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Zakariya Ghalmane, Mohammed El Hassouni, Chantal Cherifi, Hocine Cherifi

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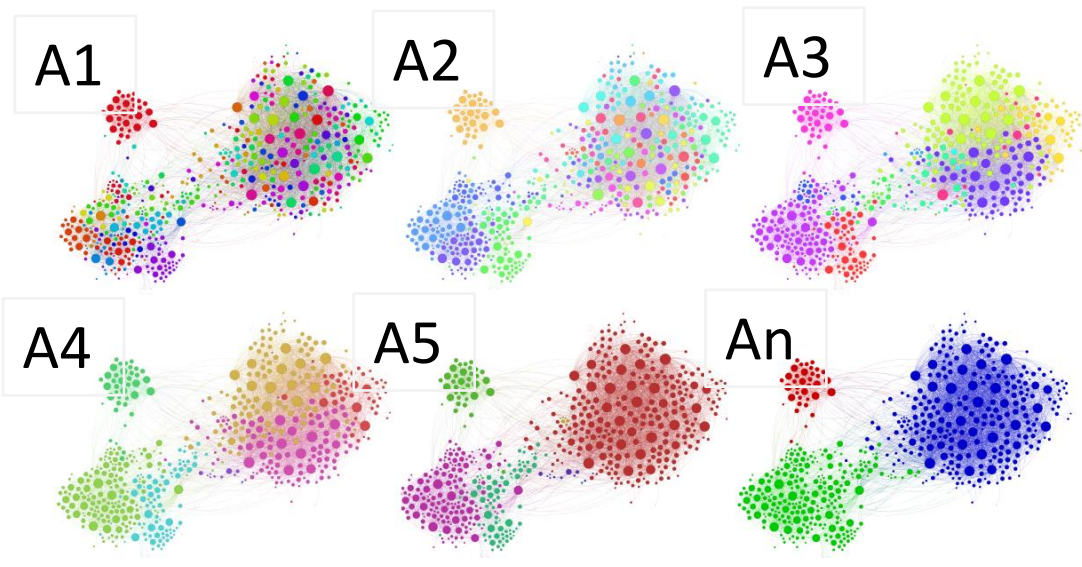
Influential Spreaders in Modular Networks

Zakariya Ghalmane & Mohammed El Hassouni
University Mohammed V MOROCCO

Chantal Cherifi
University of Lyon 2 FRANCE

Hocine Cherifi
University of Burgundy FRANCE

Problematic

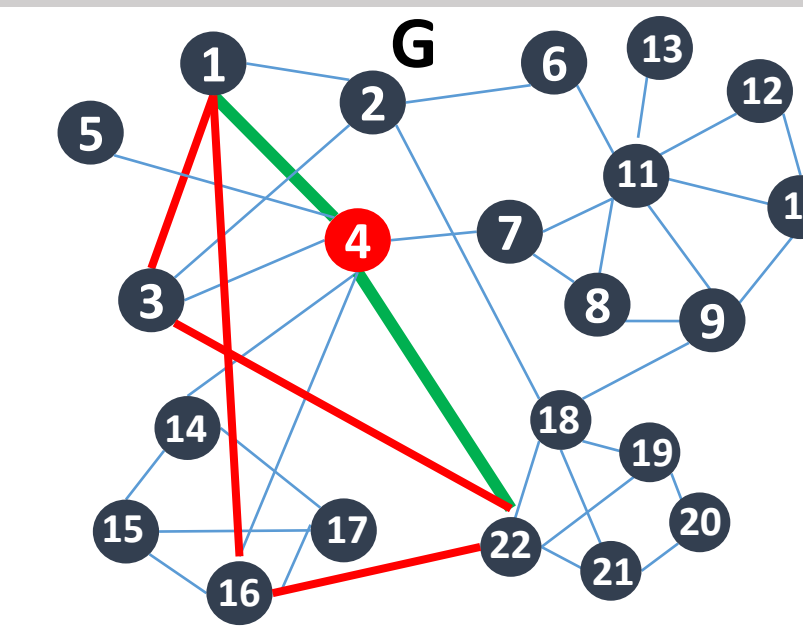


Centrality in modular networks?

