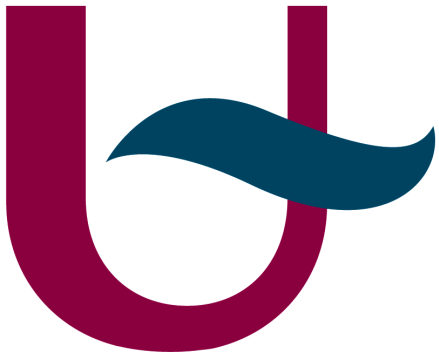
Unevenness in network properties

on the social Semantic Web



Universiteit Antwerpen

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Informatie- en Bibliotheekwetenschap

2nd Workshop on Social Aspects of the Web, 2008

Overview

Introduction: the Semantic Web

- *Social Semantic Web*: RDF data containing social information

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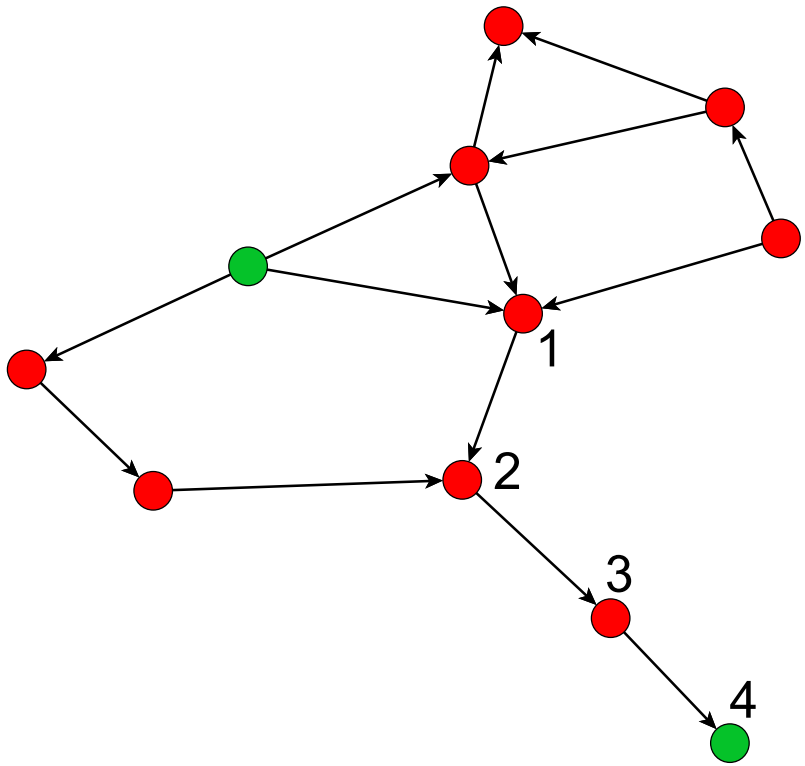

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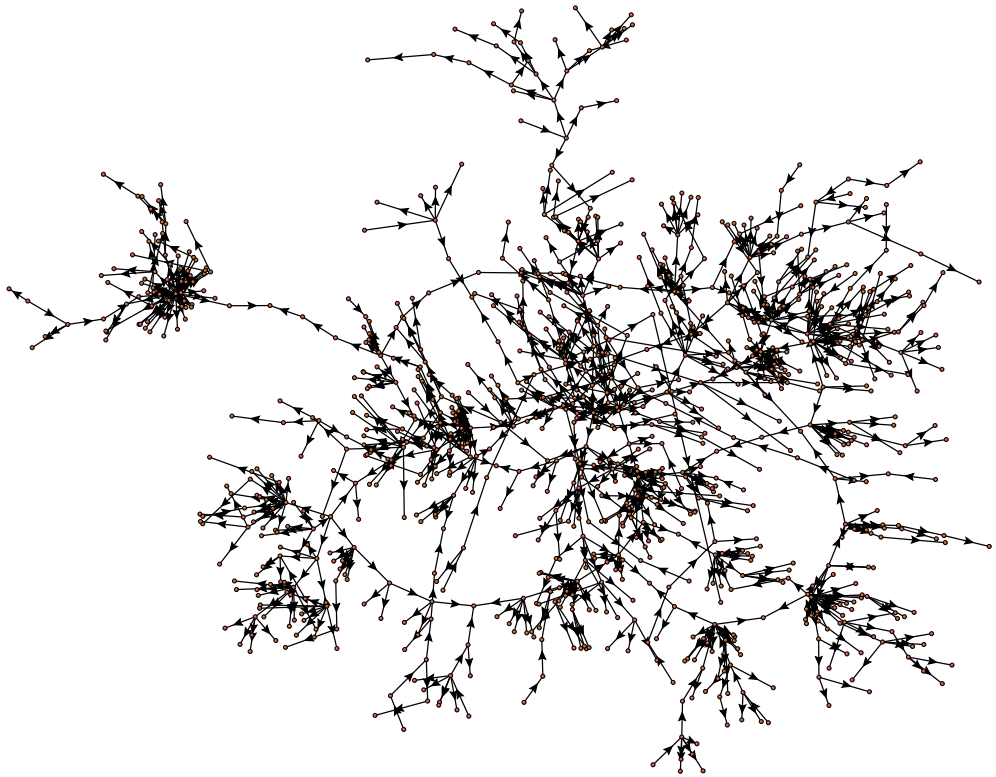

