Livestock Breeding and Genomics - Exercise 6

Peter von Rohr

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Problem 1: Numerator Relationship Matrix

Construct the numerator relationship matrix A for the following pedigree and verify the result using the function `getA()` from package `pedigreemm`.

Table 1: Pedigree For Constructing Numerator Relationship Matrix

Animal	Sire	Dam
5	1	2
6	1	3
7	4	5
8	4	5
9	4	6
10	4	6

Problem 2: BLUP Animal Model

Use the following dataset to predict breeding values for all animals.

Table 2: Data for Animal Model

Animal	Sire	Dam	Herd	Observation
5	1	2	1	16.77
6	1	3	1	20.04
7	4	5	1	18.39
8	4	5	2	5.43
9	4	6	2	11.92
10	4	6	2	7.36

Assumptions

- Random residuals are un-correlated and they all have equal variance σ_e^2 which is assumed to be 24.
- The additive genetic variance σ_a^2 is assumed to be 8.
- The pedigree is the same as in Problem 1. You can use `solve()` in R or `pedigreemm::getAInv()` to invert A.

Your Tasks

- Specify all components including expected values and variances of the animal model using the information from the dataset.
- Set up mixed model equations
- Solve mixed model equations for estimates of fixed effects and for predicted breeding values