Hypotheses:

- Community structure available (Ground-truth or Community detection)
- Non Overlapping community structure

Example: Betweenness α in non-modular networks

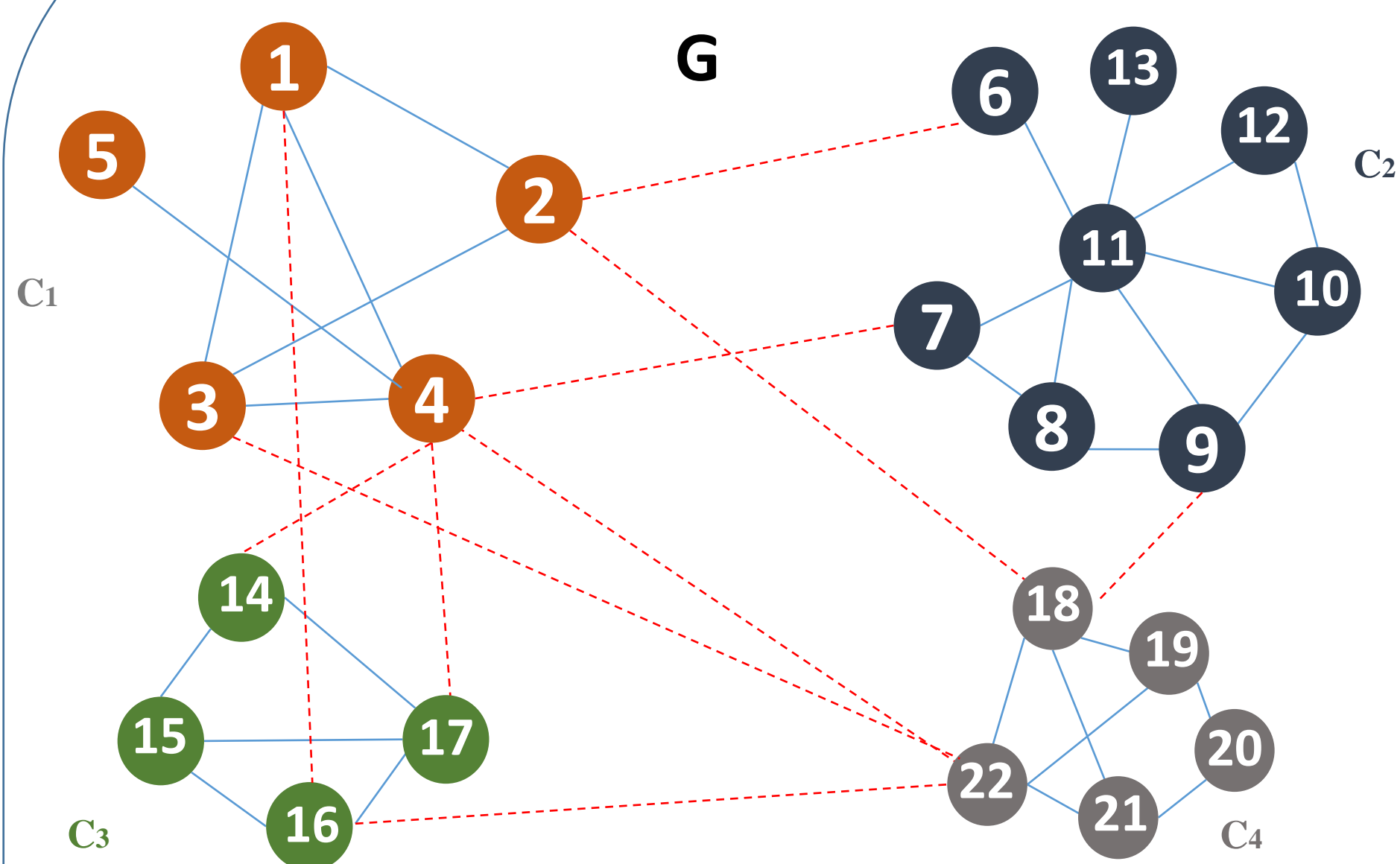


Betweenness α of a node $v_i \in G$:

$$\alpha(v_i) = \sum_{j,k \in G} \frac{\sigma_{jk}(v_i)}{\sigma_{jk}}$$

Complexity: $O(\ln)$

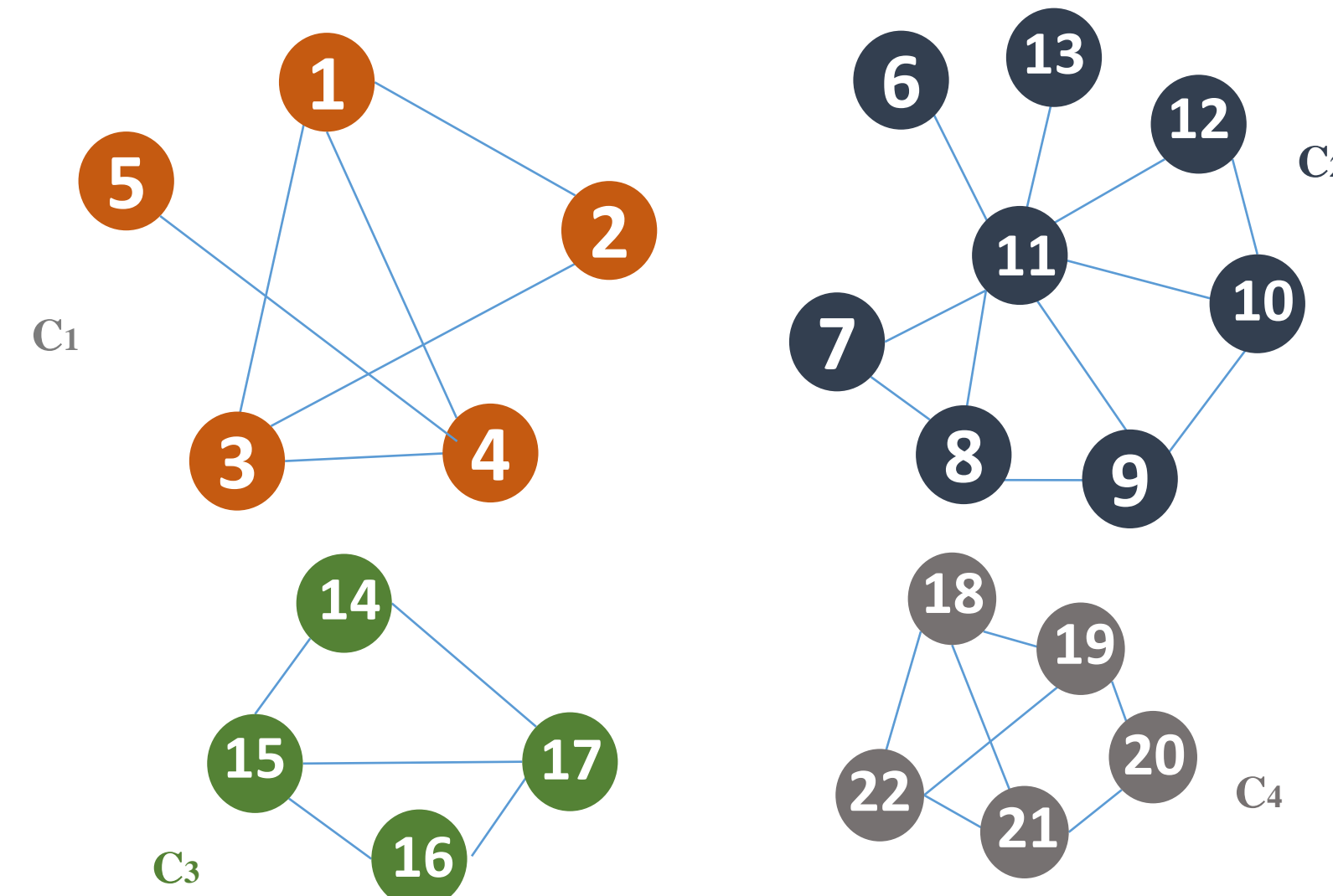
Betweenness in Modular networks: $A = [\alpha_L, \alpha_G]$