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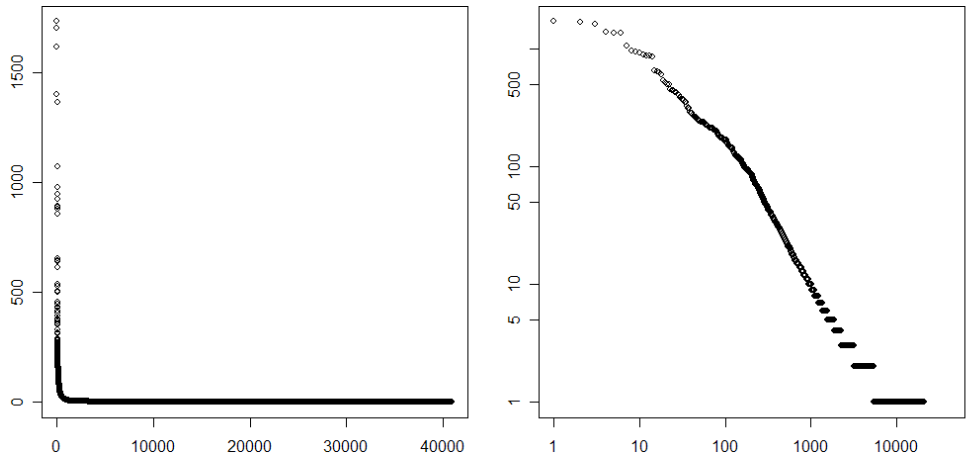
  - short paths
  - clustering
  - skewed degree distribution: $P(k) \approx Ak^{-\gamma}$



Introduction: Questions

- Social Network Analysis with Semantic Web data
  - prior work by Peter Mika, Li Ding etc.
  - goal: study network properties of multiple aspects $\longrightarrow$ one RDF graph as 'master'

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  - prior work by Peter Mika, Li Ding etc.
  - goal: study network properties of multiple aspects $\longrightarrow$ one RDF graph as 'master'
- It is well-known that properties like degree distribution are skewed, but *how* skewed exactly?

