Characterization of Large Networks
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Large Networks
• Networks of different kinds arise in many areas:
  • computer networks,
  • web networks,
  • social networks,
  • collaboration networks,
  • co-purchasing networks,
  • citation networks,
  • road networks,
  • biological networks,
  • etc.

• These networks are usually large.
• They show some similarities but several differences.
• Various real-world networks and several mathematical models were studied.

Models and Generators
• Network generators were implemented based on well-known mathematical models: Erdős-Rényi and Barabási-Albert.
• The Barabási-Albert (BA) model applies a preferential attachment scheme: a new node is connected to an existing node \( v \) with a probability proportional to \( d(v) \) or \( d(v)^α \).

• We also implemented a generator that produces random graphs for given degree distributions.
• These generators were mainly used for approximating real-life networks.

Real-World Networks
• The SNAP library provides a collection of large real-world networks.
• Selected instances with 20,000 – 400,000 nodes and 90,000 – 2,350,000 edges were used for this research.

Characterization
• The following charts compare various real-world networks with generated random graphs:
  • BA: Barabási-Albert network of almost the same density,
  • RND: random network with exactly the same degree distribution.

Comparison
• The following charts compare the real-world networks with each other.

Implementation
• The LEMON C++ network optimization library and the SNAP network analysis library were used.
  • http://lemon.cs.elte.hu
  • http://snap.stanford.edu