



Academia de Studii Economice
Departamentul de Informatică și Cibernetică Economică

Calea Dorobanți, 15-17, Sector 1, București, 010552 (camera 2314)

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Contest Topics for Associate Professor

Position 55, 2020-2021, semester 2

Topics: Bases of Operational Research, Bases of Economic Cybernetics, Simulation of Economic Processes, Computational Intelligence in Economics

Bases of Operational Research

1. Network optimization: Concepts and definitions specific to graph theory. Typology of networks. Graph based modeling. Minimum cost trees. Roads of optimum value in transport networks. Software packages for network optimization.
2. Management of complex projects (Critical path analysis): Leading a project by building the Coordinating Network Graph. Construction of the coordinating network using the representation "activity - node ". Gantt chart drawing. Optimization of resource allocation in complex project management.
3. Optimization methods in the transport and distribution networks. Maximum flow in transport networks: Types of economic problems modeled by flow in networks. Flow in the transport and distribution networks. The Ford-Fulkerson algorithm for determining the maximum value flow in a transport network. Applications. The problem of supply and demand.
4. Optimization of economic processes using Linear Programming (LP): Introduction to the modeling process. Linear example. The general form of a linear programming problem (LP). Permissible solutions to a (LP) problem. Forms of presentation of a problem of (LP): canonical form, standard form.
5. Duality in linear programming. Rules for the construction of the dual problem. Duals of particular forms of problems of (LP). Duality theorems. The economic interpretation of duality.
6. Optimization methods in transport and distribution networks. The classic transport problem (TP). The problem of balanced transport (BTP). Methods of solving BTP. Determination of an initial basic allowable solution (Minimum cost method on the table and Vogel method). Testing the optimality of a basic permissible BTP solution. Improvement of a basic solution. Algorithm for solving PTE. Convergence. Degeneration. Variants of the transport problem. TP unbalanced. Balancing modes. TP with blocked routes. Other economic problems reducible to the problem of transport

Bibliography

1. Ciobanu, Gh., Nica, V., Mustață, Fl., Mărăcine, V. Mitrut, D, Cercetări operaționale. Optimizări în rețele. Teorie și aplicații economice, MATRIX ROM, București, 2002, România
2. Ciobanu, Gh., Nica, V., Mustață, Fl., Mărăcine, V., Cercetări operaționale cu aplicații în economie. Teoria grafurilor și Analiza drumului critic, MATRIX ROM, București, 1996, România
3. Nica, V., Ciobanu, Gh., Mustață, Fl., Mărăcine, V. , Cercetări Operaționale - Programare liniară, Probleme de optimizare în rețele de transport și distribuție, Teoria jocurilor strategice, MATRIX ROM, București, 1998, http://asecib.ase.ro/cursuri_online.htm, cap. 1 și 2, România
4. White , J. and White, L. , A review of the recent contribution of systems thinking to operational research and management science, European Journal of Operational Research, Volume 207,



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6. COOKE, S., SLACK, N. , Making Management Decision, Prentice Hall International UK Ltd., 1991, Marea Britanie
7. Dantzig, G. B., & Thapa, M. N. , Linear programming. 1: Introduction, Springer-Verlag, 1997
8. HILLIER, F. S., LIEBERMAN, G. I. , Introduction to Operations Research, ediția a 8-a, McGraw Hill Publishing Co., New York, 2005, Statele Unite ale Americii
9. LAPIN, L. , Quantitative Methods for Business Decisions - with Cases, Harcourt Brace Jovanovich Publishers and its subsidiary, Academic Press, 1991
10. Oliveira, C.A., Pardalos, P.M. , Mathematical Aspects of Network Optimization, Springer Optimization and its Applications, vol. 53, 2011
11. Zelinka, I., Snasel, V., Abraham, A. (editori) , Handbook of Optimization. From Classical to Modern Approach, Intelligent Systems Reference Library, vol. 38, 2012

Bases of Economic Cybernetics

1. The emergence and development of cybernetics. The main stages of the development of cybernetics from the beginning to the present
2. Complex adaptive system. Definitions and properties
3. Connectivity and interdependence in complex adaptive systems. Complex networks in the economy
4. Co-evolution of complex adaptive systems in the economy. The fitness landscape and patterns of co-evolution
5. Dissipation and chaos in complex systems in the economy. Operation-away-from-equilibrium
6. Regulatory feedback processes. Multiplier, accelerator and mixed type fundamental processes
7. Self-organization of complex adaptive systems in the economy
8. Examples of complex adaptive systems and patterns of their evolution
9. Examples of complex adaptive systems in the economy: enterprises, financial markets, corporate and national economy. Similarities and differences. The evolution of these systems modeling and development of micro-macro models of interdependencies
10. Modeling based on equations in the economy. Build models based on equations. Validation of models. Calibration data models. Solving models using different means. Interpretation of results. Sensitivity study for the solution obtained
11. Agent-based modeling in the economy. Peculiarities of agent-based models. Building agent-based models. Development of the models. Simulation models based on agents. The solution and the interpretation
12. Simulation of the cybernetic-economic systems. Dynamic system and its role in the development of cybernetic simulation models. Feedback loops, delays and streams. Making general scheme of the model. Solving simulation model using specific software (Powers, STELLA etc.)
13. Quantitative and qualitative properties of complex economic and social networks



