□ Correction: Set

$g_i = (w_i^T - s_i^T) \cdot q$ where $s_i = 2p - 1$ with p being the allele frequency of the positive allele

□ Matrix-Vector:

$$g = U \cdot q = (W - S)\, q \quad \text{with that } E(g) = \emptyset$$

- Requirement 2: $var(g) = G \cdot \sigma_g^2$

- $\sigma_g^2 = \underbrace{\sigma_q^2}_{\text{Marker-Effect variance}} \cdot \sum_{j=1}^{k} (1 - 2p_j(1-p_j))$

- Together with $g = U \cdot q$

$$var(g) = U \cdot \underbrace{var(q)}_{I \cdot \sigma_q^2 \text{ (see MEM)}} \cdot U^T = UU^T \cdot \sigma_q^2$$

$\Rightarrow var(g) = UU^T \cdot \sigma_q^2 = G \cdot \sigma_q^2 \cdot \sum_{j=1}^{k} (1 - 2p_j(1-p_j))$

$\Rightarrow G = \dfrac{UU^T}{\sum_{j=1}^{k} (1 - 2p_j(1-p_j))}$