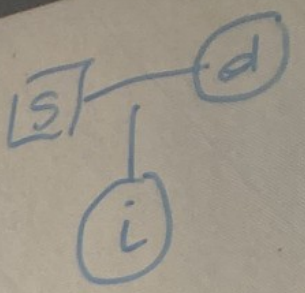


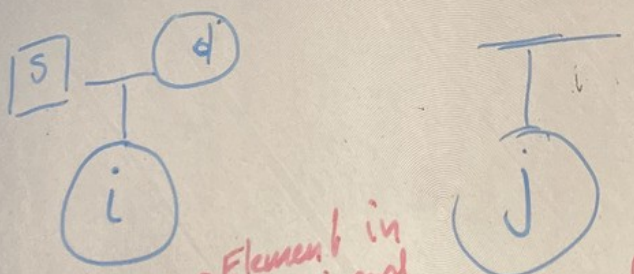
General:

$G = var(u) = A \cdot \sigma_u^2$

↓

#Numerator Relationship Matrix

(Additiv genetische Verwandtschaftsmatrix)



$cov(u_i, u_j) = \underbrace{(A)_{ij}}_{\text{Element in row i and column j of matrix A}} \cdot \sigma_u^2 = \left(\frac{1}{2}(A_{sj}) + \frac{1}{2}(A_{dj})\right] \cdot \sigma_u^2$

$cov(u_1, u_3) = cov\left(u_1, \frac{1}{2}u_1 + \frac{1}{2}u_2 + u_3\right)$

$= cov\left(u_1, \frac{1}{2}u_1\right) + cov\left(u_1, \frac{1}{2}u_2\right) + cov(u_1, u_3)$

$= \frac{1}{2} cov(u_1, u_1) + \frac{1}{2} \underbrace{cov(u_1, u_2)}_{0} + cov(u_1, u_3)$

$= \frac{1}{2} var(u_1) + \frac{1}{2} \cdot 0 + 0$

$= \frac{1}{2}(1 + F_1) \cdot \sigma_u^2$; F_1 corresponds to $1/2$ o