Step 1: extraction query

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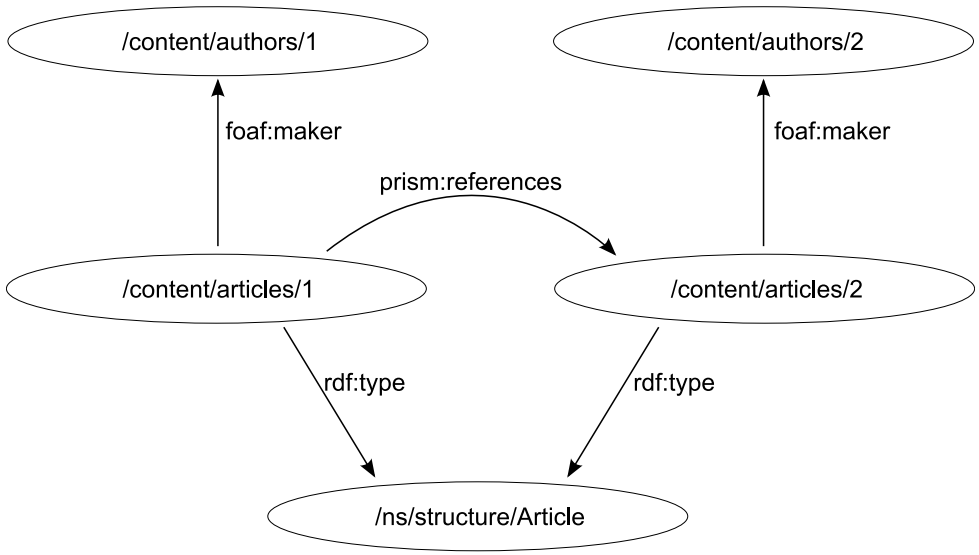
- **Example**:



```
BASE <http://metastore.ingentaconnect.com>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX prism:
  <http://prismstandard.org/namespaces/1.2/basic>
PREFIX ex: <http://example.com/ns/>

CONSTRUCT { ?author1 ex:cites ?author2 }
WHERE {
  ?art1  a                  </ns/structure/Article> ;
         foaf:maker         ?author1 ;
         prism:references   ?art2 .
  ?art2  a                </ns/structure/Article> ;
         foaf:maker       ?author2 .
}
```

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  - through **pyNetConv** to Pajek, GML, GraphML, ...

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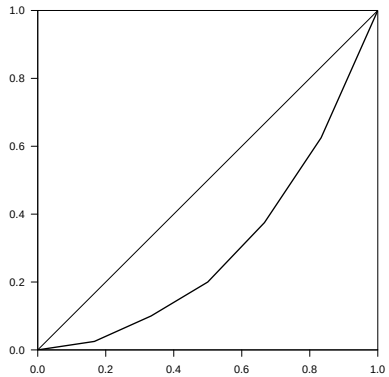
- Lorenz curve: *graphical* measure



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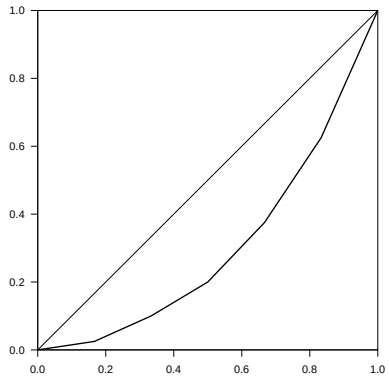
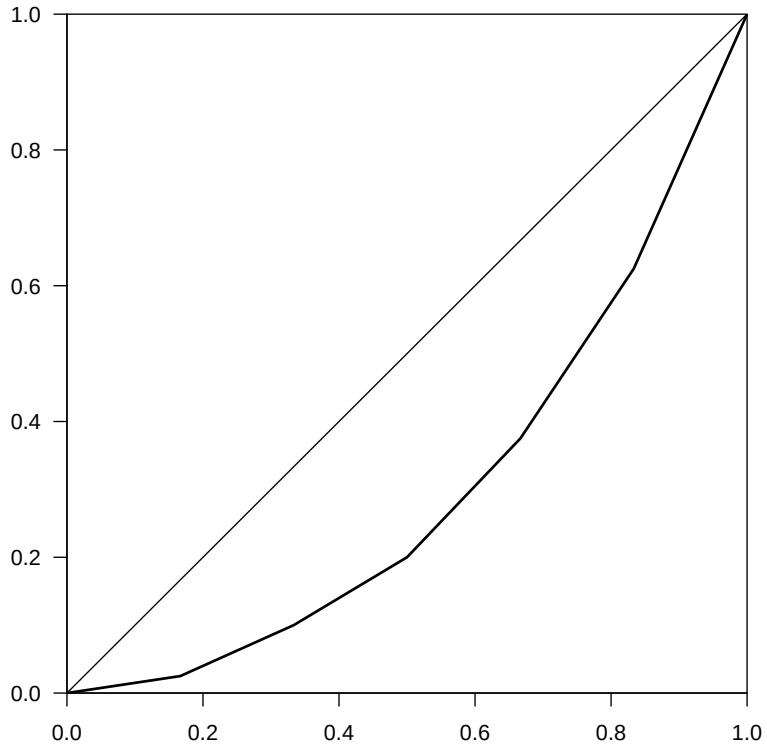


