Livestock Breeding and Genomics - Exercise 9

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2023-11-10

Problem 1: Numerator Relationship Matrix

The following pedigree is given

Calf	Sire	Dam
4	1	2
5	3	2
6	4	5

The pedigree can be read from the file

```
## https://charlotte-ngs.github.io/lbgfs2023/data/ped_num_rel_mat.csv
```

Compute the numerator relationship matrix A for the given pedigree. Recall from the course notes that elements of matrix A are computed differently for elements on the diagonal and for off-diagonal elements. In summary, we compute

- diagonal element $(A)_{ii}$ as $(A)_{ii} = 1 + F_i$ where $F_i = 0.5 * (A)_{sd}$ where s and d are parents of i.
- off-diagonal element $(A)_{ki}$ as $(A)_{ki} = 0.5 * [(A)_{ks} + (A)_{kd}]$ where s and d are parents of i

Task

Use two nested loops over the rows and the columns of matrix A to compute all the elements of matrix A using the formulas given above.

Problem 2: Verification

Use the function `pedigreemm::getA()` from package `pedigreemm` to verify your result from problem 1.

Problem 3: Functions in R

Computations such as the computation of the diagonal elements or such as the one of the off-diagonal elements can be isolated and factored out in a important programming construct which is called `function`. A function takes a set of input parameter and transforms them into a result which is returned. For our example of the numerator relationship matrix two functions can be constructed according to the following template

```
compute_square <- function(pn_number){
  square_result <- pn_number*pn_number
  return(square_result)
}
```

The function can be used by function calls which take a given input and return a result

```
compute_square(pn_number = 3)
```

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

```
compute_square(1:10)
```

```
##  [1]   1   4   9  16  25  36  49  64  81 100
```

Task

Use the above template to construct a function and factor out the computations of the diagonal elements and of the off-diagonal elements into two separate functions.