

$$\text{var}(u_i) = \frac{1}{4} \text{var}(u_s) + \frac{1}{4} \text{var}(u_d) + \frac{1}{2} \text{cov}(u_s, u_d) + \text{var}(m_i)$$

□ Definition of $G = A \cdot \bar{F}_u^2$, we know that

$$\text{var}(u_s) = (1 + F_s) \bar{F}_u^2$$

$$\text{var}(u_d) = (1 + F_d) \bar{F}_u^2$$

$$\text{cov}(u_s, u_d) = (A)_{sd} \bar{F}_u^2 = 2F_i \bar{F}_u^2$$

where F_k is the inbreeding coefficient of animal k

□ Solve for $\text{var}(m_i)$:

$$\text{var}(m_i) = \text{var}(u_i) - \frac{1}{4} \text{var}(u_s) - \frac{1}{4} \text{var}(u_d) - \frac{1}{2} \text{cov}(u_s, u_d)$$

$$= (1 + F_i) \bar{F}_u^2 - \frac{1}{4} (1 + F_s) \bar{F}_u^2 - \frac{1}{4} (1 + F_d) \bar{F}_u^2 - \frac{1}{2} (2F_i \bar{F}_u^2)$$

$$= \left(\frac{1}{2} - \frac{1}{4} (F_s + F_d) \right) \bar{F}_u^2$$

for known parents s and d of animal i