- Gini index: *numerical* measure
  - equivalent to Pratt's measure

- Lorenz curve



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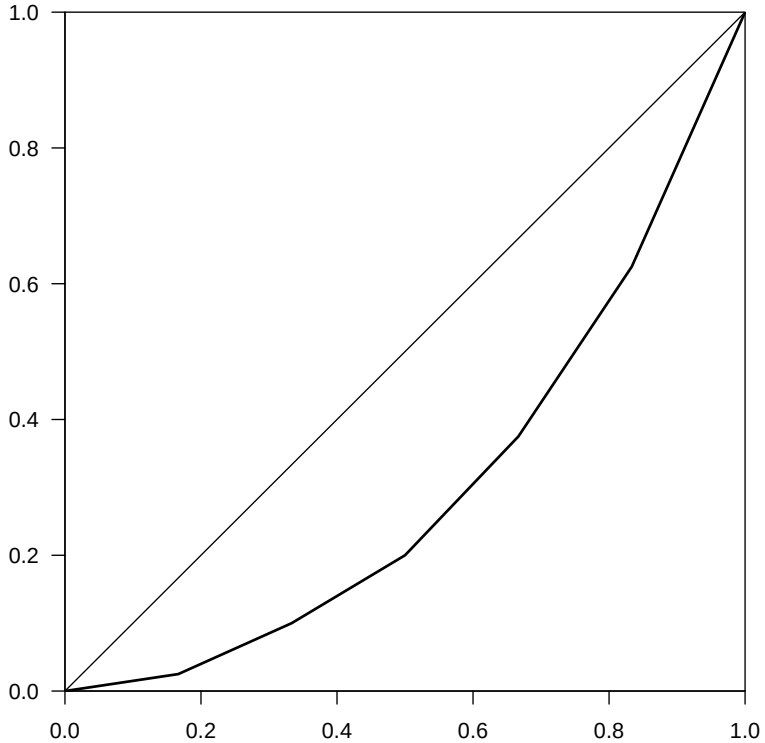

- Gini index: $G'(X) = \frac{2}{\mu N^2}\left(\sum_{j=1}^{N}(N+1-j)x_j\right) - \frac{1}{N}$

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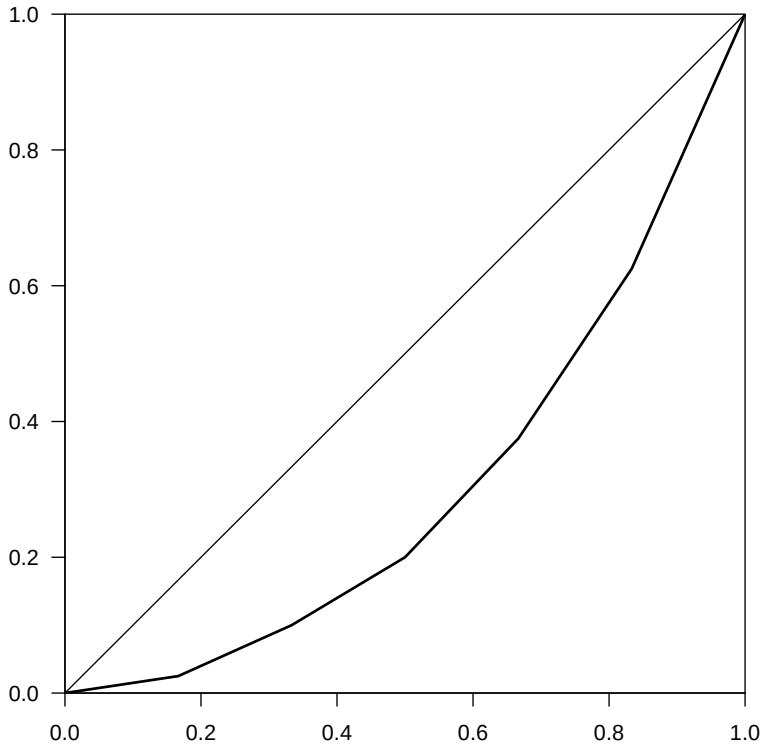

