

Important themes

- What is the difference between probability and statistics?
- Why is it important to have a good study design?
 - More detailed:
 - Examples of different study designs
 - Assign properties to the correct type of study design
 - How is study design linked to (selecting a tool for statistical) data analysis?
- What is the importance of exploratory data analysis?
 - More detailed:
 - What is EDA?
 - How can it be carried out? What are the tools?
 - What are possible conclusions you can make after an EDA analysis?
 - How to interpret specific graphical EDA output (like 4-plots, qq-plots)?
- Why is “data” subject to “error”?
 - More detailed:
 - Examples of “errors” and “bias”
 - How can some of these errors be detected? (for instance, EDA, testing)
 - How can some of these errors be avoided? (for instance via study design, data collection scheme)
 - What is the difference between Population (Distribution) and Sample (Distribution), a Parameter and a Statistic?
 - What is the difference between standard deviation and standard error and why is it important to differentiate between these? (think More detailed about “testing” and using the correct “test statistic”)
 - Where does the Delta Method fit in? Why is it useful?
 - What is (expected) Fisher’s Information and where does it play a role? (for instance, think about Cramer-Rao)
- What are different properties for estimators and how are they defined?
 - More detailed:
 - What is the difference between an estimator and an estimate?
 - Why is it important to balance variance and bias and which concept allows you to do so? (for instance think about Mean-Squared Error – or MSE)
 - What are different ways to estimate parameters?
 - What are the overlapping / different properties of MMEs (methods of moments estimators) and MLEs (maximum likelihood estimators)?
 - How are MMEs obtained?
 - How can uncertainty around estimates be assessed?
- What is a confidence interval?
 - More detailed:
 - How can confidence intervals be constructed?
 - How should a 90% confidence interval be interpreted?
 - What is a pivotal quantity?
- What are the key components of hypothesis testing?
 - More detailed:

- What is statistical inference?
- Complete course summary tables related to tests for a single mean, multiple means, single variance (for instance, some elements in this table may be omitted and you may need to select the correct entry from a list of choices)
- How can confidence intervals be used for hypothesis testing? What are the three types of hypothesis testing? Explain (think about quantile, confidence interval, probability based)
- What is a p-value? (also revise the “fallacies of statistical testing”) Power? Type I and Type II errors?
- How are effect size, power, sample size, Type I and Type II errors related?
- How can the relation between two categorical variables or between two continuous variables be quantified?
 - More detailed:
 - What is linear regression? What are the assumptions? (think about systematic and probability parts)
 - What is the difference between association and causation?
 - What is an Odds Ratio (OR) and how/when may it be different from a RR (relative risk)?