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14. Fundamental regulatory mechanisms of economic systems. The main types of mechanisms: accelerator, multiplier and mixed. Influence diagrams and their role in achieving cybernetic models of macroeconomic systems

Bibliography:

1. Scarlat E., Chirita Nora, Bazele Ciberneticii Economice, Economica, Bucuresti, 2016, România
2. Scarlat E., Chirita Nora, Delcea Camelia, Bradea Ioana, Bazele Ciberneticii Economice. Teorie si Aplicatii, Economica, Bucuresti, 2015
3. Navikov, D.E, Cybernetics - From Past to Future, Springer, 2016
4. Teahan W., Artificial Intelligence: Agents and Environments, W.Teahan&VentusPublishing Ltd, 2010
5. Scarlat E., Chirita Nora , Bazele Ciberneticii Economice, Economica, Bucuresti, 2016, România

Simulation of Economic Processes

1. General considerations on the use of simulation techniques in economics
2. Methods and techniques of simulation
3. Generation of pseudo-random numbers and stochastic variables
4. General structure of the economic simulation models
5. Principles and characteristics of the Monte Carlo method
6. Applications of simulation in the study of waiting processes
7. Applications of simulation in the processes of storage, maintenance, production programming and decision theory. Macroeconomic simulation process
8. Game Simulation
9. Business games

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1. I. Dobre; Fl. Mustață, Simularea proceselor economice, Editura Infocrec, București, 1996, România
2. Fl. Mustata;M. Paun;I. Dobre, Simularea numerica a proceselor economice, Ed. ASE, București, 2000, România
3. T.H.Naylor, Computer simulation experiments with models of economic systems, John Wiley & Sons, New York, 1971, Statele Unite ale Americii
4. Nersesian, R.L, Computer Simulation in Financial Risk Management. A Guide for Business Planners and Strategists, Quorum Books, New York, 1991, Statele Unite ale Americii
5. Fishwick, P.A., Luker, P.A, Qualitative Simulation Modeling and Analysis, Springer, 1991

Computational Intelligence in Economics

1. Computational Intelligence: Fundamental principles and concepts, trends and fields of application



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2. Fuzzy-type approach: motivation; aim; advantages and purposes; Uncertainty and imprecision; Fuzzy sets; Definition, properties and types; Specific representations; Operations
3. Fuzzy relationships; Operations; Fuzzy multicriterial decisions; Aggregation of fuzzy sets; Score functions
4. The construction of fuzzy type models and applications in the economic-financial field. Optimizing investment decisions within companies
5. Economic processes modelling with fuzzy numbers
6. Linguistic variables. Fuzzy inference rules. Theory of approximate reasoning.
7. Classification algorithms. Expected Maximization
8. Classification algorithms. SVM.
9. Inductive learning through observation. Decision Trees.
10. K-Nearest Neighbours.
11. Logistic regression. Fuzzy clustering.
12. The use of supervised neuronal networks supervised for the pattern recognition and predictions.
13. Unsupervised neural networks: Extracting patterns and visualizing data.
14. Genetic algorithms (Genetics coding, population initialization, genetic operators, crossover and mutation, selection of individuals)

Bibliography:

1. Chen S-H., Wang P. P., Kuo T-W., Computational Intelligence in Economics and Finance, Springer-Verlag, Berlin, Heidelberg, Berlin, 2007, Germania
2. Goldberg, D. E., Genetic algorithms in search, optimization and machine learning, Addison-Wesley, Boston, 1989, Statele Unite ale Americii
3. Kordon A. K., Applying Computational Intelligence: How to Create Value, Springer-Verlag Berlin Heidelberg, 2010, Germania
4. Kruse R., Moewes C. et al, Computational Intelligence. A Methodological Introduction, Springer, 2003, Germania
5. Georgescu I., Inteligența Computațională, ASE, 2015, România
6. Vose M. D., The simple genetic algorithm: Foundations and theory, MIT Press, Cambridge, MA, 1999, Statele Unite ale Americii
7. Alpaydin, A., Introduction to Machine Learning, 2nd edition, The MIT Press, Cambridge, Cambridge, 2010, Statele Unite ale Americii
8. Georgescu, I., Possibility Theory and the Risk, Springer, Dordrecht, 2012, Germania
9. Fuller, R., Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000, Germania

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