

Coping with Poorly Measured Concepts

In a statistical analysis, it is usually not possible to recover from poorly measured concepts or badly collected measurements. Unfortunately, during your lifetime you will be bombarded with statistics derived from poorly measured concepts, confounded measurements, and simply fictitious data. When confronted with statistical evidence of any kind, regardless of whether or not the statistical analysis is done in good faith, it is ultimately up to you to ask reasonable questions about the data and potential confounding variables in the experimental data.

2.2 Exercises

Basic Concepts

1. What is a scale?
2. Where do scales come from? Select a scale and describe its history.
3. How are scales related to measurement?
4. The best measurement scales have what four properties?
5. Describe three scales used in an automobile.
6. What is a level of measurement?
7. What are the four levels of measurement? Give an example of each.
8. What is the fundamental difference between interval and ratio data?
9. What is an arbitrary zero value? Which level of measurement has this property?
10. What is the primary difference between nominal and ordinal data?
11. For which level(s) of measurement is arithmetic appropriate?
12. What are fuzzy concepts? What are the measurement problems associated with fuzzy concepts?
13. Give an example of a tool that has been widely accepted as an instrument used to measure a fuzzy concept.
14. What is a metric?
15. How are sensors related to scale of measurement?
16.
 - a. Name three metrics used in business.
 - b. Name three metrics used in medicine.
 - c. Name three metrics used in sports.

Exercises

17. Determine the level of measurement (ratio, interval, ordinal, or nominal) for each of the following variables.
 - a. The temperature (in degrees Fahrenheit) of patients with pneumonia.
 - b. The age at which a college student graduates.
 - c. Client satisfaction survey responses: Poor, Average, Good, and Excellent.
 - d. The region of the U.S. in which an individual lives: North, South, East, or West.

- e. The number of people with a Type A personality.
- f. A person's blood type.
18. Determine the level of measurement (ratio, interval, ordinal, or nominal) for each of the following variables.
- The time it takes for a student to complete an exam.
 - Majors of randomly selected students at a university.
 - The category which best describes how frequently a person eats chocolate: Frequently, Occasionally, Seldom, or Never.
 - The number of pounds of snack food eaten by an individual in his or her lifetime.
19. Given the table below on browser usage, what is the highest level of measurement that the data could have?⁶⁰ Justify your answer.

Browser Usage Share (%)					
Month	Year	Google Chrome	Mozilla Firefox	Internet Explorer/ Microsoft Edge	Apple Safari
April	2022	64.3	3.4	4.1	19.2
May	2022	65.0	3.3	4.0	19.0
June	2022	65.9	3.3	4.1	18.6
July	2022	65.1	3.3	4.1	18.9
August	2022	65.5	3.2	4.3	18.8
September	2022	65.7	3.2	4.3	18.7
October	2022	65.3	3.1	4.4	19.0
November	2022	65.9	3.0	4.5	18.7
December	2022	64.7	3.0	4.2	18.3
January	2023	65.4	3.0	4.5	18.7
February	2023	65.8	2.9	4.3	18.8
March	2023	64.8	2.9	4.6	19.5

20. A researcher is studying the preferences of college students for different types of food. They survey a sample of 100 students and ask the following two questions:
- Write the number of times in the last month that you ate a lunch or dinner from each of the following types of restaurants (dine in or take out):
 - _____ Asian (Chinese, sushi, pho, Thai, Indian, Korean, etc.)
 - _____ Italian (spaghetti, lasagna, pasta, pizza, calzone, etc.)
 - _____ Mexican (taco, burrito, enchilada, nachos, quesadilla, fajita, etc.)
 - _____ American (hamburger, hot dog, mac-n-cheese, fried chicken, barbecue, etc.)

- Which one of the following is your favorite type of restaurant food?

Mark with an X.

_____ Asian _____ Italian _____ Mexican _____ American

- For the response to the first question about the number of times eating restaurant food, what level of measurement is the variable *the number of times you ate Asian food*?
- For the response to the second question about the favorite type of restaurant food, what level of measurement is the variable *favorite type of restaurant food*?

21. The table displays data from movies released in 2022.

Movies Released in 2022					
Movie title	Rating	Runtime (minutes)	Genre	IMDb rating	Oscar nominations
Black Panther: Wakanda Forever	PG-13	161	Action	6.7	5
Avatar 2	PG-13	192	Fantasy	7.7	4
Lightyear	PG	105	Animation	6.1	0
The Fabelmans	PG-13	151	Drama	7.6	7
Scream	R	114	Horror	6.3	0
Top Gun: Maverick	PG-13	130	Action	8.3	6
Glass Onion	PG-13	139	Comedy	7.1	1

Note

IMDb is the Internet Movie Database.

- What level of measurement is the variable *Rating*?
- What level of measurement is the variable *Run time*?
- What level of measurement is the variable *Genre*?
- What level of measurement is the variable *Oscar nominations*?

22. A hotel manager is interested in getting feedback from guests. Two variables of interest to the manager are cleanliness and aesthetics of the rooms. Discuss what problems you would encounter when measuring those variables.