INTRODUCTION TO PROBABILITY MODELS

Lecture 32

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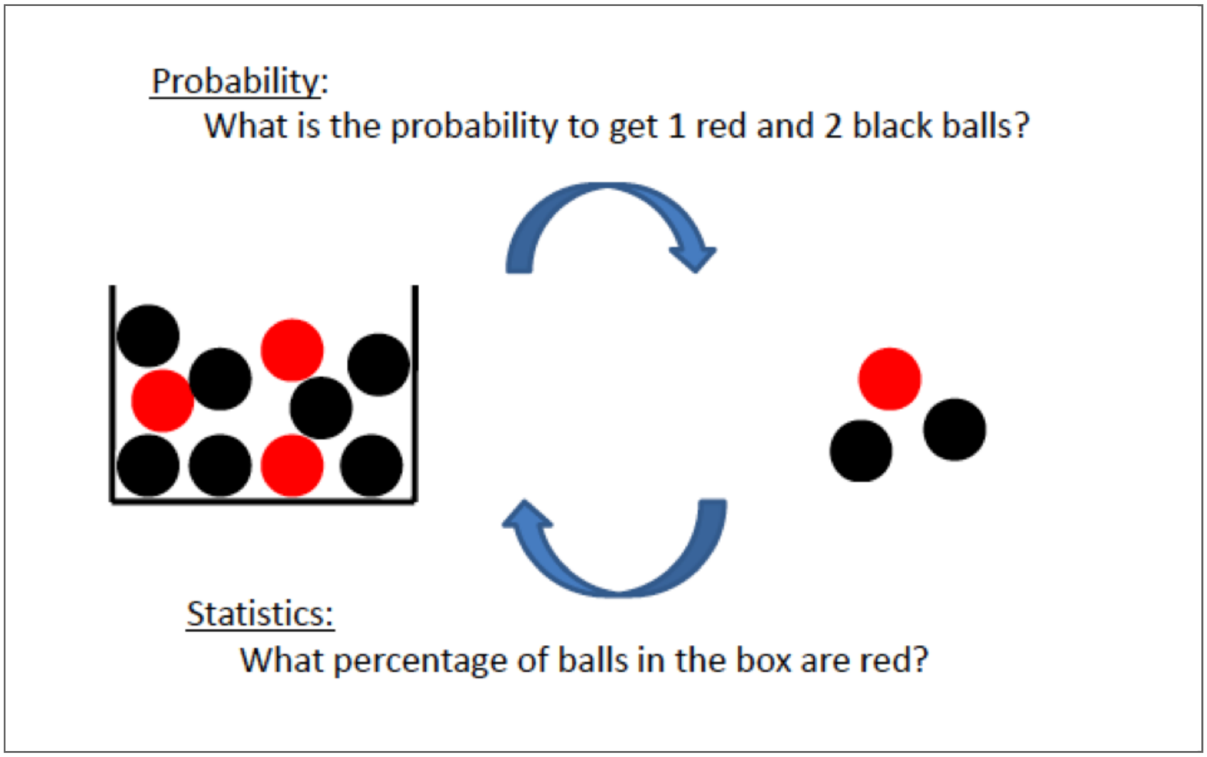
PROBABILITY VS STATISTICS

- Probabilityis the science which studies likeliness of future event is based on the underlying model or population or process
- Statistics is the science of collecting, analyzing, presenting, and interpreting data



Probability:

What is the probability to get 1 red and 2 black balls?

Statistics:

What percentage of balls in the box are red?

CONCEPTS

- **Dataset:**all the data collected in a particular study
- **Elements:**the individual entities of a data set
- **Variable:**a character of interest for the elements
- **Observation:**the set of measurements obtained for a particular element

TYPES OF VARIABLES

1. Qualitative Variable: has names or labels used to identify an attribute of an element, also called categorical. Scale of measurement is
   - Nomial: ranking or order is meaningless (e.g. color)
   - Ordinal: inherent rank or order to the data (e.g. income categories)
2. Quantitative Variable: has numeric values that indicates how much or how many of something. Scale of measurement in
   - Interval: difference of quantities are meaningful, ratios of quantities cannot be compared (e.g. temperature in degrees Fahrenheit)
   - Ratio: ratios of quantities are meaningful (e.g. length)

EXAMPLE 1

The table shows a data set.

Year	**Major**	**GPA**	**Total Credit Hours**
Sophomore	Psychology	3.14	42
Senior	Accounting	3.45	105
Senior	Philosophy	3.06	111
Freshman	Statistics	2.89	17
Sophomore	Spanish	3.25	38
Junior	Accounting	2.95	79

1. How many elements are in the data set?
2. How many variables are in the data set?
3. What is the 4_{th} observation in the data set?
4. What type of variable is each variable in the data set?

EXAMPLE 2

State the type of variable for each

1. Smoking status
2. Income
3. IQ
4. Level of satisfaction
5. T-shirt size (S, M, L, XL)
6. Score on the Mathematics portion of the SAT

TYPES OF DATA

Based on how the data were collected

- Cross-sectional data: collected at the same point (or approximately the same point) in time
- Time series data: collected over several time periods

EXAMPLE 3

State whether the data for variable is cross-sectional or time series.

1. Current GPAs of Sophomore Management students
2. Your GPA during your time at Purdue
3. Daily closing price of a stock for month of March
4. Value of the stocks in the Dow Jones Industrial Average on March 31, 2016
5. Bushels of corn harvested in each of Indiana’s counties in 2015.
6. Score on the Mathematics portion of the SAT

NUMERICAL SUMMARIES

MEASURES OF CENTER

- **Mean:** arithmetic average

  $$\bar{x} = \frac{x_1 + x_2 + \cdots + x_n}{n} = \frac{1}{n} \sum_i^n x_i$$

  Example: 1, 2, 2, 3, 4, 7, 9
- **Mode:** most frequent value in a dataset Example: 2 is the mode in the previous example
- **Median:** midpoint of the data such that half of the values are smaller and half of the values are larger.

HOW TO FIND A MEDIAN

1. Arrange the data in increasing order(from the smallest to the largest)
2. Count the number of observations, n.
3. If n is **odd**, median is the middle ordered value: $M = (\frac{n+1}{2})_{th}$ ordered value
4. If n is **even**, median is the average of two middle ordered value: M = average of $(\frac{n}{2})_{th}$ and $(\frac{n}{2} + 1)_{th}$ ordered value