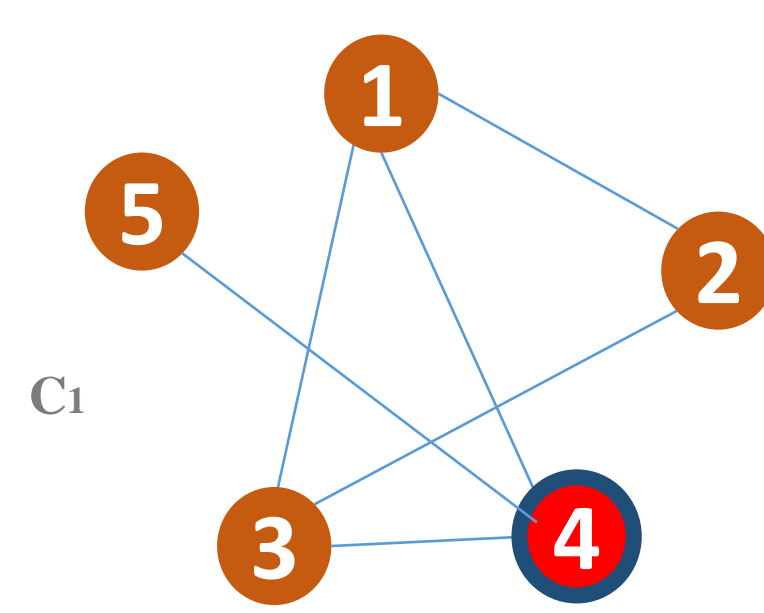
1. Split the original network into two networks

