Selection Index To Predict Breeding Values

Peter von Rohr

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Prediction of Breeding Values Using Selection Index

- Goal: predict breeding value for one trait by selection index $I = b^T * y^*$
- Index Normal Equations

$$Pb = Gw$$

- Set aggregate genotype H to just one trait

$$H = a \qquad \text{and} \qquad w = 1$$

- Leads to

$$Pb = G \qquad \text{and} \qquad b = P^{-1}G$$

Example: Own Performance

- Available source of information:
  - one own performance record
  - on the same trait as in H and
  - for which we want to predict breeding values for
- Always the same strategy
  - Determine P and G and compute b
  - Compute I
- For our example:
  - P is the variance-covariance between all information source
  - phenotypic own performance record as the only information
  - $P = \sigma_y^2$
  - G: covariance between true breeding value and information source
  - $G = cov(a, y^*) = cov(a, a + e) = cov(a, a) + cov(a, e) = \sigma_a^2$
  - $b = P^{-1}G = \frac{\sigma_a^2}{\sigma_y^2} = h^2$
  - $\hat{a}_i = I = b * y^* = h^2 * (y - \mu)$

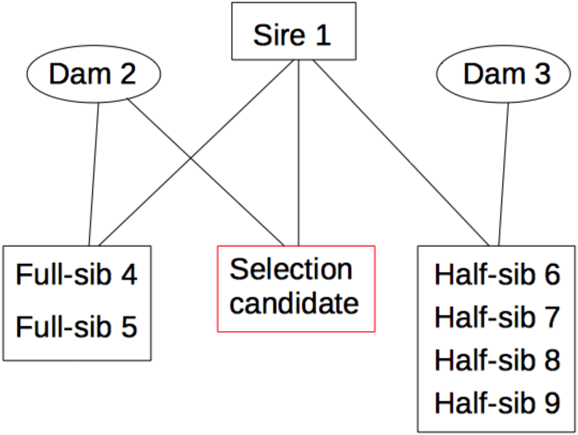
Example: Repeated Records

- Problem 1 in Exercise 6

Combining Information

- Examples so far: nice to confirm what we knew already
- Interesting property of selection index
  - Combine different information sources
- Example: Predict Breeding value for animal i based on
  - Average of two full-sib records
  - Average of four half-sib records

Records of Full- and Half-Sibs



Data

Measurement	Sire	Dam	Weigth
1	1	2	270.10
2	1	2	263.52
3	1	3	221.49
4	1	3	280.41
5	1	3	215.75
6	1	3	292.45

Compute Matrix P

$$P = \begin{bmatrix} var(\bar{y}_{FS}) & cov(\bar{y}_{FS}, \bar{y}_{HS}) \\ cov(\bar{y}_{FS}, \bar{y}_{HS}) & var(\bar{y}_{HS}) \end{bmatrix}$$

$$var(\bar{y}_{FS}) = \frac{1 + (n_{FS} - 1)h^2/2}{n_{FS}} * \sigma_y^2$$

$$var(\bar{y}_{HS}) = \frac{1 + (n_{HS} - 1)h^2/2}{n_{HS}} * \sigma_y^2$$

$$cov(\bar{y}_{FS}, \bar{y}_{HS}) = \frac{1}{4} h^2 \sigma_y^2$$

Compute Matrix G

$$G = \begin{bmatrix} cov(a_i, \bar{y}_{FS}) \\ cov(a_i, \bar{y}_{HS}) \end{bmatrix}$$

$$cov(a_i, \bar{y}_{FS}) = \frac{1}{2}\sigma_a^2$$

$$cov(a_i, \bar{y}_{HS}) = \frac{1}{4}\sigma_a^2$$

Problem 2 in Exercise 6

- Compute b
- Compute $\hat{a}_i = I = b^T y^*$

$$y^* = \begin{bmatrix} \bar{y}_{FS} - \mu \\ \bar{y}_{HS} - \mu \end{bmatrix}$$