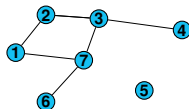
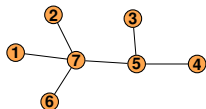


1

Random Graph

Scale-Free ← or → Erdos-Renyi



2

Adjacency Matrix

$$A = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 \end{bmatrix}$$

Degree Vector

$$v_d = [1, 1, 1, 1, 3, 1, 4]$$

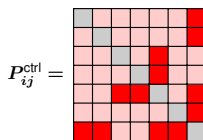
Functional Features

$$f = [2, 5, 7]$$

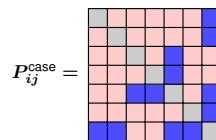
3

Correlation Matrices

$$P_{ij}^{\text{ctrl}} = \begin{cases} \rho^{\text{hi}} + \varepsilon_{ij} & A_{ij} = 1 \text{ \& } (i \in f \text{ or } j \in f) \\ \rho^{\text{lo}} + \varepsilon_{ij} & A_{ij} = 0 \end{cases} \quad P_{ij}^{\text{case}} = \begin{cases} b^{\text{int}} + \varepsilon_{ij} & A_{ij} = 1 \text{ \& } (i \in f \text{ or } j \in f) \\ P_{ij}^{\text{ctrl}} & A_{ij} = 0 \end{cases}$$



■ - High
■ - Null
■ - Diagonal



■ - Low
■ - Null
■ - Diagonal

4

Cholesky Decomposition

$$P^{\text{ctrl}} = U^{\text{ctrl}} (U^{\text{ctrl}})^T$$

$$P^{\text{case}} = U^{\text{case}} (U^{\text{case}})^T$$

5

Correlated Data

$$Y^{\text{ctrl}} = X^{\text{ctrl}} (U^{\text{ctrl}})^T, \quad x_{ij}^{\text{ctrl}} \sim \mathcal{N}(0, 1) \quad Y^{\text{case}} = X^{\text{case}} (U^{\text{case}})^T, \quad x_{ij}^{\text{case}} \sim \mathcal{N}(0, 1)$$

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