2. Using the classical definition:
Compute α_L on G_L
Compute α_G on G_g

Local Network G_L

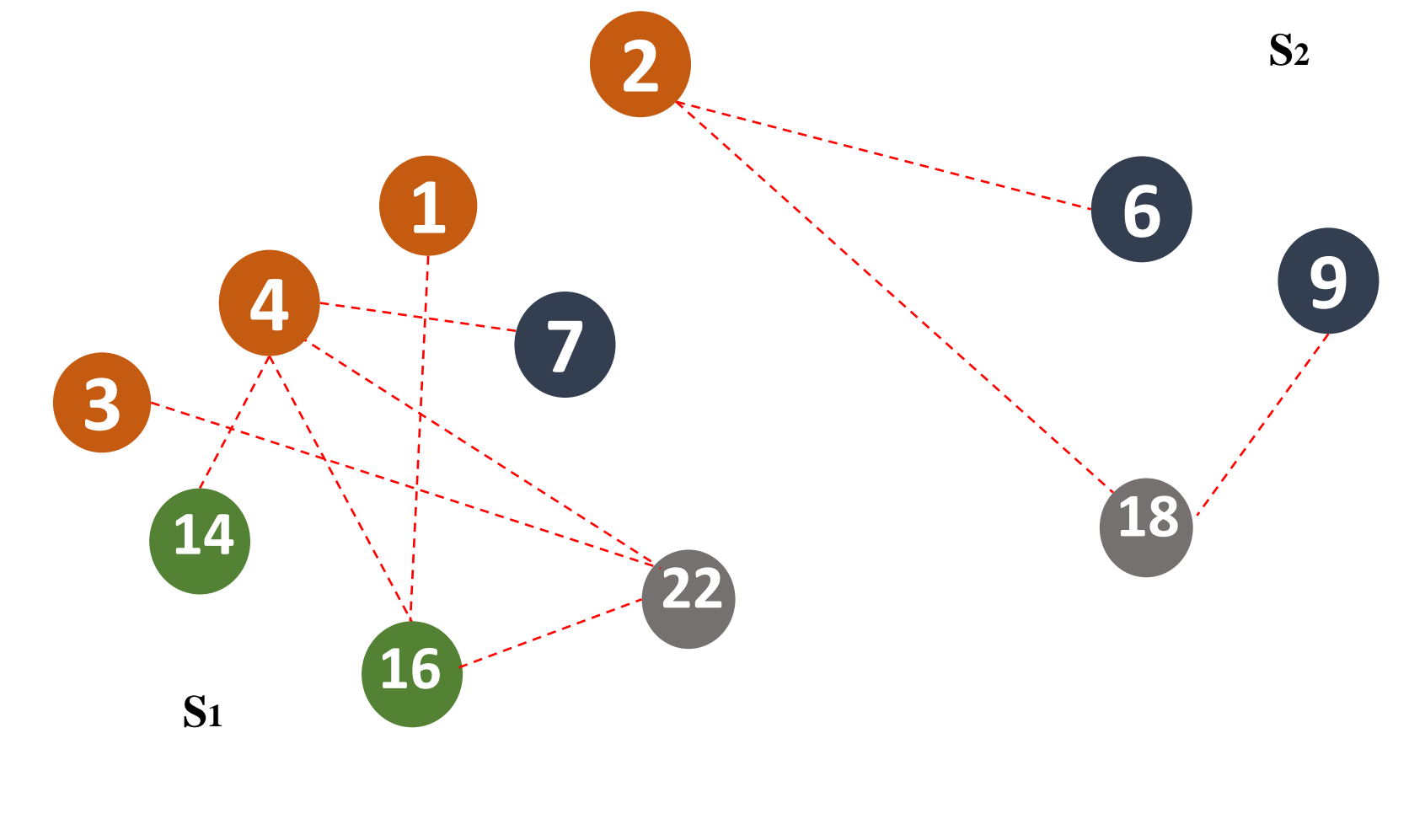


Local Component α_L

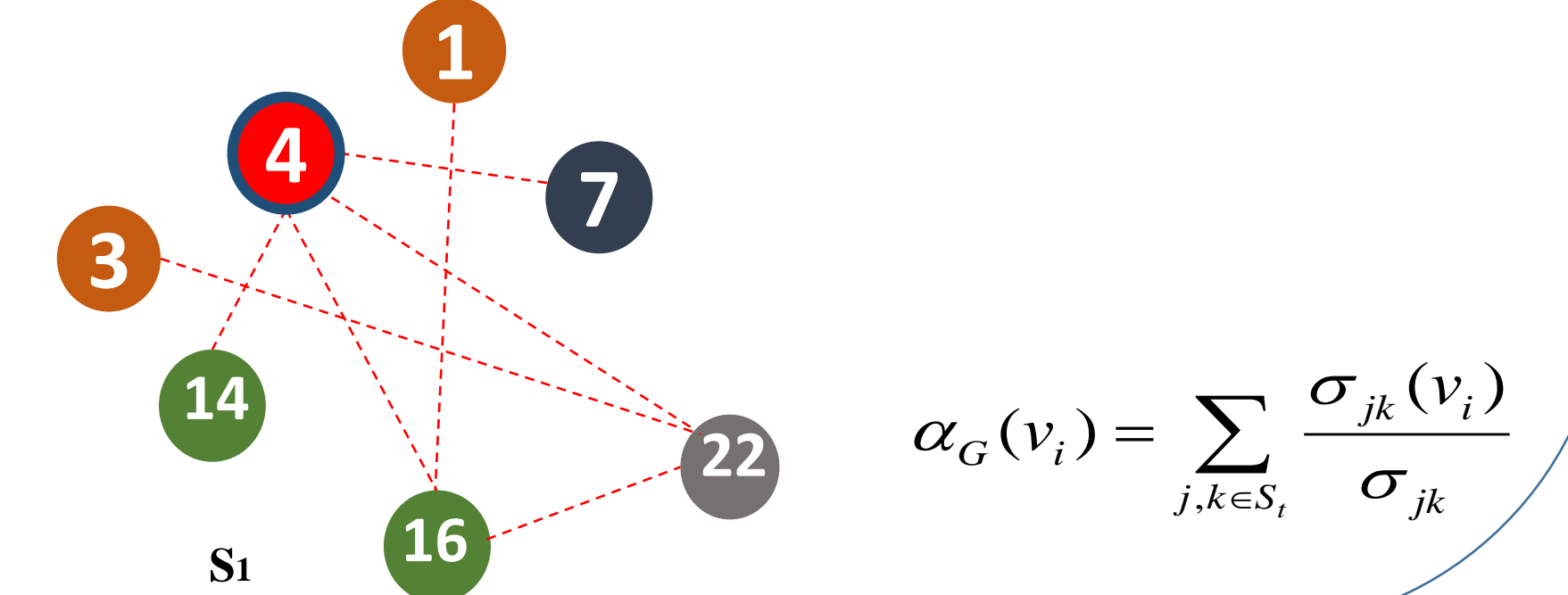


$$\alpha_L(v_i) = \sum_{j,k \in