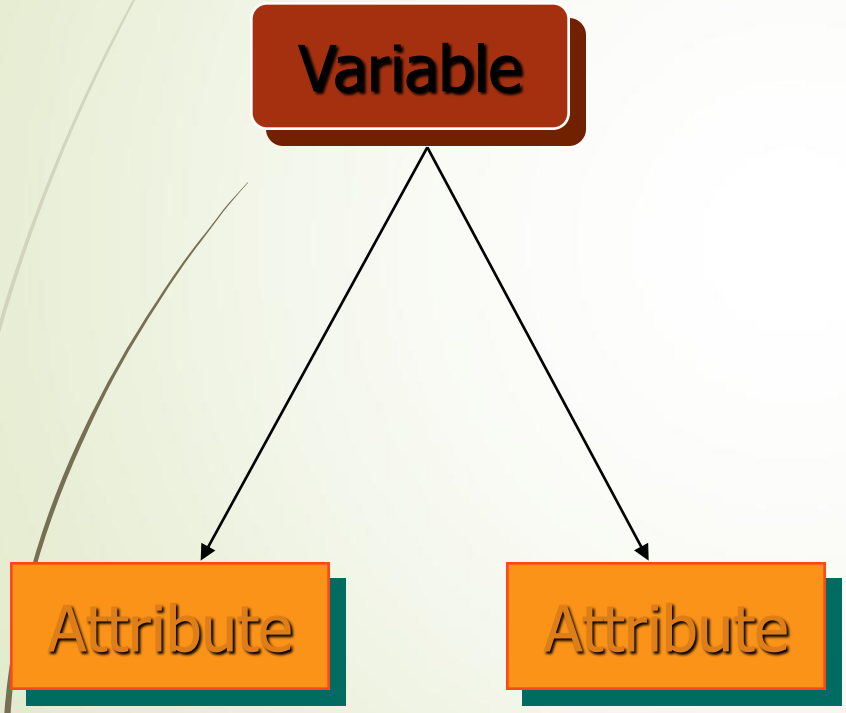
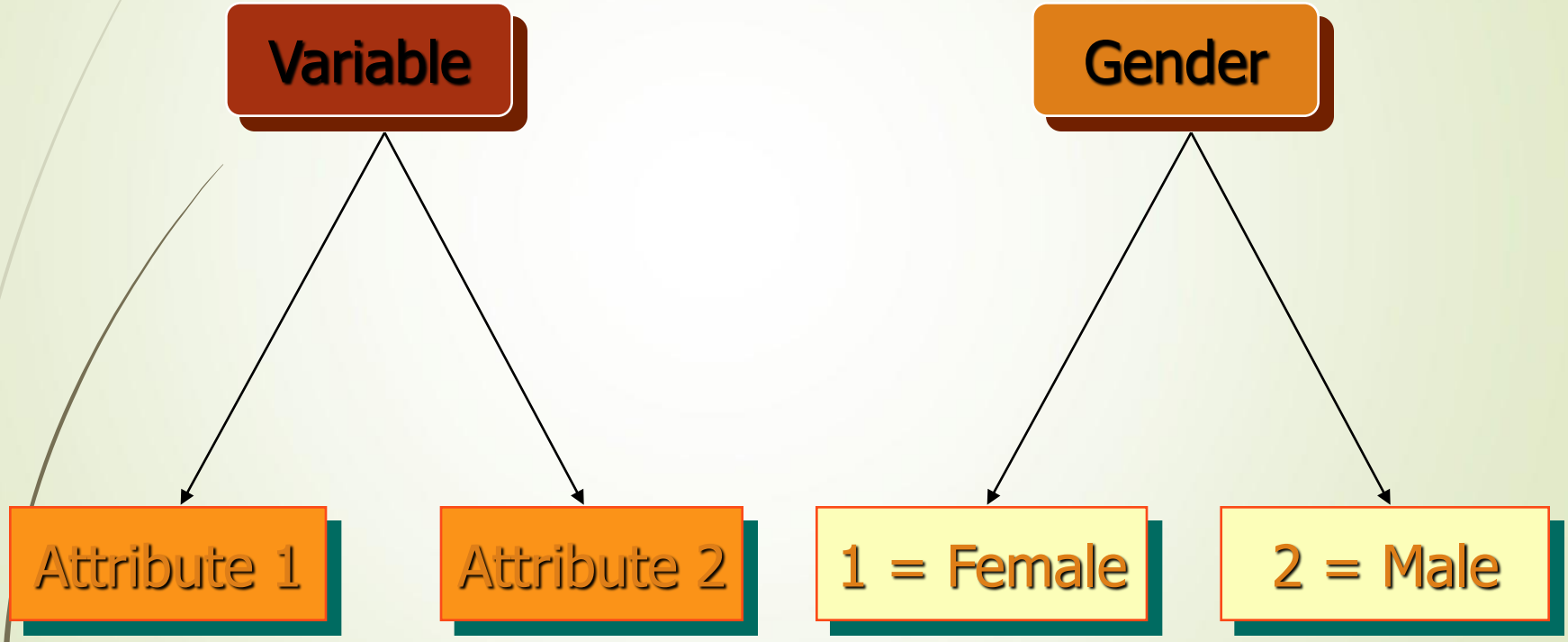
COM 631/731

