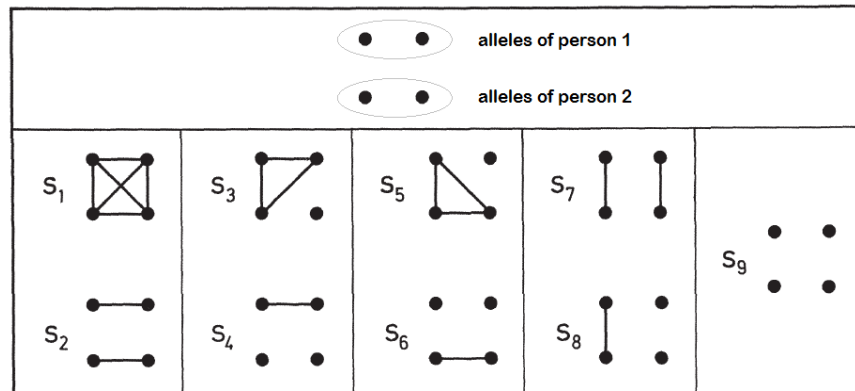


Figure 1: Jacquard's 9 condensed identity states