

Student will draw **one question from topics 1-20** (fields Econometrics, Operation Research)

1. Discrete decision model with multiple criteria – basic concepts, preference information of criteria, computational principles.
2. Methods with aspiration levels – (conjunctive, disjunctive, PRIAM), methods with ordinal information – (lexicographic, ORESTE).
3. Methods with cardinal information – utility maximization, AHP, TOPSIS, AGREPREF, ELECTRE.
4. Multi-objective linear programming (MOLP) – basic concepts, set of non-dominated solutions.
5. Methods with a priori information – utility function, distance minimization from ideal solution, goal programming, maximization of minimal component.
6. Methods with progressive information (Interactive methods) – basic principles, GDF method, STEM, Zionts – Wallenius method, Steuer's method.
7. Methods with a posteriori information – multi-criteria simplex method.
8. Generalized linear regression models. Methods of model estimation in the presence of heteroskedastic and/or autocorrelated errors.
9. Panel data analysis: Pooled cross sections, First differences, Fixed effects and Random effects estimators.
10. Distributed lag models, Partial adjustment models, Adaptive and Rational expectations.
11. Instrumental variables: IV estimator. Testing for endogeneity in regressors, Weak instruments. Two stage least squares: 2SLS estimator.
12. Vector autoregressive models (VAR) and Vector error correction models (VECM). Impulse-response functions.
13. Models with limited dependent variables: Binary and count outcomes.
14. Econometric modelling and forecast evaluation. Simulation and Bootstrap methods.
15. Assignment problems. Formulation of mathematical models of perfect matching, linear assignment problem, bottleneck assignment problem and quadratic assignment problem.
16. Travelling salesman problem. Formulation of mathematical models of symmetric and asymmetric versions of the problem. Travelling salesman problem with time windows.
17. Vehicle routing problem. Formulation of mathematical model of the problem. Vehicle routing problem with time windows. Heterogeneous fleet vehicle routing problem.
18. Flows in graphs. Formulation of mathematical models of maximal flow problem, minimum-cost flow problem, maximum flow cost-limited problem and fixed-charge flow problem.
19. Distribution models. Formulation of mathematical models of container transportation problem, facility location problem and bin packing problem.
20. Arc routing problems. Formulation of mathematical models of undirected and directed postman problem.

And **one questions from topics 21-40** (fields Statistics, Economic Statistics and Economic Demography)

21. Probability distributions of random variables and random vectors (joint, conditional and marginal distributions). Moment and quantile characteristics (location, variability, skewness, kurtosis) of random variables; characteristics of random vectors (covariance matrix, correlation matrix).
22. Point estimation. Properties of point estimates. Maximum likelihood estimate.
23. Interval estimation. Construction, interpretation, properties of confidence intervals. Confidence intervals for the parameters of normal distribution and Bernoulli distribution (large sample)
24. Hypothesis testing. Basic terms and definitions. Tests for the parameters of normal distribution (one sample, two samples-independent and paired samples).
25. Interest rate, discounting, compound interest, financial annuities and debt amortization.
26. Basic financial instruments and derivatives, financial risk, portfolio analysis and diversification.
27. Classical linear regression model, least-squares estimators of regression parameters, properties of the estimators. Hypothesis testing in the classical linear regression model.
28. Estimation of the mean response in the classical linear regression model, properties of the estimators. Prediction of new response observations in the classical linear regression model, properties of the error of prediction.
29. Qualitative variables as explanatory variables in regression. Polynomial and spline regression models.
30. Residual diagnostics. Detection of heteroscedasticity and error autocorrelation. The impact of heteroscedasticity and error autocorrelation, and possible solutions (generalized least squares, sandwich estimators, transformations).
31. Stock returns (gross, net and log returns) and the characteristics of log returns (distribution and autocorrelation).
32. Volatility and GARCH models.
33. Models of trend and seasonality in time series.
34. Linear models of stationary and nonstationary time series
35. Linear models of multivariate time series.
36. Construction of time series models.
37. Labour market – methodology and main indicators.
38. Construction and quality of composite indicators.
39. Main macroeconomic indicators – methodology, construction and relationship.
40. Social statistics and human capital.