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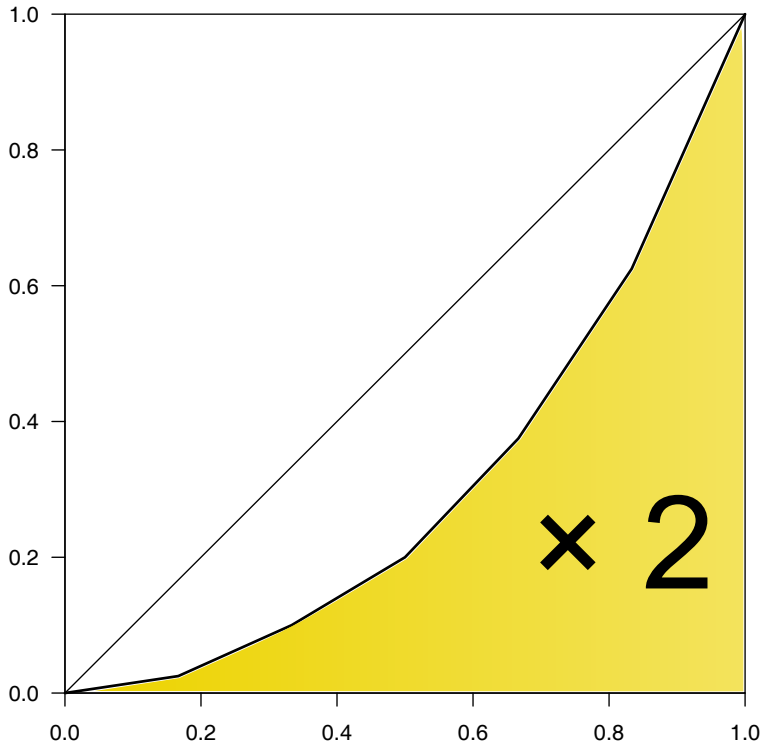

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- Queried through: SPARQL protocol
- Many interesting graphs can be derived

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- In other words:
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  - Arcs = letters from writer to recipient
- Simple SPARQL query:

```
PREFIX agrippa: <http://anet.ua.ac.be/agrippa#>
CONSTRUCT {
  ?sender <urn:agrext#writesLetterTo> ?recipient
} WHERE {
  ?context agrippa:hasLetterWriter ?sender .
  ?context agrippa:hasRecipient ?recipient .
}
```

