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Chapter 2 TB

True False

1. True or False: Qualitative data can be in the form of numbers (p3, 4, 5)

   True

2. True or False: Data based on rankings are qualitative (p3, 4, 5)

   True

3. True or False: Nominal scales are qualitative measurements that use ranks to represent categories. (p6)

   False

4. True or false: Nominal scales are inherently quantitative (p4, 5, 6)

   False

5. True or False: Ordinal scales are **not** a type of qualitative data. Rather, they are quantitative data. (p7, 8)

   False

6. True or False: Placement in a race is on an ordinal scale (p7, 8)

   True

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7. True or False: Unlike interval scales, ratio scales have a true and meaningful zero point (p10)

   True

8. True or false: Just because you have numbers in a dataset to calculate a mean or median, it doesn't mean that the result is meaningful. (p8, 9)

   True

9. True or False: A frequency distribution is a table that shows the frequency of possible measurements that could have been observed (p18)

   False

10. True or False: When counting cumulative frequency, the total frequency will only increase as you move up in an ordered dataset. (p21)

    True

11. True or False: In a grouped frequency distribution, the groups are formed based on the total number of observations. (p27)

    False

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12. True or False: Grouped frequency distributions can be presented in different ways, such as to show relative frequencies and cumulative relative frequencies. (p31, 32)

True

13. True or False: When creating a grouped frequency distribution, it is best to start with 2 groups and then work your way up until a desired amount is reached. (E, p29)

False

14. True or False: Relative frequencies are generally displayed as percentages or proportions, instead of actual counts. (p20)

True

15. True or False: Cumulative relative frequencies are also known as percentile rank (p23, 24)

True

16. True or False: If a certain datum or observation is associated with a cumulative relative frequency of 59%, that means that 59% of the observations were ranked below that datum or observation. (p24)

True

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17. True or False: Asking participants of a survey to pick their favorite color would be on an ordinal scale (p6, 7, 8)

    False

18. True or False: Interval scales and ratio scales are not that different. Interval scales contain a true 0 point but ratio scales don't. (p10, 11).

    False

19. True or False: In an ungrouped frequency distribution, you are able to extract the entire dataset precisely to have each observation available. (p17, 18)

    True

20. True or false: Reaction time measured in milliseconds is on an interval scale because there are equal intervals between each millisecond (p10)

    False

Multiple choice

1. Which of the following scenarios is a reason to use grouped frequency distributions over ungrouped frequency distributions? (p27)
    a. small datasets with low variability
    b. datasets on a nominal scale
    c. datasets that contain categorical variables such as gender or color

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d. large datasets with high variability

2. Which of the following accurately describes how 0's are represented in different scales? (p10)
   a. They can be arbitrary for nominal scales, and do not reflect an absence of what is being measured on a ratio scale.
   b. The represent an absence of what is being measured on all measurement scales regardless of what kind of scale the data are on.
   c. The represent the absence of that which is being measured for interval scales only
   d. They represent the absence of that which is being measured for ratio scales only.

3. Which of the following does **not** describe ordinal scale? (p7, 8)
   a. Class rank in school
   b. Letter grades on a test
   c. Percentage of points earned on a test
   d. All of the above are ordinal scales.

4. According to S.S. Stevens, what are the two basic characteristics of an object or event that is measurable? (p3, 4)
   a. Quality and interest
   b. Quality and quantity

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c. Who and how many

d. When and where

Use the following data on the temperature of a recent summer for questions 5 – 8.

Degrees F	*crf*
90-99	100
80-89	89
70-79	81
60-69	40
50-59	21
40-49	7
30-39	3

5. What percentage of days were hotter than 79 degrees Fahrenheit? (p22, 23)

   a. 81%

   b. 89%

   c. 19%

   d. 100%

6. How many days were 59 degrees or less? (p22, 23)

   a. 21

   b. 7

   c. 3

   d. Insufficient information from the data

7. The most common range of temperature for the recorded days in this dataset was which range?

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a. 70 – 79
b. 60 – 69
c. 90 – 99
d. 80 – 89

8. What percentage of days had temperatures between 40 and 69 degrees Fahrenheit? (p22, 23)
   a. 61%
   b. 28%
   c. 37%
   d. Insufficient information from the data

9. What unique feature about interval scales separates it from ordinal scales? (p8, 9)
   a. equal distance between any two adjacent points on the scale
   b. a true 0 that represents absence
   c. rank ordered data
   d. All of the above.

The following data set presents the number of laptops individuals own. Questions 10 through 13 will use the data below:

Number of laptops	***f***
0	7
1	141
2	81
3	5
4	3
5	7

10. How many individuals had either 1 or 3 laptops? (p18, 19)
    a. 146
    b. 141

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c. 227
d. 86

11. In this sample, the fewest people had how many laptops? (p18, 19)
    a. 1
    b. 2
    c. 3
    d. 4

12. This distribution is _____, and is showing the _____. (p18, 19)
    a. grouped; relative frequency
    b. ungrouped; frequency
    c. ungrouped; relatively frequency;
    d. ungrouped; percentile rank.

