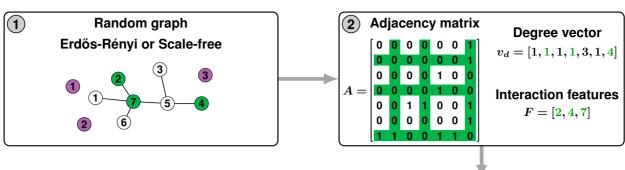
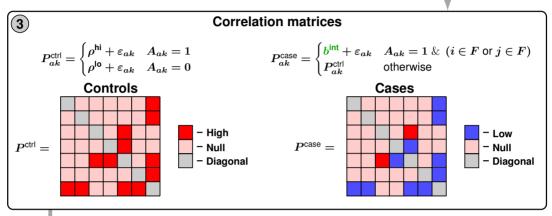
GWAS data: interactions and main effects





$oxed{4}$ Cholesky decomposition $P^{ ext{ctrl}} = U^{ ext{ctrl}} \left(U^{ ext{ctrl}} ight)^{ extsf{T}} \ P^{ ext{case}} = U^{ ext{case}} \left(U^{ ext{case}} ight)^{ extsf{T}}$

$oxed{5}$ Correlated continuous data $X^{ ext{ctrl}} = Z^{ ext{ctrl}} \left(U^{ ext{ctrl}} ight)^{ extsf{T}} \; , \; \; z_{ij}^{ ext{ctrl}} \sim \mathcal{N}(0,1)$

$$X^{\mathrm{case}} = Z^{\mathrm{case}} \left(U^{\mathrm{case}} \right)^{\mathrm{T}} \;\;,\;\; z_{ij}^{\mathrm{case}} \sim \mathcal{N}(0,1)$$

$$Y^{\text{cont}} = \begin{bmatrix} X^{\text{ctrl}} \\ ---- \\ X^{\text{case}} \end{bmatrix}$$

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

7 Main effect data

Controls

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

For
$$a=1,2,3$$
 For each $i=1,\ldots,m_{\mathsf{ctrl}}$ $X_{ia}^{\mathsf{ctrl}} \sim \mathcal{B}\left(n=2,p_{\mathsf{ctrl}}
ight)$

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Cases
$$p_{ ext{case}} = ar{f} + rac{1}{2} b^{ ext{main}}$$

For
$$a=1,2,3$$
 For each $i=1,\ldots,m_{ ext{case}}$ $X_{ia}^{ ext{case}} \sim \mathcal{B}\left(n=2,p_{ ext{case}}
ight)$

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

Interaction data $f_a \sim \mathcal{U}\left(arepsilon, 2ar{f} - arepsilon ight), \quad a = 1, 2, \dots, 7$ For $a = 1, 2, \dots, 7$

For
$$a=1,2,\ldots,7$$
 For each $i\in\mathcal{I}$ $X_{ia}^{ ext{int}}\sim B^{-1}\left(Y_{ia}^{ ext{unif}};n=2,p=f_a
ight)$

8 Mixed effects data

$$X = \left| X^{\mathsf{int}} \right| X^{\mathsf{main}}$$