MTH 23.5 LECTURE NOTES (Ojakian)

Topic 3: Introduction to Statistics

OUTLINE

References (**Algebra Book**: None; **Statistics Book**: 1.1, 1.2, 1.3, 1.4)

1. Introduction to Statistics
2. Random Samples
3. Experimental Design

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1. Introductory Example
   (a) Who is going to win the midterm elections in November 2026? You're voting if you can, right?!
   (b) How might you predict the outcome?
2. Basic Terminology of Statistics

   Do survey: Commute time? Favorite Fast Food?

   Use survey as example for below terminology. Use Example 1.2 (Section 1.1, page 8).

   (a) Individual:
   (b) Variable:
   (c) Data:
   (d) Quantitative/Numerical versus Qualitative/Categorical Variable:
   (e) Population versus Sample ("census" versus "representative sample"): Have a "criteria" for being in the population ...
   (f) Parameter versus Statistic:
   (g) Summarizing data: mode, "middle", max, min, range, counting, proportion, mean
   (h) Examples
      i. Example 1.3 (Section 1.1, page 9).
      ii.

      PROBLEM 1. *Discuss how the mean commute time for our class can be viewed as a parameter or a statistic.*
3. Sample Mean versus Population Mean

   $\overline{X}$ = Sample Mean and μ = Population Mean

   PROBLEM 2. *Consider the basket-ball. Find random samples of size 5. Compare various values of $\overline{X}$ to the ONE value of μ.*
4. Data Summaries in General
   (a) Summarize all the data with a single number (Examples: mean, median, mode)

(b) Other Data Summaries: Maximum and Minimum, Range, various percentages, various counts, etc.

(c)

PROBLEM 3. *Find examples of other data summaries.*

5. Levels Of Measurement

(a) Level of Measurement: Nominal (or qualitative/categorical), Ordinal, Interval, Ratio (Section 1.3, page 26).
Example: Temperature, Height, Generation, ...

PROBLEM 4. *From **Statistics Book** (7th Edition) do Sec 1.1 - Prob 11*

(b) More Examples.

PROBLEM 5. *From **Statistics Book** (7th Edition)) do Section 1.1 - Probs 7, 9. Also determine the level of measurement for each problem.*

6. What is Statistics and What is this course?

(a) The Field of Statistics:

(b) Descriptive versus Inferential Statistics:

(c) Us: Statistics and Background Math/Algebra

PROBLEM 6. *From **Statistics Book** (7th Edition) Section 1.1, do Problem 15.*

7. Random Samples

(a) Simple Random Sample:

i. Example 1.13 (Section 1.2, page 23)

ii.

PROBLEM 7. *From **Statistics Book** (7th Edition) Section 1.2 do Problem 8.*

(b) Sampling Error versus Non-Sampling Error:

(c) Another Example:

i. Guess average age in class! Or average height! (from a small random sample)

ii. To guess the population mean, take a random sample of size 4 and find the sample mean.

8. Experimental Design

(a) Observation versus Experiment:

PROBLEM 8. *From **Statistics Book** (7th Edition) Section 1.3 do Problem 7.*

(b) Aspects of an Experiment.

i. Control Group versus Treatment Group:

ii. Completely Randomized Experiment:

iii. Placebo Effect:

iv. Double-blind:

(c)

PROBLEM 9. *From **Statistics Book** (7th Edition) Section 1.3 do Problem 9. Also, specify the control group and how to make the study double-blind (if possible).*