Centrality Measures in Bipartite Graphs

Social Network Analysis of a 17th Century Spanish Mission

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Santa Catalina de Guale Cemetery

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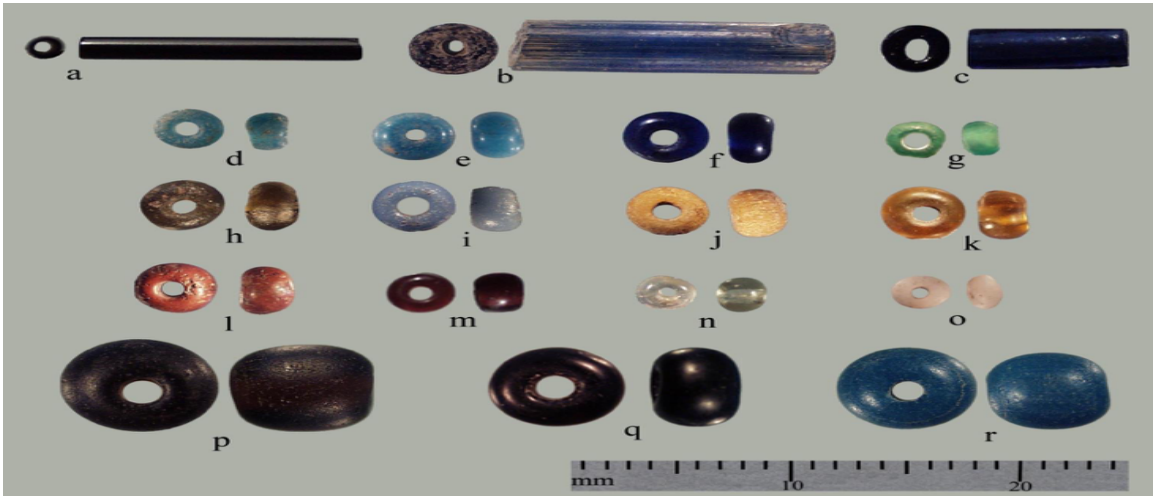


Definition: Set-Based Weighted Bipartite Graph Structure

A set-based weighted bipartite graph structure consists of three mathematical sets: a set of vertexes of type α, a set of vertexes of type β, and a set of undirected weighted edges connecting vertexes from one set to the other.