C_i} \frac{\sigma_{jk}(v_i)}{\sigma_{jk}}$$

Global Network G_g



Global Component α_G



$$\alpha_G(v_i) = \sum_{j,k \in S_i} \frac{\sigma_{jk}(v_i)}{\sigma_{jk}}$$

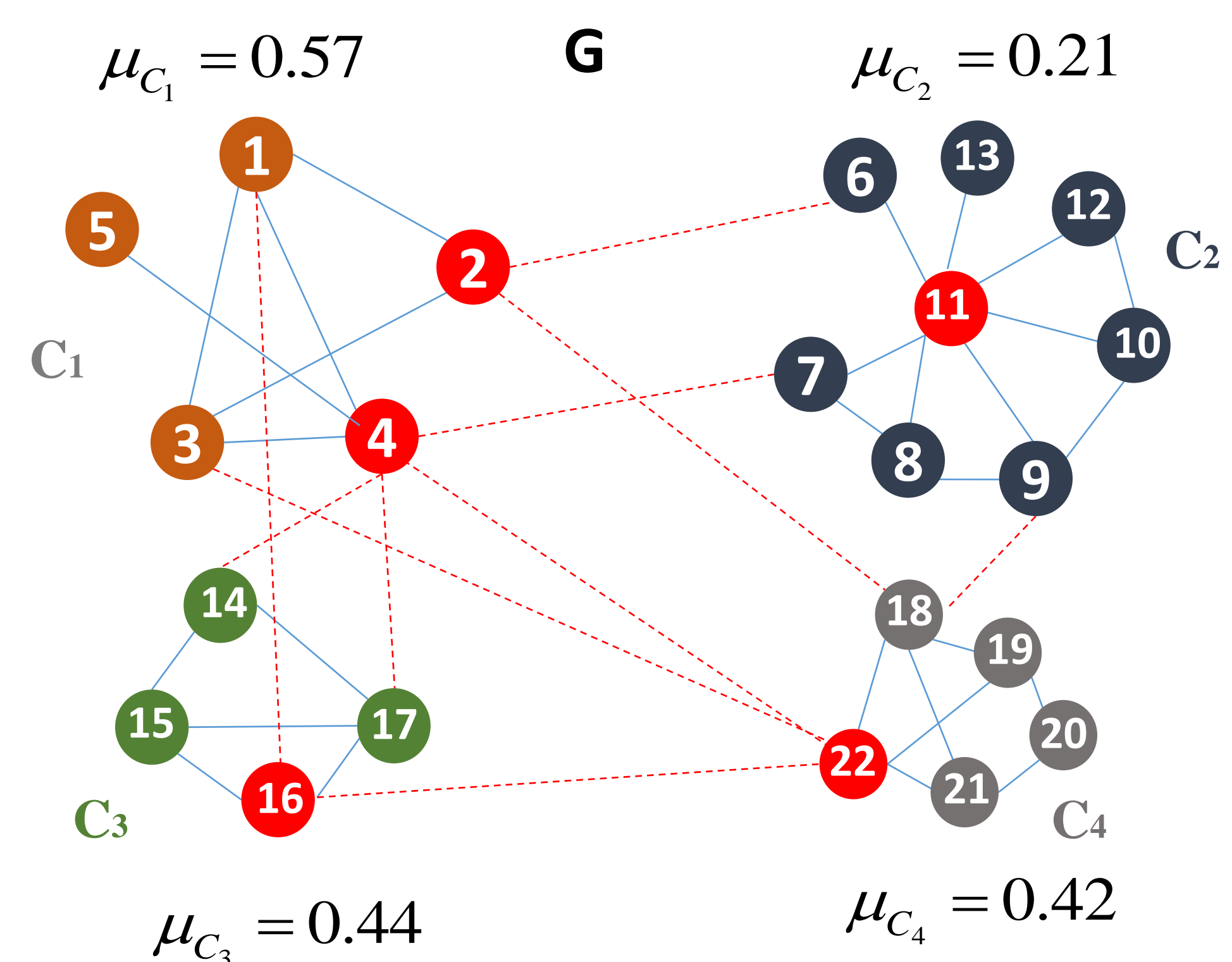
Ranking the Nodes



