Types of Scales

Scale type	Admissible transformations	Statistics	Examples
Nominal	1-1 mapping	Mode, Frequency (counts)	Labeling, classifying entities
Ordinal	Monotonic increasing function	Mode, Median, Percentile, Spearman r, Kendall r, Frequency (counts), order, **<,>,=**	Preference, hardness, air quality, intelligence tests (raw scores)
Interval	$M'=aM+b, a >0$	Mode, Median, Mean, Standard deviation, Pearson product-moment correlation, Multiple product-moment correlation **+,-**	Relative time, temperature (Fahrenheit, Celsius), intelligence tests (standardized scores)
Ratio	$M'=aM, a> 0$	Geometric mean, Coefficient of variation **+,-,*,/**	Time interval, length, temperature (Kelvin)
Absolute	$M'=M$	All stats	Counting entities

Levels of Measurement

Various scales of measurements exist:

- Nominal Scale

- Ordinal Scale

- Interval Scale

- Ratio Scale

The Nominal Scale (1/2)

Example: *A religion nominal scale*

Joe   Michelle

Rachel   Christine

Michael   James

Clyde   Wendy

Catholic

Muslim

Other

Jewish

The Nominal Scale (2/2)

- The most simple measurment scale
- Involves sorting elements into categories with regards to a certain attribute
- There is no form of ranking
- Categories must be:
  - Jointly exhaustive
  - Mutually exclusive

The Ordinal Scale (1/2)

Example: *A degree-classification ordinal scale*

Joe   Michelle

Rachel   Christine

Michael   James

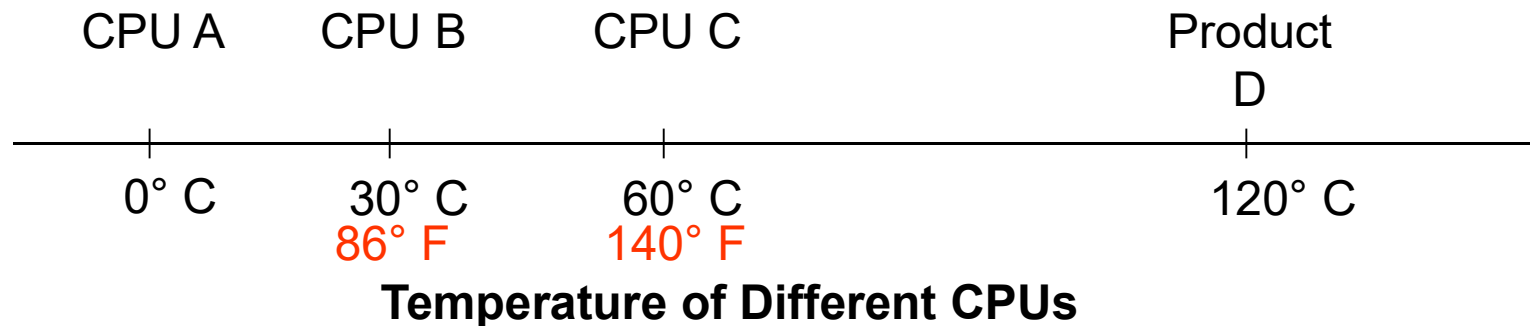Clyde   Wendy

1st Class

2nd Class

Failed

3rd Class

The Ordinal Scale (2/2)

- Elements classified into categories
- Categories are ranked
- Categories are transitive A > B & B > C ➜ A > C
- Elements in one category can be said to be better (or worse) than elements in another category
- Elements in the same category are not rankable in any way
- As with nominal scale, categories must be:
  – Jointly exhaustive
  – Mutually exclusive

Interval Scale

- Indicates exact differences between measurement points
- Addition and subtraction can be applied
- Multiplication and Division **CANNOT** be applied
- We can say that product D has 8 more crashes per month but we cannot say that it has 3 times as more crashes

CPU A   CPU B   CPU C   Product D

0° C   30° C   60° C   120° C

86° F   140° F

Temperature of Different CPUs

Ratio Scale

- The highest level of measurement available
- When an absolute zero point can be located on an interval scale, it becomes a ratio scale
- Multiplication and division can be applied (product D crashes 4 times as much per month than product B)
- For all practical purposes almost all interval measurement scales are also ratio scales

Measurement Scales Hierarchy

- Scales are hierarchical
- Each higher-level scale possesses all the properties of the lower ones
- A higher-level of measurement can be reduced to a lower one but not vice-versa