Levels of Measurement

Variable vs. Attribute



Variable vs. Attribute

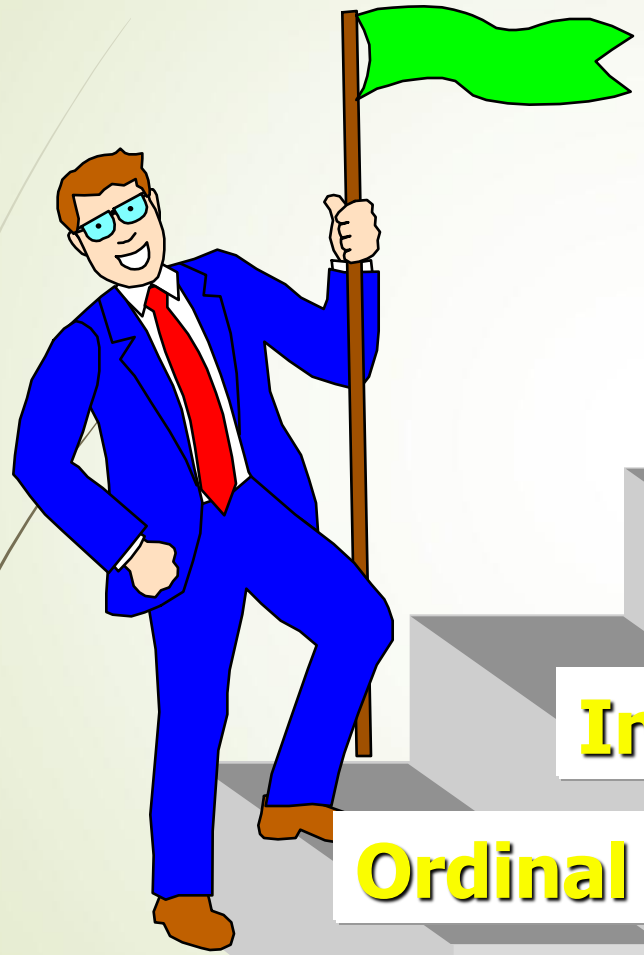


Levels of Measurement

There are two main types of level of measurement:

- The nominal level of measurement, which is qualitative, has no mathematical interpretation. (e.g., “2” does not mean 2 of something)
- The quantitative levels of measurement are progressively more “demanding” mathematically – ordinal, interval, ratio.

The Hierarchy of Levels



Ratio Absolute zero

Interval Distance is meaningful

Ordinal Attributes can be ordered

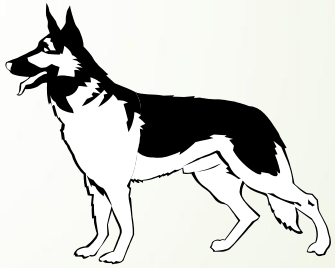
Nominal Attributes are only given labels/numbers

Nominal Measures

The nominal level of measurement labels attributes with no mathematical interpretation; they vary in kind or quality but not in amount.

1 = Terrier

≠



2 = German Shepherd

In terms of the variable "Dog Breed", you can say that the German Shepherd is not equal to (or not the same as) the Terrier, but you cannot say that the "German Shepherd" is greater than ("dog breedier") or less than ("less dog breedy") than the Terrier.