Example: Weighed Modular Betweenness Centrality

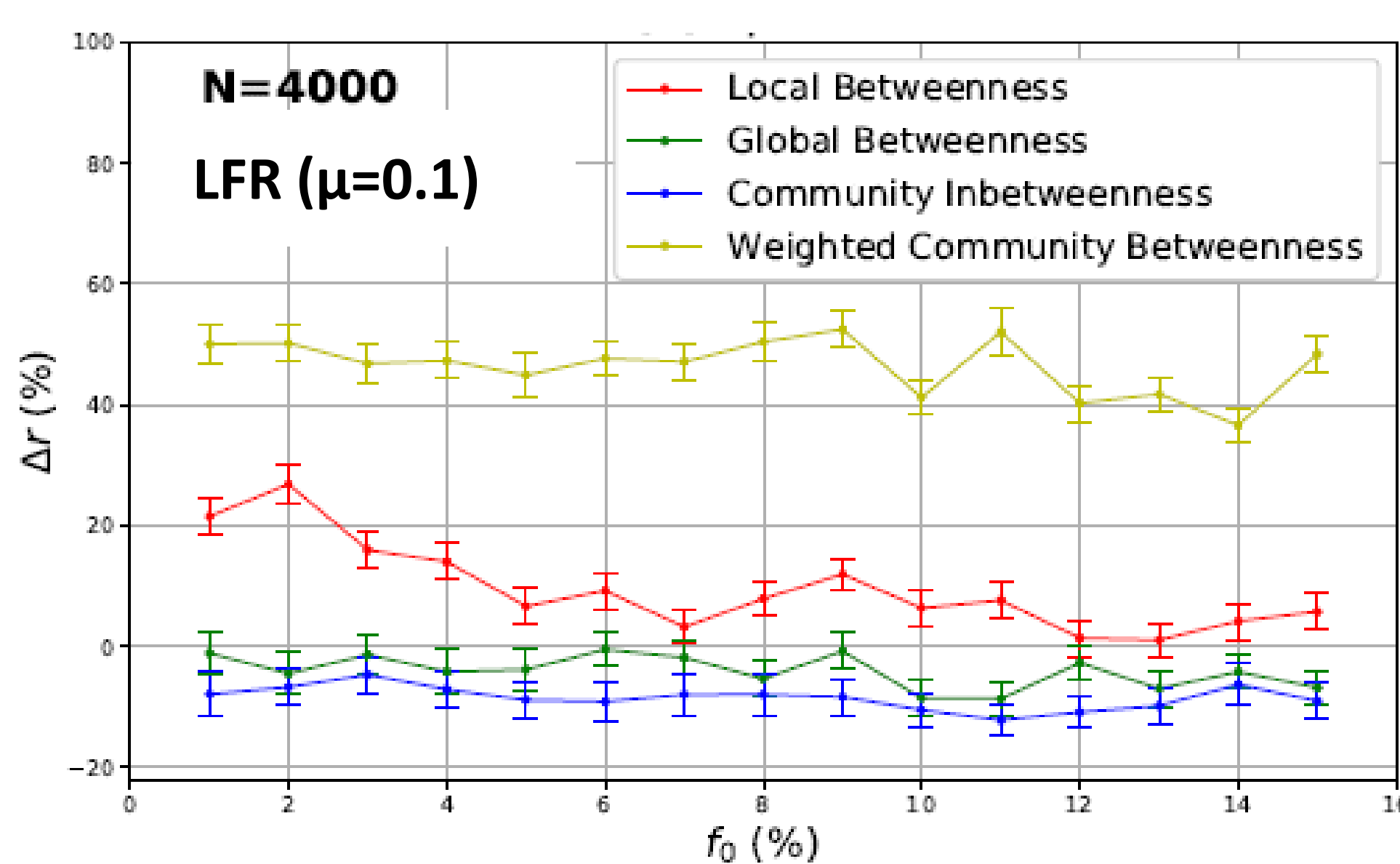
$$\alpha_W(v_i) = (1 - \mu_{C_i}) * \alpha_L(v_i) + \mu_{C_i} * \alpha_G(v_i)$$

$$\mu_{C_i} = \frac{\sum_{v_j \in C_i} k^{inter}(v_j)}{\sum_{v_i \in C_i} k(v_i)}$$

