Lecture's plan:

1. Organization and structure.
2. Introduction to R.
3. Set operations. Venn diagramms.
4. De Morgan's laws. Probability.
5. Tutorial in R.
6. Descriptive statistics. Plots in R.
7. Conditional probability and Bayes theorem.
8. Random variables and their distributions.
9. Expectations, moments and transformations. Markov's inequality.
10. Chebyshev's inequality. Basic univariate discrete and continuous distributions.
11. Sampling distributions and main large scale sample theorems. Convergence in probability. Weak law of large numbers.
12. Normal distribution. Strong law of large numbers. CLT. T-distribution, F-distribution.
13. Basics of inference. Likelihood estimation.
14. Bayesian estimation. Approximate Bayesian Computations.
15. Statistical testing. $p<0.05$. One sample Z-test. One sided and two sided tests. The p-value. Testing miu with unknown sigma. The t-test.
16. Testing the variance. Type I and II Errors. The power of a test. Hypothesis testing for two and more samples.
17. ANOVA testing. Summary of tests and usage in R (t-test,f-test,z-test,chi2-test, Smirnov-Kolmogorov, Kruskal-Wallis, Wilcoxon/Mann-Whitney,two-sample permutation test).
18. Correlation and association analysis. Chi-square test.
19. Entropy. Mutual information. Linear correlation. Intraclass correlation.
20. Modelling of data. Linear regression.
21. Maximum likehood estimation. Model diagnostic.
22. Logistic regression and odds ratio.
23. Classification. LDA. Nearest centroid. kNN. Artificial Neural Network. SVM. Dimension reduction. Cross validation.
24. Assess performance of the classifier. Accuracy. Sensitivity. Specificity. Matthews correlation coefficient.
25. Perceptron. Multilayer NN. Front error propagation and backpropagation.
26. PCA vs LDA. Unsupervised learning.
27. K-means algorithm. Hierarchical clustering.
28. Nearest-Neighbour algorithm and differente clustering algorithms.

Homeworks:

1. Using the data, plot all histogramms, plot vertically the means, test the difference and plot p-value on the plot.
2. Apply kNN and SVM using one leave out cross validation, compute the table and compute the sensitivity, sensitivity, accuracy, precision, and Matt. corr.