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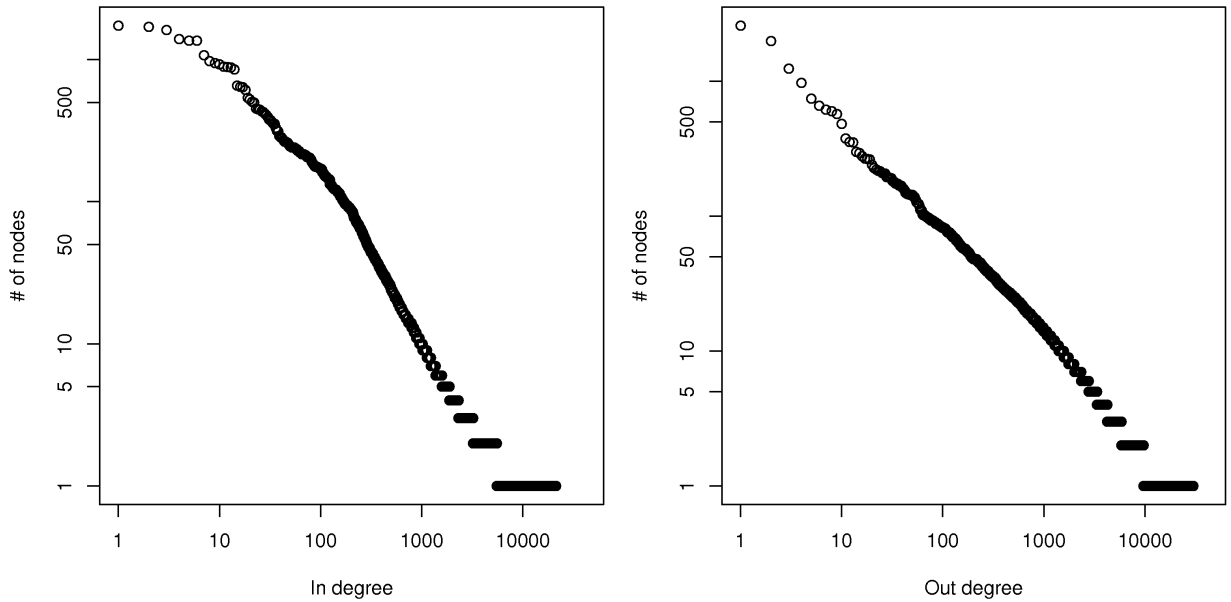
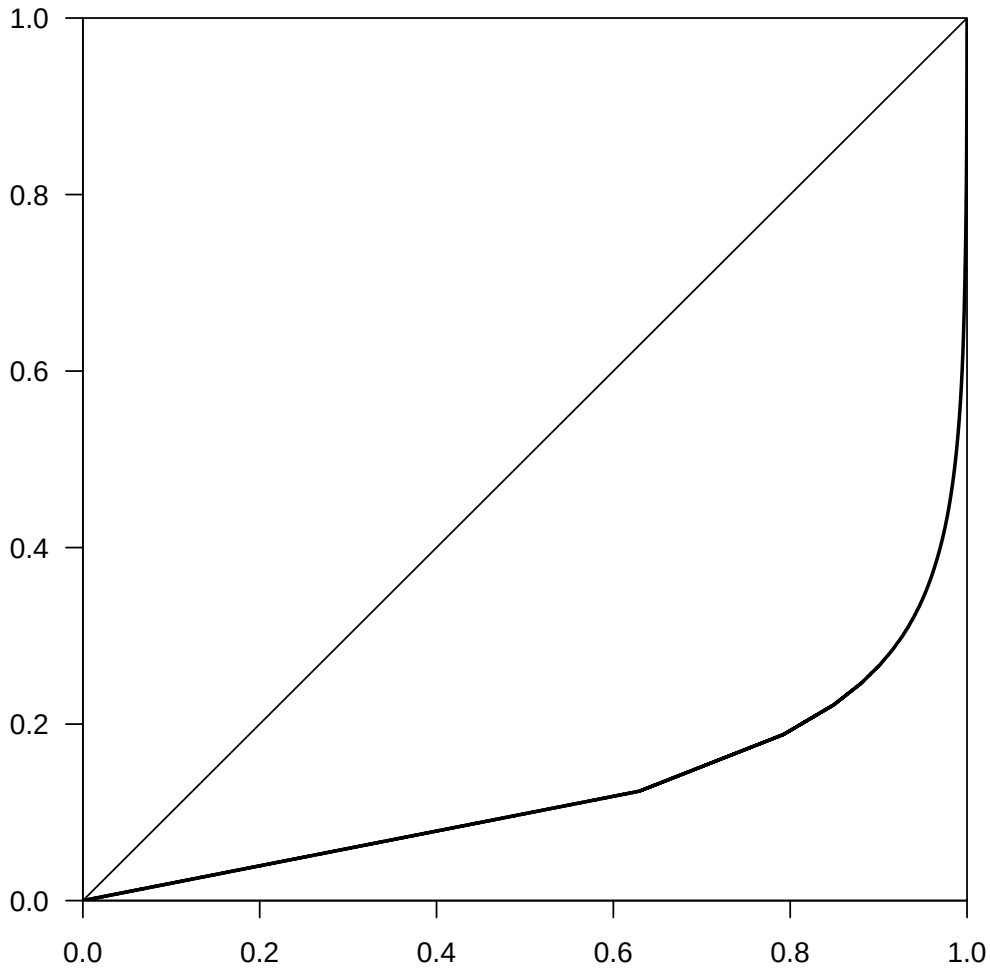
- Example of unevenness (in degree and out degree):



Lorenz curves for centrality measures

Degree centrality (DC)



