

numerator
relationship
matrix

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 4 & 5 & 6 \\ 3 & 4 & 5 & 6 & 7 \\ 4 & 5 & 6 & 7 & 8 \\ 5 & 6 & 7 & 8 & 9 \end{bmatrix}$$

$$(A)_{12} = \frac{\text{cov}(u_1, u_2)}{\sigma_u^2} = 0$$

$$(A)_{13} = \frac{\text{cov}(u_1, u_3)}{\sigma_u^2} = \frac{\text{cov}(u_1, [\frac{1}{2}u_1 + \frac{1}{2}u_2 + u_3])}{\sigma_u^2}$$

replaced
by parents
1 and 2

$$u_3 = \frac{1}{2}u_1 + \frac{1}{2}u_2 + u_3$$

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

$$= \frac{\frac{1}{2} \text{cov}(u_1, u_1)}{\sigma_u^2} + \frac{\frac{1}{2} \text{cov}(u_1, u_2)}{\sigma_u^2}$$

$(A)_{11}$

$(A)_{12}$

$$= \frac{1}{2} (A)_{11} + \frac{1}{2} (A)_{12}$$