

$$u_5 = \frac{1}{2}u_3 + \frac{1}{2}u_2 + m_5$$

Write equations in matrix vector notation

vector  $u = \begin{bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \\ u_5 \end{bmatrix}$

vector  $m = \begin{bmatrix} m_1 \\ m_2 \\ m_3 \\ m_4 \\ m_5 \end{bmatrix}$

Define Matrix  $P = \begin{matrix} & \begin{matrix} u_1 & u_2 & u_3 & u_4 & u_5 \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{matrix} & \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 1/2 & 1/2 & 0 & 0 & 0 \\ 0 & 1/2 & 1/2 & 0 & 0 \end{bmatrix} \end{matrix}$

$u = P \cdot u + m$  ;  $P$  Links parents to offspring and is a lower triangular matrix

First decomposition of breeding values  $u$ .