Topics for Exam 1

1. **Exploratory data analysis**

    1.1 Variables: quantitative and qualitative

    1.2 Distribution of a variable

    1.3 Describing distributions: location, spread, shape, numerical summaries

    1.4 Pictures of distributions: histograms and box plots

2. **Significance Testing**

    2.1 Hypothesis testing: null hypotheses or model, test statistic, p–value.

    2.2 Definition of statistical significance

3. **Probability**

    3.1 Definition and interpretations: relative frequency interpretation and probability models.

    3.2 Estimating probabilities through simulations

    3.3 Independent events and conditional probabilities

    3.4 Computing probabilities: equally likely events, independent events, mutually exclusive events, probabilities of joint events

4. **Random Variables and their Distributions**

    4.1 Definition of a random variable: random experiments and sample spaces.

    4.2 Discrete versus continuous random variable

    4.3 Probability distribution of a discrete random variable

    4.4 Cumulative distribution

    4.5 Expectation of a random variable

    4.6 The Law of Large Numbers

    4.7 Variance and standard deviation of a random variable.

5. **Sampling**

    5.1 Random sampling

    5.2 Sampling with and without replacement

5.3 Parameters and statistics

5.4 Sampling distribution

6. **Experiments**

6.1 Randomized comparative experiment

6.2 Control group

6.3 Randomization test

6.4 Hypothesis testing

Relevant sections in the text:

- Sections 1.1 and 1.2 in Chapter 1

- Sections 4.1–4.5 in Chapter 4

- Section 6.2 in Chapter 6

Relevant chapters in the Class Notes:

- Chapter 2

- Chapter 3

- Appendix A

Important Concepts

Quantitative and categorical variables, distribution, sampling, random sample, parameter, statistic, sampling distribution, probability, probability distribution, statistical significance, p–value, random variable, expected value, variance, standard deviation.

Important Skills

1. Know how to how to estimate or compute probabilities

2. Know how to compute expected values and variances of random variables

3. Know how to set up significance tests