Master Degree Exam Requirements

Subject: Quantitative Methods
Academic year 2024/2025

1. **Measuring uncertainty.** Probability, basic definitions and rules (addition rule for elementary events, conditional probability, multiplication rule, Bayes' Theorem).
2. **Random variable.** Discrete and continuous probability distributions. Most common models of distributions (Bernoulli, binomial, Poisson, uniform, normal, exponential).
3. **Random sampling and statistical inference.** Population and random sample, methods of sampling, sampling distribution, sampling error. Statistical point and interval estimates, the quality of an estimate, confidence interval for mean and proportion.
4. **Principles of statistical hypotheses and tests.** Type I and type II errors, decision rules in statistical tests. Hypotheses about population means and proportions.
5. **One-way ANOVA.** Explanation and use of ANOVA, assumptions, hypothesis, post-hoc tests.
6. **Relationships between two quantitative variables.** Correlation and regression, coefficient of correlation, properties, hypothesis about coefficient, interpretation.
7. **Regression with one or more than one explanatory variables.** An estimate of parameters of regression line, assumptions and the properties of the least squares regression estimate, use of the model for prediction, meaning of the regression coefficients, possible difficulties and avoiding them, tests of significance in regression analysis.
8. **Time series analysis, description and characteristics.** Univariate time-series model and components of time series. Estimates of trend and seasonal components, quality of the model.
9. **Modelling finite state-space process as Markov chain.** Description of the process, transition probabilities, regular and absorbing chains, properties and long run behaviour, examples.
10. **Linear Programming (LP) and Operations Research.** Formulating the economic and mathematical models, preparing LP task, basic terminology.
11. **Application of the graph theory and network analysis in economic modelling.** Basic terminology of networks, the minimum spanning tree problem, the shortest path problem, project planning control, methods CPM and PERT.
12. **Statistical models and data.** Knowledge extraction from data, principles and steps in data mining process, methods of data exploration, measures of diversity.
13. **Modelling, simulation and data.** Real world problems and simulations, data and simulation of random events. Expected statistical properties of pseudorandom numbers generators.

References:

Hebák P., Kahounová J.: Počet pravděpodobnosti v příkladech. Informatorium, Praha 2005.

Hebák P., Skalská H.: Pravděpodobnost a statistika. Příklady a otázky. Gaudeamus, 2011.

Jablonský J.: Modely operačního výzkumu. Gaudeamus, 2002

Jablonský J.: Operační výzkum. Kvantitativní modely pro ekonomické rozhodování, Professional Publishing, Praha 2007

Skalská H.: Stochastické modelování. Gaudeamus, Hradec Králové, 2013

Skalská H.: Aplikovaná statistika. Gaudeamus, Hradec Králové, 2006

Skalská H.: Přednášky k předmětu Statistické modely a data, elektronická verze, 2014.

English Reference:

Hillier F.S., Lieberman G.J.: Introduction to operations research. McGraw-Hill, 2004

Grinstead Ch., M., Snell J., L.: Introduction to Probability. Chance project publication,

http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/book.html

http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/Chapter11.pdf

Groebner D.F., Shannon P.W., Fry P.C., Smith K.D.: Business Statistics. A Decision Making Approach. Prentice Hall, 2008.

Tufféry S.: Data Mining and Statistics for Decision Making. Wiley &Sons, Ltd., 2011