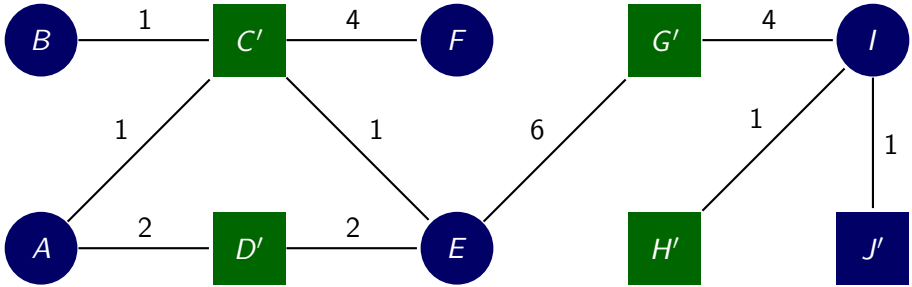


Figure: Example Weighted Bipartite Graph

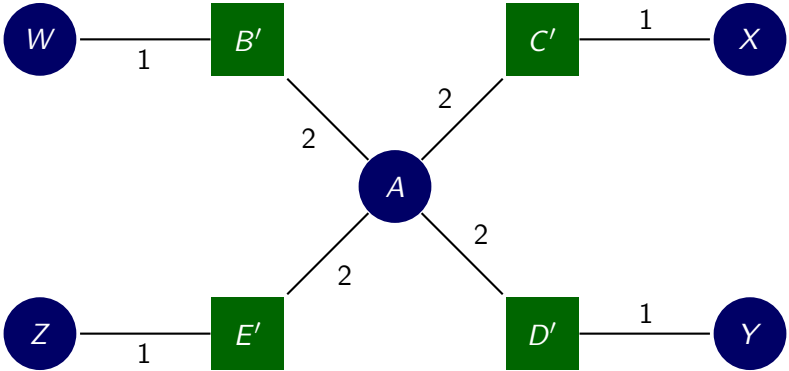


Figure: Freeman Example Weighted Bipartite Graph

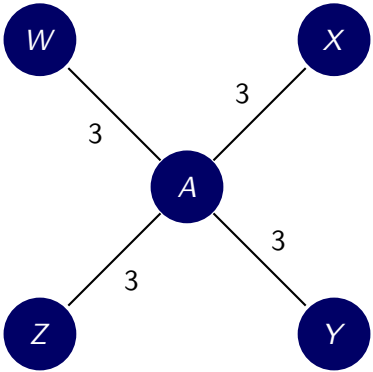
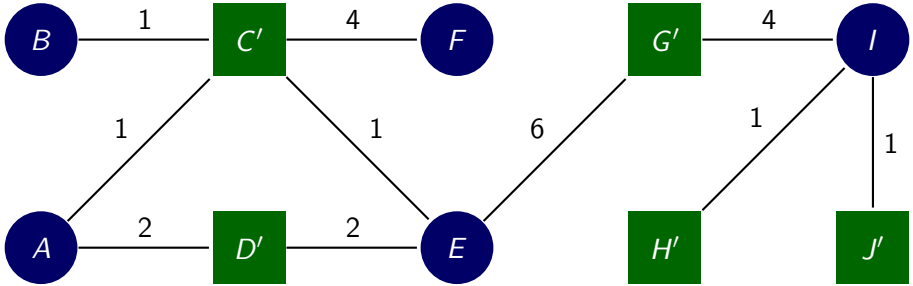


Figure: Projected Freeman Example Weighted Graph

Definition: Degree Centrality

Degree Centrality is a measure of how many immediate neighbors a vertex has in a graph.

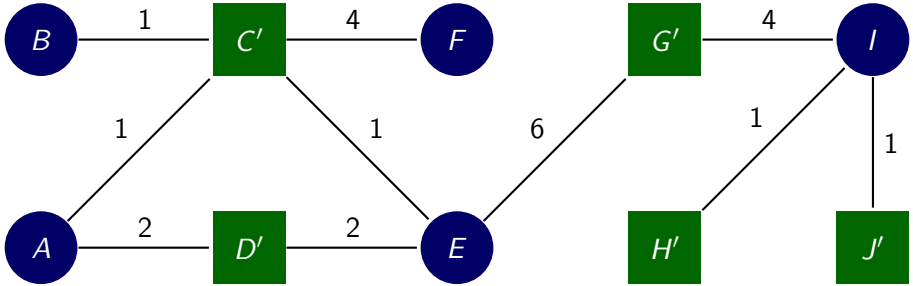
$$\text{Degree Centrality } (v) = \sum_{u \in G} e(v, u)$$



Definition: Closeness Centrality

Closeness Centrality is a measure of how close a vertex is to every other vertex in a graph.

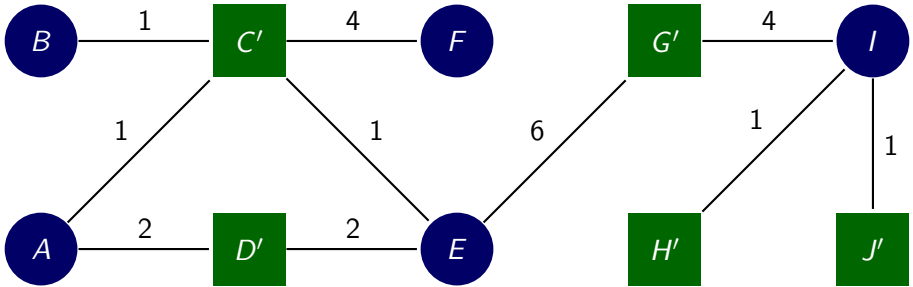
$$\text{Closeness Centrality } (v) = \left(\sum_{u \in G} d(u, v)\right)^{-1}$$



Definition: Betweenness Centrality

Betweenness Centrality is a measure of how many shortest paths include a specific vertex.

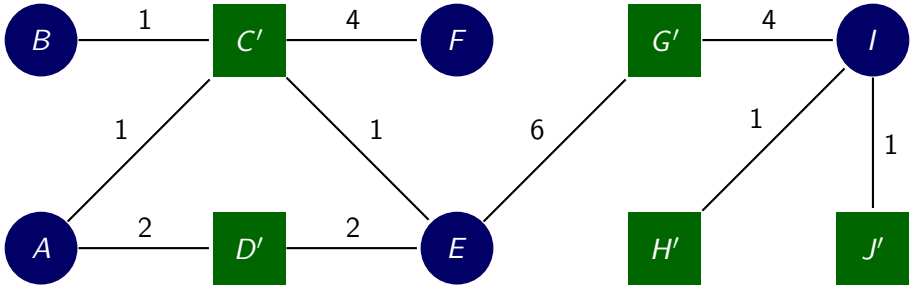
$$\text{Betweenness Centrality } (v) = \sum_{s,t \in G} \delta(s,t,v)$$



Definition: Eigenvector Centrality

Eigenvector Centrality is a measure of how close a vertex is to central vertexes in a graph.

$$\text{Eigenvector Centrality}\ (v) = \lambda^{-1} \sum_{k} a_{ki} x_k$$



Current Problem:
No algorithms currently take subsets into account when calculating centrality.

Future Work:
Designing applicable software to calculate weighted bipartite centrality with respect to submodules.

Thank You!