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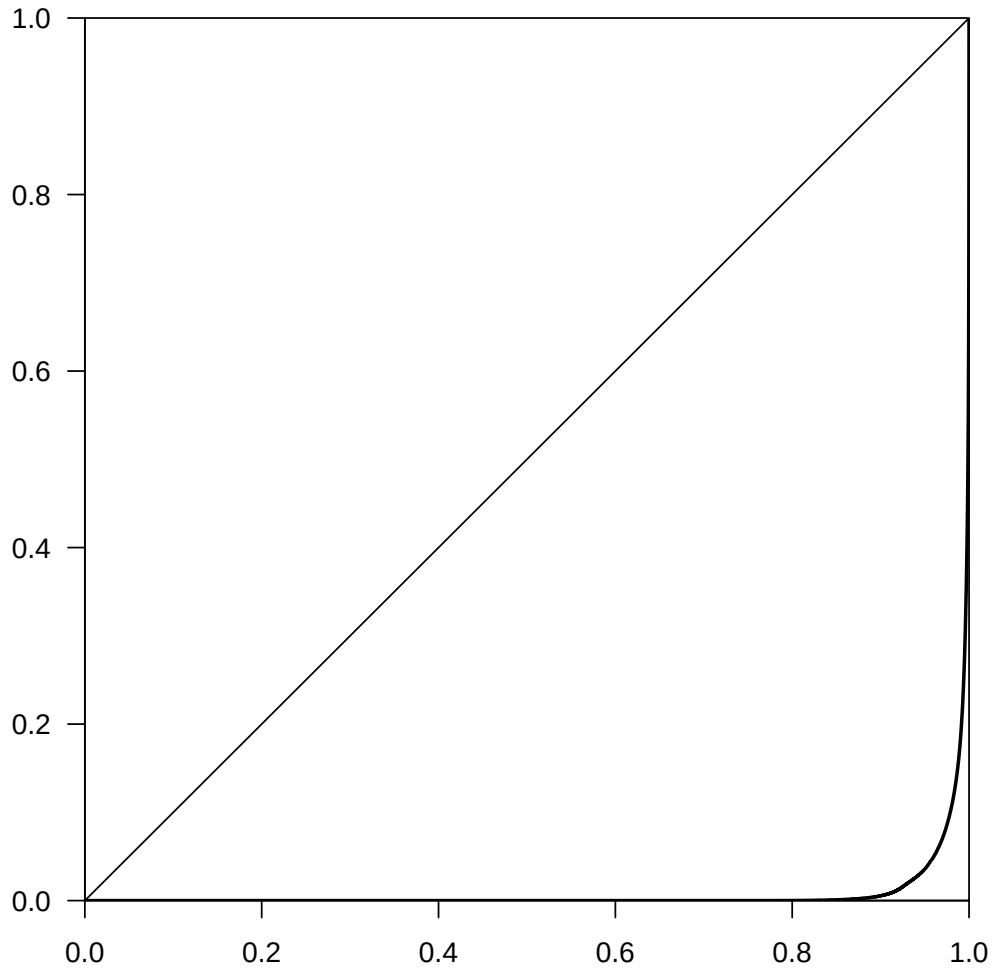
Betweenness centrality (BTC)



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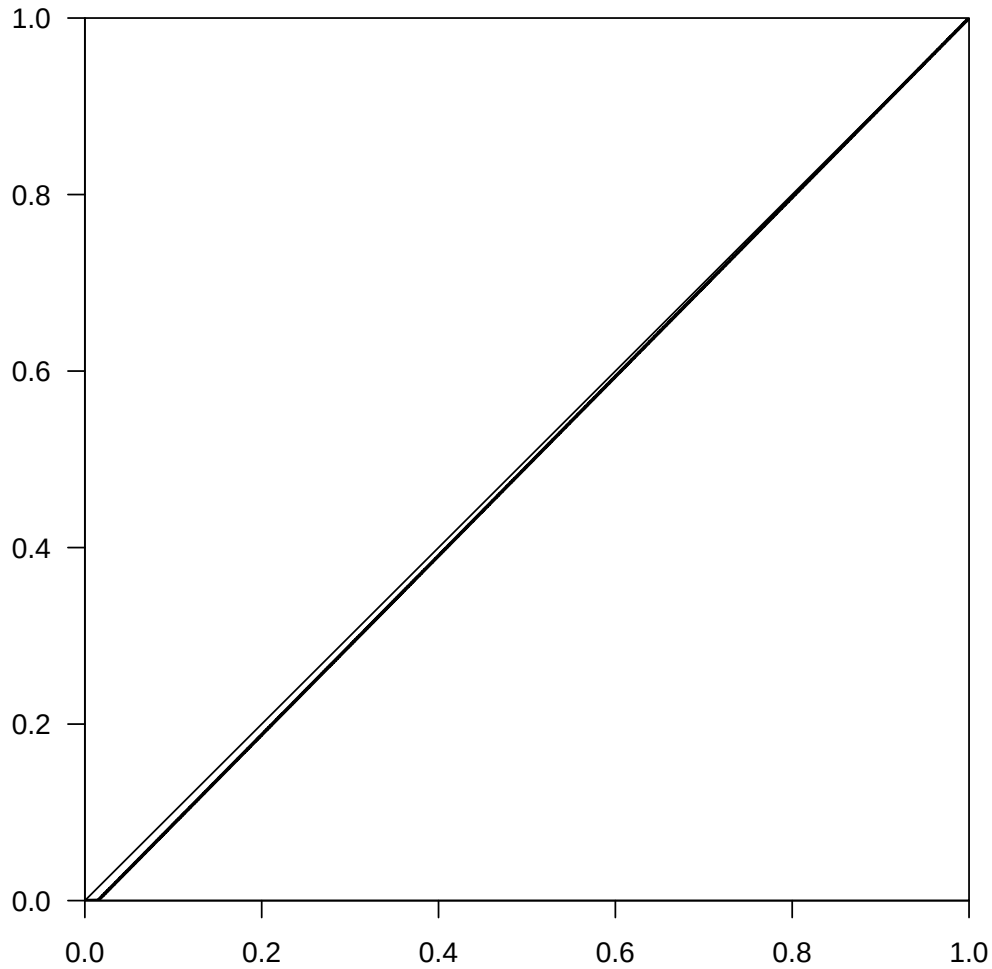
Closeness centrality (CC)