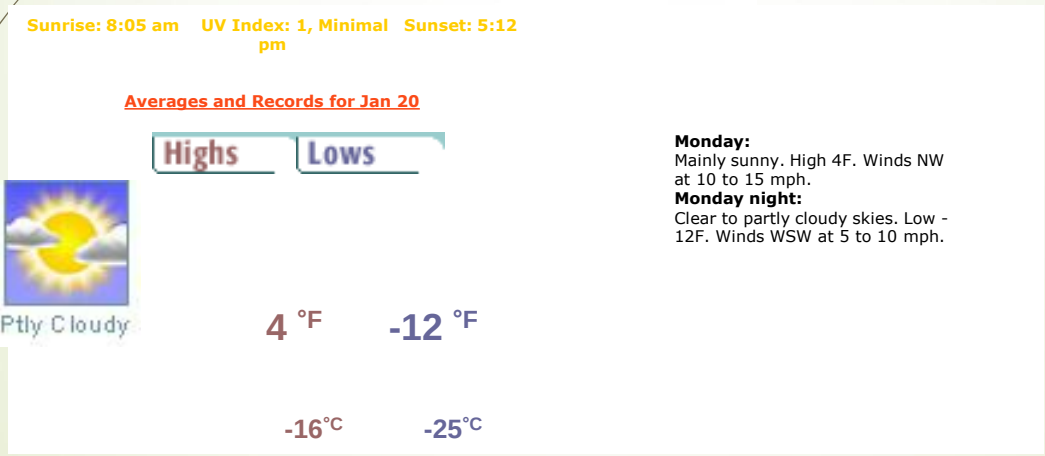
Ordinal Measures

At this level, you specify only the order of the attributes of the variable in "greater than" and "less than" distinctions. At the coffee shop, for example, you might choose between a small, medium, or large cup of decaf—that's ordinal measurement.

You can tell that each cup contains more than the previous cup, but you don't know exactly how much more there is in each larger cup.

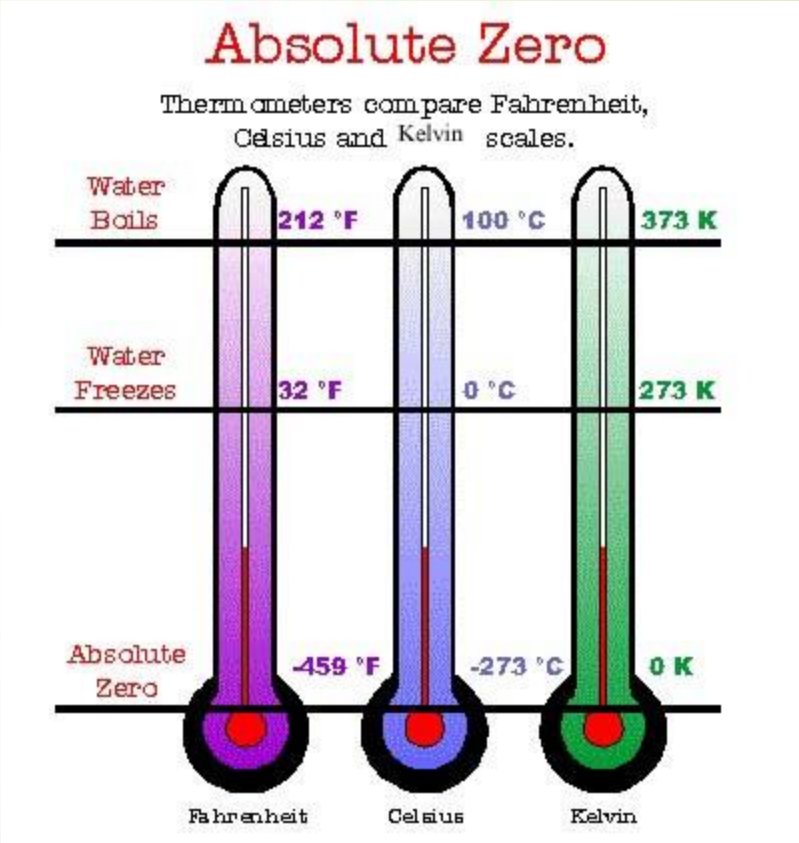
Interval Measures

At the interval level of measurement of attributes of a variable, numbers represent fixed measurement units but have no absolute zero point. There are standard (or known) distances between each point.



For example, the Fahrenheit and Celsius scales have fixed units (degrees), but no absolute zero point. The temperature can definitely go below zero, as indicated in this weather forecast for Fargo, ND.

Here's a comparison between the two interval level temperature scales (Farenheit and Celsius). There's another scale, the Kelvin scale, which is different, in that it DOES have an absolute zero point.



?????The vast majority of social scientific variables that have standard differences between points also have true zero points and are ratio level.

Ratio Measures

A ratio level of measurement represents fixed measurement units with an absolute zero point.

- Zero, in this situation, means absolutely no amount of whatever the variable indicates (e.g., zero heat on the Kelvin scale, zero years of formal education).
- Because the numbers begin at an absolute zero point, they can be multiplied and divided (so ratios can be formed between the numbers).
- On a ratio scale from 0 to 10, 10 is five points higher than 5 and is also two times greater than 5.

