Livestock Breeding and Genomics - Excercise 11

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Problem 1: Importance of Accuracy

The importance of the accuracy of predicted breeding values is different between livestock species and even between farmers within the same breeding organisation. When considering the selection response per year as a relevant criterion for comparing different selection strategies, there is a clear trade-off between accuracy of predicted breeding values and length of the generation interval. The selection response per year is defined as

$$R = \frac{i * r_{a,\hat{a}} * \sigma_a}{L}$$

where i is the selection intensity, $r_{a,\hat{a}}$, σ_a is the genetic additive variance and L denotes the generation interval. Assume the values for i to be 1.4 and for σ to be 16. Compute the selection response R for the accuracies and the generation intervals given in the following table.

Accuracy	Generation Interval	Selection Response (R)
0.45	2.0	
0.50	2.5	
0.55	3.0	
0.60	3.5	
0.65	4.0	
0.70	4.5	
0.75	5.0	
0.80	5.5	
0.85	6.0	
0.90	6.5	

Problem 2: Decomposition of Predicted Breeding Values

Given is the following dataset.

Animal	Sire	Dam	Observation
1	NA	NA	20.09
2	NA	NA	11.32
3	NA	NA	16.40
4	1	2	20.25
5	4	3	11.49

Predict the breeding value for animal 4 once with the sire model and then with the animal model and see what is the difference between the two predicted breeding values based on the decomposition of the respective mixed model equation.

The variances are given in the following table

Component	Variance
Residual	24
Additive Genetic	8
Sire	2

The residual variance-covariance matrix R is assumed to have a simple structure, meaning that we can write

$$R = I * \sigma_e^2$$