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- According to Gini: $G'(BTC) < G'(DC) < G'(CC)$
- Why such huge differences?

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  - diameter $D = 11$
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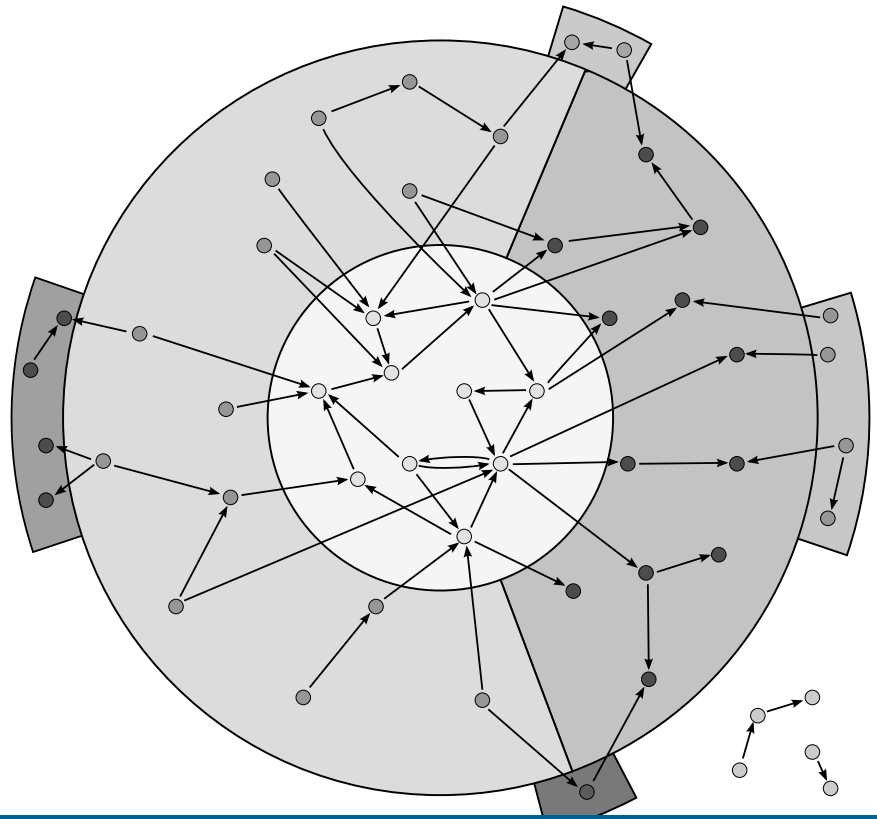
- CC is quite even, due to the small world effect
  - diameter $D = 11$
  - average length of shortest paths $= 3.85$
- BTC is very *un*even due to the bow-tie/corona structure



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- **Unevenness in network measures** can be used to test hypotheses regarding network structure
- **Future**:
  - testing on other (kinds of) networks
  - predictive power of unevenness?

Thank you!

Any questions?