Chapter 1 - Introduction to the Practice of Statistics

In statistics, you will be learning a new language... a new way of thinking. You will be doing math, but statistics is a completely different subject so you first have to learn the language of statistics... In other words ... the first couple of lectures we will be learning LOTS of definitions.

Introduction:
Most of you have become familiar with Statistics and Probability through radio, television, internet ...etc. For example, the following statements were found in newspaper.

- Nearly one in seven U.S. families still struggle with bills from medical expenses even though they have health insurance. Source: Psychology Today, October 2004
- Eating 10 grams of fiber a day reduces the risk of heart attack by 14%.
- 63% of us say we would rather hear the bad news first.
- There is a 80% chance that it will rain tomorrow.

Statistics is used in almost all fields of human endeavor ... so it’s important that we have an understanding of it. So let us begin!

Definitions to know:
1. Statistics

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<th>2. Population</th>
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<th>3. Parameter</th>
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4. Sample

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5. Statistic

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Example #1

Determine if the given value is a statistic or a parameter, explain:

a) 45% of the students in a calculus class failed the first exam

b) 25 calculus students were randomly selected from all the sections of calculus I. 38% of these students failed the first exam.
6. Descriptive Statistics

7. Inferential Statistics

8. Variable

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The following terms are used to classify a variable!!

9. Qualitative Data/ Categorical Data

10. Quantitative Data

11. Discrete variable

12. Continuous Variable
Example #2

1. The number of textbooks in a math class discrete/continuous
   Explain answer:

2. The amount of water you drink in a day in ounces discrete/continuous
   Explain answer:

3. Give two examples of
   o Discrete data
     o Continuous data

Another way of classifying a variable is by it's LEVEL!!

13. Nominal level of measurement

| Definition: | Example: |
14. **Ordinal Level of measurement**

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15. **Interval Level of measurement**

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16. **Ratio level of measurement**

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Observational Studies versus Designed Experiments

Example #1
A poll is conducted in which 500 people are asked whom they plan to vote for in the upcoming election.

Example #2
A study conducted at Virginia Polytechnic Institute and presented in "Psychology Today" divided female undergraduate students into two groups and had the students perform as many sit-ups as possible in 90 seconds. The first group was told only to "Do you best," while the second group was told to try to increase the actual number of sit-ups done each day by 10%. After 4 days, the subjects in the group who were given the vague instruction of "do your best" averaged 43 sit-ups, while the other group that was given specific instructions averaged 56 sit-ups. The conclusion then was that athletes who were given specific goals performed better than those who were not given specific goals.

1. observational study

2. designed experiment

3. explanatory variable

4. response variable

5. lurking variable (confounding variable)
Example
Suppose that I would like to know if the notes I've developed to use in class are helpful or not. So I use my notes with morning Math 150 class and I don't use any notes for afternoon Math 150 class. I will give both of my classes the same exam and compare scores.

What are some variables that I can NOT control that would affect my study?
1. Students sharing my notes

Think of others ....

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**Simple Random Sampling and other Sampling Techniques**

1. simple random sample

![Simple Random Sampling](image1)

2. systematic samples

![Systematic Sampling](image2)
3. **Stratified Samples**

   ![Stratified Sampling Diagram]

4. **Cluster samples**

   ![Cluster Sampling Diagram]

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**Example #3 - Read each scenario and then identify the type of sampling used:**

1. A farmer has a corn field with 150 rows of corn, each containing about 2000 corn plants. He divides the field into 12000 regions of 25 plants each. He then uses the random number generator in Excel to pick 20 regions and checks each of the 25 plants in those regions for disease.  
   
2. Each of the entries into a contest are placed into a hat. Five entries are drawn from the hat to choose the winners.  
   
3. The entries to a contest are arranged by the age group of the submitter. Five winning entries are selected from those under age 20, ten from those age 20 to 40, and five from those over age 40.  
   
4. A student is required to interview at least three faculty members to determine their opinion on the Farm Progress Show coming to Decatur. The student gets a list of full time faculty, divides it into males and females instructors, and then asks two female and two male instructors.
What is the difference between a random sample and a simple random sample?

5. I have a bag with 100 marbles in it. Tell whether the following are a random sample, or a simple random sample, and why:
   a. You reach in and choose one marble
   b. You reach in and choose groups of 5 marbles at a time

6. Can we have a sample that is a Simple Random Sample, but not a Random Sample?

Bias in Sampling

1. Sampling error

2. Non-Sampling Error