Different types of comparisons of units of analysis can be conducted using different levels of measurement

Examples of appropriate comparison statements		Relevant level of measurement			
	math operations	*Nominal*	*Ordinal*	*Interval*	*Ratio*
A is equal to (not equal to) *B*	= (≠)	☻	☻	☻	☻
A is greater than (less than) *B*	> (<)		☻	☻	☻
A is three more than (less than) *B*	+ (–)			☻	☻
A is twice (half) as large as *B*	* (/)				☻

Another way to think the characteristics of measurement

	Characteristics of Variable Categories				
Level of measurement	Mutually Exclusive	Exhaustive	Rank-ordered	Standard Distance	True Zero Point
Nominal	X	X			
Ordinal	X	X	X		
Interval	X	X	X	X	
Ratio	X	X	X	X	X

Mutually exclusive – *variable's categories classify each unit of analysis into one and only one category*
Exhaustive – *variable's categories must permit the classification of every unit of analysis*
Rank-ordered – *variable's categories can be ranked from low to high or vice versa*
Standard distance – *fixed measurement units between variable's categories*
True zero point – *point at which variable has no measurable quantity or magnitude*

Implications of Measurement Levels

- Certain quantitative analysis techniques require measurement at a minimum level.
- Variables measured at a higher level can be transformed to a lower level, but not the reverse.
- The level of measurement you choose will be influenced by your data analysis plans.
- If your data analysis techniques can't be determined in advance, choose the highest possible level of measurement.

Levels of Measurement

Short quiz – Answer is presented on the slide after the question.

What is the level of measurement for the the variable, "Number of Presidential Elections In Which Respondent Voted in Entire Life," measured by the number the respondent reports?

A. Nominal
B. Ordinal
C. Interval
D. Ratio

What is the level of measurement for the the variable, "Number of Presidential Elections In Which Respondent Voted in Entire Life," measured by the number the respondent reports?

A. Nominal
B. Ordinal
C. Interval
* D. Ratio

What is the level of measurement for the variable, “political ideology”, measured as 1 = “Very Conservative,” 2 = “Conservative,” 3 = “Moderate,” 4 = “Liberal,” and 5 = “Very Liberal”?

A. Nominal
B. Ordinal
C. Interval
D. Ratio

What is the level of measurement for the variable, "political ideology", measured as 1 = "Very Conservative," 2 = "Conservative," 3 = "Moderate," 4 = "Liberal," and 5 = "Very Liberal"?

A. Nominal

* B. Ordinal

C. Interval

D. Ratio

What is level of measurement for the variable "political party affiliation," with values 1 = "Democrat," 2 = "Independent," 3 = "Republican," or 4 = "Green"?

A. Nominal
B. Ordinal
C. Interval
D. Ratio

What is level of measurement for the variable "political party affiliation," with values 1 = "Democrat," 2 = "Independent," 3 = "Republican," or 4 = "Green"?

* A. Nominal
  B. Ordinal
  C. Interval
  D. Ratio

What is the level of measurement for the variable "Educational Attainment" measured as 0 = less than H.S.; 1 = some H.S.; 2 = H.S. degree; 3 = some college; 4 = college degree; 5 = post college?

A. Nominal
B. Ordinal
C. Interval
D. Ratio

What is the level of measurement for the variable "Educational Attainment" measured as 0 = less than H.S.; 1 = some H.S.; 2 = H.S. degree; 3 = some college; 4 = college degree; 5 = post college?

A. Nominal

* B. Ordinal

C. Interval

D. Ratio

Indicate how much you agree or disagree with the following:

"I consider myself a citizen of the world."

1 = strongly disagree

2 = disagree

3 = neither agree nor disagree

4 = agree

5 = strongly agree

A. Nominal

B. Ordinal

C. Interval

D. Ratio

Indicate how much you agree or disagree with the following:

"I consider myself a citizen of the world."

1 = strongly disagree

2 = disagree

3 = neither agree nor disagree

4 = agree

5 = strongly agree

A. Nominal

B. Ordinal

* C. Interval

D. Ratio

Indicate how much you agree or disagree with the following:

"I consider myself a citizen of the world."

0 1 2 3 4 5 6 7 8 9 10

completely disagree ... completely agree

A. Nominal
B. Ordinal
C. Interval
D. Ratio

Indicate how much you agree or disagree with the following:

"I consider myself a citizen of the world."

0 1 2 3 4 5 6 7 8 9 10

completely disagree — completely agree

A. Nominal
B. Ordinal
C. Interval
* D. Ratio

What is the level of measurement for the variable "Biological Sex" measured as a dummy variable with 0 = male; 1 = female?

A. Nominal
B. Ordinal
C. Interval
D. Ratio

What is the level of measurement for the variable "Biological Sex" measured as a dummy variable with 0 = male; 1 = female?

A. Nominal
B. Ordinal
C. Interval
* D. Ratio

NOTE: We would want to re-label this variable as something like "Female"

end