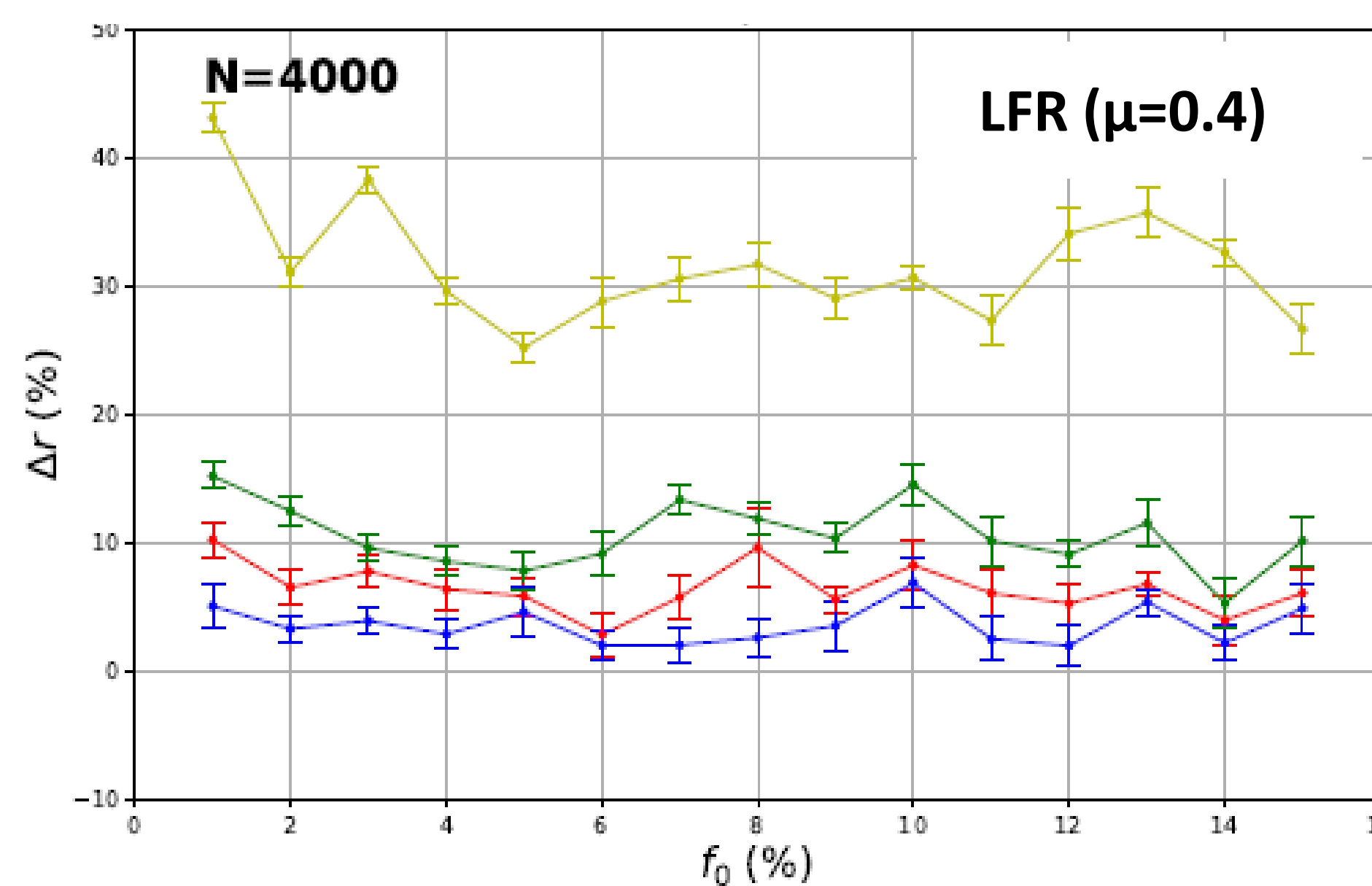


Results

Strong community structure



Medium community structure strength



Weak community structure

