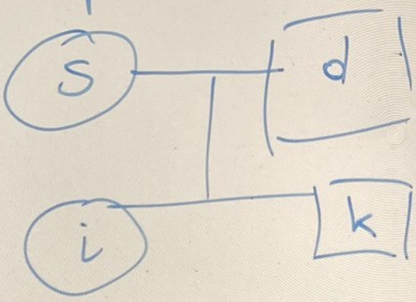
Breeding Values

$$y_{ij} = \mu + herd_j + u_i + e_{ij}$$

- Observation: weight of animal i in herd j
- u_i must be random, because $cov(u_i, u_k) \neq 0$ if animals i and k are related
- Example: animals i and k are full-sibs:



- For animal k: $y_{kl} = \mu + herd_l + u_j + e_{kl}$

$cov(u_i, u_k) \neq 0$, because of decomposition of breeding values

$$\left.\begin{aligned} u_i &= \tfrac{1}{2} u_s + \tfrac{1}{2} u_d + m_i \\ u_k &= \tfrac{1}{2} u_s + \tfrac{1}{2} u_d + m_k \end{aligned}\right\} cov(u_i, u_k) \neq 0$$

$$cov(u_i, u_k) = cov\left(\left[\tfrac{1}{2} u_s + \tfrac{1}{2} u_d + m_i\right], \left[\tfrac{1}{2} u_s + \tfrac{1}{2} u_d + m_k\right]\right)$$
$$= \tfrac{1}{4} var(u_s) + \tfrac{1}{4} var(u_d) = \tfrac{1}{2} \sigma_u^2$$

provided s and d not related.