RECOMMENDED LITERATURE

Topics 1-20

1. Belton, V., Stewart, T. J.: *Multiple criteria decision analysis: an integrated approach*. Boston: Kluwer Academic Publishers, 2002.
2. Zopounidis, C, ed., Pardalos, P. M., ed.: *Handbook of multicriteria analysis*. Heidelberg: Springer, 2010.
3. Chankong, V., Haimes, Y. Y.: *Multiobjective Decision Making: Theory and Methodology*. USA: Dover Publications, 2008.
4. Greene, W. H.: *Econometric analysis*. 7th ed. Boston: Prentice Hall, 2012.
5. Wooldridge, J. M.: *Econometric analysis of cross section and panel data*. 2nd ed. Cambridge: MIT Press, 2010.
6. Eiselt, H. A., Sandblom, C.: *Integer programming and network models*. Berlin: Springer, 2000.
7. Nemhauser, G. L., Wolsey, L. A.: *Integer and combinatorial optimization*. New York: Wiley, 1988.

- Papadimitriou, Ch. Ch., Steiglitz, K.: *Combinatorial optimization: algorithms and complexity*. Mineola: Dover Publications, 1998.

Topics 21-40

- Trešl, J.: *Success in Statistics*, Praha: VŠE, 1998.
- Weiss, N. A.: *Elementary statistics*. 8th ed. Boston: Addison-Wesley, 2012.
- Weisberg, S.: *Applied linear regression*. 3rd ed. Hoboken: John Wiley & Sons, 2005.
- Rawlings, J. O., Pantula, S. G. a Dickey, D. A.: *Applied regression analysis: a research tool*. 2nd ed. New York: Springer, 1998.
- Heij, Ch. et al.: *Econometric methods with applications in business and economics*. Oxford: Oxford University Press, 2004.
- Wei, W. W. S.: *Time Series Analysis – Univariate and Multivariate Methods*, Addison Wesley Publishing Company, Inc., 1990.
- Capinski, M., Zastawniak, T.: *Mathematics for Finance: An Introduction to Financial Engineering*. Springer, Berlin, 2010.
- Clayton, G. E., Giesbrecht, M. G. a Guo, F.: *A guide to everyday economic statistics*. New York: McGraw-Hill Higher Education, 2010.
- Cipra, T.: *Financial and Insurance Formulas*. Physica, Berlin 2010.
- Neftci, S.N.: *Principles of Financial Engineering*. Academic Press, London 2008.
- REJDA, G.E.: *Principles of Risk Management and Insurance*. Prentice Hall, New Jersey 2010.
- Giovannini, E.: *Understanding economic statistics: an OECD perspective*. Paris: Organisation for Economic Co-operation and Development, 2008. Available from: <http://dx.doi.org/10.1787/9789264046986-en>.
- Anderson, D. R., Sweeney, D. J. a Williams, T. A.: *Statistics for business and economics*. 6th ed. Minneapolis: West Publishing Company, 1996.
- Bloom, D. E.: *The demographic dividend: a new perspective on the economic consequences of population change [online]*. Santa Monica, Calif.: Rand, 2003 [cit. 2016-10-07]. Available from: <https://login.zdroje.vse.cz/login?url=http://site.ebrary.com/lib/vsep/Doc?id=10056112>.
- Journal of population economics*. Berlin: Springer.
- Easterlin, R. A.: *The reluctant economist: perspectives on economics, economic history and demography*. Cambridge, Cambridge University Press, 2004, <http://site.ebrary.com/lib/vsep/Doc?id=10130455>
- Shoven, J., B.: *Demography and the economy*. Chicago, IL, USA, University of Chicago Press, 2011, 9780226754727 <http://site.ebrary.com/lib/vsep/Doc?id=10444595>
- Fox, J.: *Applied Regression analysis and generalised linear models*. Los Angeles, Sage, 2008. ISBN 978-0-7619-3042-6.