MAE 508 Statistics and Data Analysis for Teachers

Class 1: What is Statistics?

- Science of collecting and analyzing data

- Concerns Events: Draw conclusions and make decisions

- Provision of methods to reduce bias and error in collecting data

Examples: Traffic, Survey

To make wise, educated “guesses”

Three common statistical tasks:
1. Collect data
2. Summarize and explore data
3. Draw conclusions and make decisions
Collect, detect errors and deduce patterns, then represent:

**DESCRIPTIVE STATISTICS**

or

*Exploratory data Analysis*

vs

*Confirmatory Data Analysis* – deals with drawing conclusions/making decisions

**INFERENTIAL STATISTICS**

Fitting models to data
Probability and Statistics: a link?

First look at difference between *population* and *sample*

*Population*: Collection of units of interest

*Sample*: A subset

Interested in one or more measurable properties or attributes associated with each unit of the populations

These are VARIABLES

In general, interested in numerical characteristics of a population variable: These are PARAMETERS

Need to deal with SAMPLES – cost, equity etc
Later SIMULATIONS
In order to avoid BIAS we select a RANDOM SAMPLE

Such a sample gives an EQUAL pre-assigned chance to every unit in the population to enter the sample

NOTE difference between RANDOM and HAPHAZARD

In Probability assume *we know the population and its parameters*

Statistics, population and parameters are *unknown*. Assume probability distributions as MODELS of the data

Quantities estimating or making a decisions about an unknown parameter from the sample is a STATISTIC

Different samples can give different results – Sampling Variability
Statistics are subject to SAMPLING ERRORS

One question in inferential statistics is to quantify this error

Probability: given a population, draw inferences about a sample, DEDUCTIVE

Statistics is INDUCTIVE in nature
Review of Probability

Classical Approach developed by Fermat (1601-65) and Pascal (1623-62) studying games of chance and later by Bernouilli, de Moivre, Laplace, Gauss (1777-1855)

Frequentist Approach from here and is still predominantly used in medicine (seeking patterns, cure rates and relative frequencies)