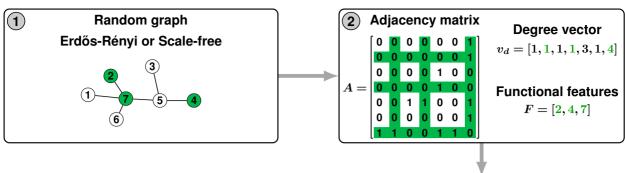
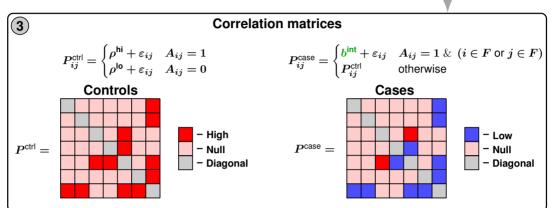
GWAS data: interactions and main effects





Cholesky decomposition **(4)**

$$P^{\mathsf{ctrl}} = U^{\mathsf{ctrl}} \left(U^{\mathsf{ctrl}}
ight)^\mathsf{T}$$

$$P^{\mathsf{case}} = U^{\mathsf{case}} \left(U^{\mathsf{case}}
ight)^\mathsf{T}$$

(5)Correlated continuous data

$$X^{ ext{ctrl}} = Z^{ ext{ctrl}} \left(U^{ ext{ctrl}}
ight)^{\mathsf{T}} \quad , \quad z^{ ext{ctrl}}_{ij} \sim \mathcal{N}(0,1)$$

$$X^{\mathsf{case}} = Z^{\mathsf{case}} \left(U^{\mathsf{case}}
ight)^{\mathsf{T}} \;\;,\;\; z_{ii}^{\mathsf{case}} \sim \mathcal{N}(0,1)$$

$$Y^{\mathsf{norm}} = \begin{bmatrix} X^{\mathsf{ctrl}} \\ ---- \\ X^{\mathsf{case}} \end{bmatrix}$$

$$oldsymbol{Y}^{\mathsf{unif}} = oldsymbol{\Phi} \left(oldsymbol{Y}^{\mathsf{cont}}
ight)$$

(7) Main effect data

Controls

$$p_{ ext{ctrl}} = rac{1-b^{ ext{main}}}{2}$$

For each
$$a \in \mathcal{A}$$

For each $i = 1, \ldots, m_{\mathsf{ctrl}}$

$$egin{aligned} oldsymbol{X_{ia}^{ ext{ctrl}}} &\sim \mathcal{B}\left(n=2, p_{ ext{ctrl}}
ight) \end{aligned}$$

$$p_{ extsf{case}} = rac{1 + oldsymbol{b}^{ ext{main}}}{2}$$

For each
$$a \in \mathcal{A}$$

For each
$$i=1,\ldots,m_{ ext{case}}$$
 $X_{ia}^{ ext{case}} \sim \mathcal{B}\left(n=2,p_{ ext{case}}
ight)$

$$X^{\mathsf{main}} = egin{bmatrix} X^{\mathsf{ctrl}} \\ ---- \\ X^{\mathsf{case}} \end{bmatrix}$$

$$f_a \sim \mathcal{U}(0.1, 0.4), \quad a \in \mathcal{A}$$

For each
$$a \in \mathcal{A}$$
For each $i \in \mathcal{I}$

$$X_{ia}^{ ext{int}} \sim B^{-1}\left(Y_{ia}^{ ext{unif}}; n=2, p=f_a
ight)$$

$$X = \begin{bmatrix} X^{\mathsf{int}} & X^{\mathsf{main}} \end{bmatrix}$$