General concepts

- Causal inference
- Potential Outcomes Framework (POF)
- Individual treatment effect (ITE)
- Counterfactuals
- Average Treatment Effect (ATE)
- Naïve Average Treatment Effect (NATE)
- Average Treatment on the Treated (ATT) and Control (ATC)
- Decomposing the bias of NATE: baseline bias and differential treatment effect bias
- Stable Unit Treatment Value Assumption (SUTVA)
- Independence/Ignorability of treatment assignment
- Conditional Independence/Conditional of treatment assignment
- DAGs
- Mediators, colliders, and confounders
- Back-door paths, back-door criterion
- Selection bias
- Randomized treatment assignment
- Observational vs experimental studies
- Natural experiments
- Exogeneity vs. endogeneity
- A basic understanding of how to read the formulas and how to use the notation to format simple statements in the POF
- Application papers: Research question, methods applied, and reading outputs as shown on the slides

Regression

- Mechanics of OLS
- Omitted Variable Bias (OVB)
- Interpretation of the coefficients
- Estimation of the bias of a coefficient when there is OVB
- Conditions under which regression can be used to estimate causal effects
- Criteria for selecting relevant covariates
- Post-treatment bias

Matching

- Conditional vs. unconditional randomization
- Stratification
- Exact matching
- Common support
- Propensity score matching
- Logistic Regression intuition
- Balance tests
- Selection on observables

Instrumental Variables

- Intention to treat (ITT) effect
- Instrumental variable (Z) vs. treatment receipt indicator (D)
- Principal strata (or compliance types): Compliers, Always-takers, never- takers, defiers
- IV assumptions
- Estimation of LATE
- Causal graphs perspective on IV

Regression Discontinuity

- Meaning of forcing (or running) variable X and treatment variable D
- Local randomization
- Assumption of continuity of average potential outcomes
- Bandwidth choice
- LATE at the threshold
- Different model types
- Falsification checks
- Internal and external validity of RD

Difference-in-Differences

- Visual approach to DD
- Algebraic approach to DD
- Assumption of parallel trends
- Potential sources of parallel trends violations

Fixed Effects

- Panel data vs pooled cross section
- Error term decomposition in panel setup: unit fixed effects, time fixed effects, idiosyncratic error
- Time demeaning
- Least Squares Dummy Variables (LSDV) estimation
- Two-way FE model
- How to include time-invariant variables in a FE model
- Within vs. between variation
- Limitations of FE models

Mediators and Moderators

- Distinction between mediators and moderators
- Conceptual decomposition of total causal effect into direct effects and indirect effects