

MTH 23.5 LECTURE NOTES (Ojakian)

Topic 1: Introduction to Statistics

OUTLINE

References (**Algebra Book**: None; **Statistics Book**: 1.1, 1.2, 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 NYC mayor race on November 2, 2021?
 - i. Democrat: Eric Adams (former Brooklyn Borough President and police officer)
 - ii. Republican: Curtis Sliwa (founder of Guardian Angels)
- (b) How might you predict the outcome?

2. Basic Terminology of Statistics

Do survey: Commute time? Fast Food?

Use survey as example for below terminology.

- (a) Individual:
- (b) Variable:
- (c) Quantitative versus Qualitative Variable:
- (d) Population Data versus Sample Data (“census” versus “representative sample”):
- (e) Parameter versus Statistic:

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

3. Ok, let’s remember our numbers! ...: Number Line.

Definition 1. *The **number line** is a horizontal line going infinitely far to the right and left with the following properties:*

- (a) Zero is in “middle”
- (b) Positive numbers to right of zero
- (c) Negative numbers to left of zero
- (d) Left is smaller. Right is larger.

PROBLEM 2. *Draw the number line and place the following numbers on it (largest, smallest?):*

$$0, 4, -5, -8, 1/2, -1/2, 11.75, -7.75, 11\frac{1}{3}, -3\frac{3}{4}$$

4. Types of Numbers

Definition 2. A *real number* is any number on the Number Line.

Definition 3. An *integer* is a whole number, which is positive, negative, or 0.

PROBLEM 3. Which of the following numbers are integers: 9, $5/4$, $4/5$, 10.4, 10, -19 , 0.7, 0

5. Back to Statistics! ...

(a) Level of Measurement: Nominal, Ordinal, Interval, Ratio

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, Background Algebra, and Problem Solving

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

7. Random Samples

(a) Simple Random Sample:

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

(b) Sampling Error versus Non-Sampling Error:

(c) Another Example:

- i. I have 35 sheets of paper (each numbered 1 - 10), repetitions allowed. You want to guess what the mean is ...
- ii. To guess the population mean, take a random sample of size 4 and find the sample mean. Two volunteers!

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).