Measuring Data

PIERIAN DATA

Levels of Measurement

Nominal

- Predetermined categories
- Can't be sorted

Animal classification (*mammal fish reptile*)

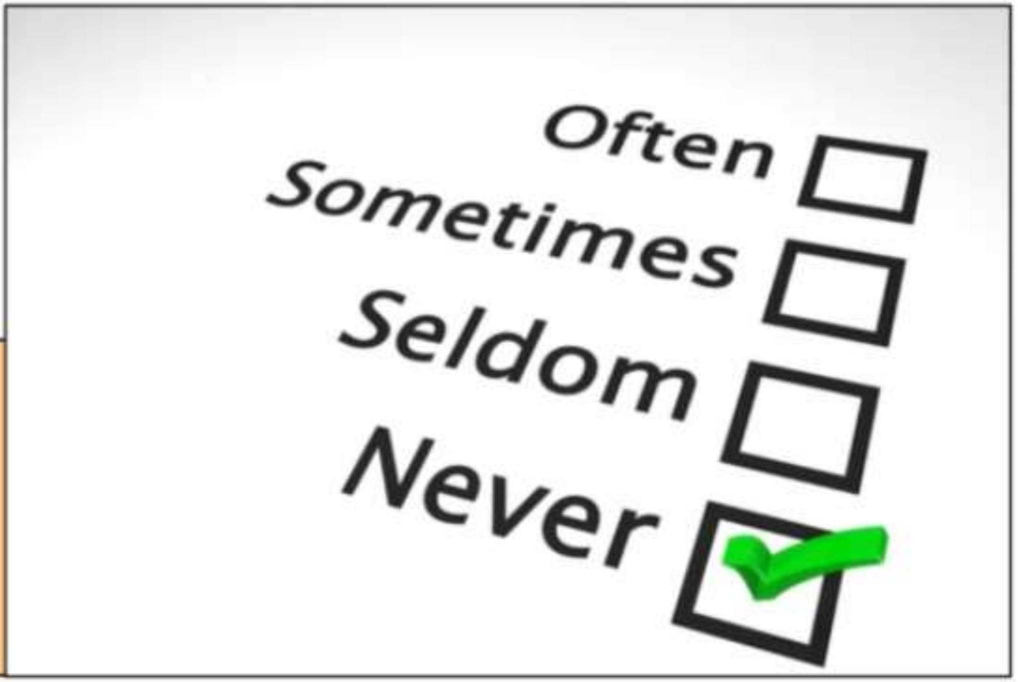
Political party (*republican democrat independent*)

Levels of Measurement

Ordinal

- Can be sorted
- Lacks scale

Survey responses



PIERIAN DATA

Levels of Measurement

Interval

- Provides scale
- Lacks a “zero” point

Temperature

Levels of Measurement

Ratio

- Values have a true zero point

Age, weight, salary

Population vs. Sample

- **Population** = every member of a group
- **Sample** = a subset of members that time and resources allow you to measure

Mathematical Symbols & Syntax

Symbol/Expression	Spoken as	Description
x^2	x squared	x raised to the second power $x^2 = x \times x$
x_i	x-sub-i	a subscripted variable (the subscript acts as a label)
$x!$	x factorial	$4! = 4 \times 3 \times 2 \times 1$
$\bar{x}$	x bar	symbol for the sample mean
μ	“mew”	symbol for the population mean (Greek lowercase letter mu)
Σ	sigma	syntax for writing sums (Greek capital letter sigma)

Exponents

$$x^5 = x \times x \times x \times x \times x$$

1 2 3 4 5

EXAMPLE: $3^4 = 3 \times 3 \times 3 \times 3 = 81$

Exponents – special cases

$$x^{-3} = \frac{1}{x \times x \times x}$$

EXAMPLE: $2^{-3} = \frac{1}{2\times2\times2} = \frac{1}{8} = 0.125$

$$x^{\left(\frac{1}{n}\right)} = \sqrt[n]{x}$$

EXAMPLE: $8^{\left(\frac{1}{3}\right)} = \sqrt[3]{8} = 2$

Factorials

$$\boldsymbol{x}! = x \times (x-1) \times (x-2) \times \cdots \times 1$$

EXAMPLE: $6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

EXAMPLE: $\frac{5!}{3!} = \frac{5 \times 4 \times \cancel{3 \times 2 \times 1}}{\cancel{3 \times 2 \times 1}} = 5 \times 4 = 20$

Simple Sums

$$\sum_{x=1}^{n} x = 1 + 2 + 3 + \cdots + n$$

EXAMPLE: $\sum_{x=1}^{4} x = 1 + 2 + 3 + 4 = 10$

EXAMPLE: $\sum_{x=1}^{4} x^2 = 1 + 4 + 9 + 16 = 30$

Series Sums

$$\sum_{i=1}^{n} x_i = x_1 + x_2 + x_3 + \cdots + x_n$$

EXAMPLE: $x = \{5,3,2,8\}$

$n = \#\ elements\ in\ x = 4$

$$\sum_{i=1}^{4} x_i = 5 + 3 + 2 + 8 = 18$$

Equation Example

- Formula for calculating a sample mean:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

- Read out loud:

"x bar (the symbol for the sample mean) is equal to the sum (indicated by the Greek letter sigma) of all the x-sub-i values in the series as i goes from 1 to the number n items in the series divided by n."

Equation Example

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

1. Start with a series of values:

   {7 8 9 10}

2. Assign placeholders to each item

   {7 8 9 10}

   1 2 3 4 n=4

3. These become x_1 x_2 etc.

$$x_1 = 7 \quad x_2 = 8 \quad x_3 = 9 \quad x_4 = 10$$

Equation Example

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

4. Plug these into the equation:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{x_1 + x_2 + x_3 + x_4 \ldots + x_n}{n}$$

$$= \frac{7 + 8 + 9 + 10}{4} \quad = \frac{34}{4} = 8.5$$