Biomedical Informatics

Examination topics for the state doctoral examination

Informatics set

Concept of data, information, knowledge, uncertainty and entropy

2. Decision making in medicine, specificity, sensitivity and predictive value

3. Expert systems and artificial intelligence in medicine

4. Use of biomedical information sources

5. Internet in medicine, health information quality assessment

6. Neural networks, Bayesian networks and types of neural networks

7. Decision theory in medicine, decision support systems

8. Cybernetic security, data protection in medicine, electronic signature

9. Hospital information system, medical record, medication record

10. Structure and principles of information systems in healthcare

11. Electronic data networks their hierarchy in healthcare

12. International classification of diseases

13. Data mining methods

14. Mathematical modeling

15. Evidence-based medicine, translational medicine

16. Clinical studies, principles and classification

17. Therapeutic algorithms and their formalization

18. Biological signals, basic concepts, classification and analysis

19. Image analysis and processing

20. Telemedicine

21. Biomedical informatics outlook

22. Health insurance, economical models of health care

23. National Health Information Systém

Medical statistics

1. Descriptive characteristics of continuous and categorical random variables, graphical representation of data

2. Population and random sample, location and scale parameter of continuous random

variables a its sample estimates, moments of continuous random variables
3. Continuous and discrete probability distributions, normal (Gaussian) and uniform distribution, alternative and binomial distribution
4. Statistical testing – random sample, representative sample, medical hypothesis, null and alternative statistical hypothesis, test statistic, significance level of statistical test, critical value, observed significance level (p-value), statistical software
5. Hypotheses testing and confidence intervals
6. Testing hypothesis about the mean of continuous random variable – parametric one-sample and two-sample tests, paired tests, nonparametric tests
7. Categorial data analysis – Chi-squared test, Fischer test
8. Correlation analysis – correlation and covariance matrix, types of correlation (Pearson, Kendall, Spearman), correlation and causality, uncorrelation vs. independence
9. Time series, time trend, periodicity
10. Multivariate methods – discriminant, factor and cluster analysis, principal components, graphical methods
11. Health statistics and clinical registries
12. Phases of clinical trials I - IV
13. Survival analysis (Kaplan-Meier estimate, Cox PH model and its variants for the case of violated PH assumptions)
14. Linear regression and problem of collinearity of the predictors
15. Analysis of variance
16. Generalised linear regression (logistic regression, Poisson regression)
17. Akaike (AIC) a Bayesian information criterium (BIC), optimal model selection
18. Parametric and nonparametric statistical tests of hypotheses (a general comparison)
19. Multiple statistical tests and inflation of statistical significance level alpha, simultaneous statistical tests
20. Euclidean and Mahalanobis statistical distance
21. Classification methods, regression and classification trees
22. Exploratory and confirmative analysis, meta-analysis
23. Bayes theorem, Bayesian vs. frequentist (classical) statistics