Statistics: Week 3

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March 19, 2007

Data Summary $(x_1, \quad , x_n)$

- Numerical: Mean, Median; SD, IQR; 5-point summary (Min, Q1, median, Q3, Max)
- Graphical: stem-and-leaf plot, histogram, box plot
- Main features of the data: Center, variation, skewness, modes, extreme values
- Examples and demo in R

From Sample to Population

Random variable is a convenient concept to model a population. Consider a few examples in mind. Do NOT just memorize the math formula.

- A coin? a dice? one person's height?
- Describing the sample vs. population
- z to X

Random Variable To know what a random variable behave, we need probability distributions (d.f., pdf/pmf, mgf) and some quantities (parameters: expectation, variance, moments, etc).

- Is this a good idea? Alternatives?

Review: Probability and rv

- Random Variable Numerical variables associated with one population.0 0 1 V150Continuous: Height, weight, blood pressur Discrete: For/Against, Gender, Social-economic statusV151
- What kind of info we would like to know regarding a rv/population?

Prtbability

A formal framework of analysis, studying uncertainty.

- Probabilities of events 1_A, indicator random variable
- Prob related to rv: probability mass function (for discrete r.v.); probability density function (pdf).
- Asymptotic relative Frequencies
- Definitions of probability, pmf and pdf, distribution function/cummulative distribution function (cdf)(P16, P60,P142, P144 in TextBook)
- Interpretation: Probability (of events) as expected value/fair price
- Example: Coin (sampling survey); weight of black sugar Shaw-Ma

Expectation, etc

- Expectation, Variance. Moments. Interpretation.
- Moment Generating FunctionLet X be a r.v. and there exists a neighborhood (h, h) such that M(t) = E(e^{tX}), t *2* (h, h) is defined. Then M(t) is the m.g.f of X. It can be utilized to m4lculate the moments of a r.v. (therefore, EX, Var(X)). $M^{(r)}(0) = E(X^r)$.
  - Very powerful in m4lculating the moments of sum of identical independe(nt)-333r.v.'s
  - Identify the distribution of a rv
  - Characteristic function $\psi(t) = E(e^{itX})$

Reading

- Review Chapter 1, 2, 3.
- Read *x*5.1–*x*5.4.
- We will go back to sections of Chapter 4 later.