Carinthia Tech Insitute
Department of Telematics and Network Engineering

NETWORK MODELLING

Master Degree Program
Communication Engineering for Information Technologies
SS 2007

Peter Bachhiesl

Abstract:

We focus on mathematical models of networks. The first part of the course is mainly affected by basics in network modelling, namely graph theory and combinatorial optimization. In the second part we introduce some important models in the field of telecommunication, e.g. network planning models, cost network flow models, network reliability models. In order to deal with real simulations the students are encouraged to implement low instances of the models by an according modelling language in the practical part of the course.

Contents

1. **Graphs and Networks**

   Keywords: graphs and networks, searching in networks, connectivity, paths and trees

2. **Network Flows**

   Keywords: Basics on network flows, maximum- and minimum cost flows, dynamic flows, multi-commodity flows

3. **Network Design**

   Keywords: Steiner trees, k-spanning trees, median of trees

4. **Network Analysis**

   Keywords: element analysis (centrality indices, Google's page rank), group analysis (density, connectivity clustering), network analysis (statistics, comparison, models, robustness)

5. **Linear- and Integer Programming Models**

   Keywords: CPLEX solutions and MATLAB based simulation of ILP models

References

1. Ball, M.O., et.al., eds., Handbooks in Operations Research and Management Sciences, Vol 7, Network Models, Elsevier, 1995
2. Ball, M.O., et.al., eds., Handbooks in Operations Research and Management Sciences, Vol 8, Network Routing, Elsevier, 1995
3. Glover, F., et.al., Network Models in Optimization and their Applications in Practice, John Wiley & Sons, 1992
4. Bell, M.G.H., et.al., Transportation network analysis, John Wiley & Sons, 1997
5. Bertsekas, D.P., Network Optimization, Continuous and Diskrete Models, Athena Scientific, 1998
6. Ahuja, R.K., et.al., Network Flows, Prentice Hall, 1993
7. Brandes, U., Network Analysis - Methodological Foundations, Springer, 2004
8. Resende, G.C., Pardalos, P.M., Handbook of Optimization in Telecommunications, Spinger Science + Business Media, 2006

Examination

By appointment.

Contact

Peter Bachhiesl
Carinthia Tech Institute
Department of Telematics and Network Engineering
Primoschgasse 8, 9020 Klagenfurt
Tel: 0463/90500-3112
Fax: 0463/90500-179
Email: p.bachhiesl@cti.ac.at

Seminar – List of topics

Analysis on elements of networks
Ref. U., Brandes, T., Erlebach, Network Analysis, Cpts. 3 and 4

Group analysis on networks
Ref. U., Brandes, T., Erlebach, Network Analysis, Cpts. 6 and 7

Network statistics
Ref. U., Brandes, T., Erlebach, Network Analysis, Cpts. 11 and 13

Telecommunications network design
A., Forsgren, M., Prytz, resp. T. Carpenter, H., Luss, in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpts. 11 and 13

Optimization issues in quality of service
J.G., Klincewitz, M., Prytz, in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 11

Location problems in telecommunications
D., Kapov-Skorin, et.al., in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 20

Pricing and equilibrium in communication networks
Q., Wang, in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 21

Optimization of dynamic routing networks
G.R., Ash, in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 22

Route optimization in IP networks
J., Rexford, in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 24

Network reliability optimization
A., Konak, A.E., Smith, in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 26

Stochastic optimization in telecommunications
A.A., Giavoronski, A.E., Smith, in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 27

Network restoration
D., Medhi, A.E., Smith, in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 28

Optimization in wireless networks

M., Min, A., Chinchuluun, resp. A., Amaldi, et.al., in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 31 and 32

Optimization issues in web search engines
Z., Liu, Ph., Nain, resp. A., Amaldi, et.al., in G.C. Mauricio et.al. Handbook of Optimization in Telecommunications, Cpt 34