13. What is the cumulative relative frequency for owning 3 laptops? (p22, 23)
    a. **95.9%**
    b. 2%
    c. 93.9%
    d. insufficient information.

14. Interval and ratio scales are best described as which of the following? (p10)
    a. descriptive
    b. quantitative
    c. qualitative
    d. categorical

15. If your score on a test had a cumulative relative frequency of 55%, what does that mean? (p22, 23)
    a. you are in the 45th percentile
    b. 55% of individuals in the sample scored higher than you
    c. 55% of individuals in the sample scored lower than you
    d. You scored 55% of the total points correct.

16. Qualitative data is generally concerned with _____ whereas quantitative data is concerned with _____. (p3, 4)

    a. frequency; categorization.

    b. categorizing; counting

    c. How and when; who and where

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d. observing; counting

17. Interval scales are inherently... (p5, 6)

a. qualitative.

b. quantitative.

c. categories.

d. None of the above.

18. In a grouped frequency distribution, which one of the following is true? (p27, 28)
a. you no longer know what the exact data points in the dataset were
b. you are only interested in percentile rank and not frequency, because the individual data points are not used
c. it makes small datasets more easily read
d. It is only a good idea when the difference between the largest and smallest observation is greater than 100.

19. As a general rule of thumb, how many groups should you start with when creating a grouped frequency distribution? (p29)
a. 2
b. 5
c. 10
d. The range divided by 5

20. What is the midpoint for each group in a grouped frequency distribution? (p32)
a. |UL – LL|/2 + LL
b. UL – LL/2 + LL
c. |UL – LL|/2 + UL
d. UL – LL/2

21. Which of the following accurately describes interval and ratio scales? (p5, 6, 7, 8)
a. They have all the qualities that ordinal scales have
b. They do not have qualities that ordinal scales have
c. They are the same, except that interval scales have a true 0 point
d. a and c only

22. A researcher is studying the life expectancy of grizzly bears. During her research, she finds that the grizzly bears that inhabit the area primarily find their food from four locations. She reorients her research and begins to

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examine what types of food is available is at each location and how common each food type is. The data is on what kind of scale? (p5, 6, 7)

a. Nominal
b. Ordinal
c. Ratio
d. Interval

23. A student researcher is asking participants to report the number of hours they studied for a recent exam and the letter grade they received. These are variables on a _____ and _____ respectively. (p5, 6, 7, 8, 9)
    a. ratio; ordinal
    b. ratio; interval
    c. interval; nominal
    d. interval; ordinal

24. A dataset that is comprised of the value of homes in a neighborhood is on a _____ scale (p10, 11)
    a. interval
    b. ratio
    c. nominal
    d. ordinal

25. Grouped tables for datasets offer which advantage over an ungrouped frequency table? (p27)
    a. it can be better organize large datasets with lots of variability
    b. It can be used for all measurement scales whereas ungrouped frequency tables cannot
    c. It shows all values of the dataset whereas ungrouped frequency tables do not.
    d. All of the above

Free Response questions

1. There are two types of data: qualitative and quantitative. Explain what they are and give an example of each (p3)

Quantitative data refers to measurements that tell us how much or many of something there are. Quantitative data are generally in the form of numbers. An example of quantitative data is heart rate.

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Qualitative data record what category an event, observation, object, or measurement falls in. Qualitative data can be in both the format of numbers and/or words. An example of qualitative data is political party affiliation.

2. identify the 4 types of measurement scales, and provide an example of each (p5, 6, 7, 8, 9 ,10, 11)

Nominal scale: this is categorical data that can be represented by numbers, but the numbers are generally arbitrary. Nominal data can be shown by frequencies. An example would be species of animals

Ordinal scale: this is also qualitative data, but the numbers can be rank ordered. An example of this would be placement in a race.

Interval scale: this is a form of quantitative data. It is rank ordered, but now adjacent data points now all have exactly the same interval. An example of an interval scale would be temperature in Fahrenheit.

Ratio scale: ratio scale shares qualities of interval scales. The main difference is that ratio scales have a true 0 point that represents an absence of that which is being measured. An example of a ratio scale is number of points scored on a test.

3. Identify and briefly describe the four ways that data can be organized in frequency tables (p18)

1. frequencies: the number of occurences in each category or observation

2. relative frequencies: The proportion of the data that has a certain value or observation in an ordered dataset

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3. cumulative frequencies: the total number of observations that has a certain observation or smaller

4. cumulative relative frequencies: the proportion of observations that has a certain data value and below in an ordered dataset

4. Below are data from an eating contest. Contestants tried to eat as many hot dogs as they can. Use the data to answer the following questions.

Hotdogs	*f*
12	1
11	3
10	6
9	12
8	33
7	29

i. The winner of the contest ate how many hot dogs? (p17)

12

ii. Create a new column of the table and calculate the cumulative frequencies (p21, 22)

Hotdogs	*f*	cf
12	1	84
11	3	83
10	6	80
9	12	74
8	33	62
7	29	29

iii. What kind of measurement scale is this data on? (p10, 11)

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Ratio

5. Weddings are becoming increasingly expensive for couples. Below are data showing how much newly weds spent on their weddings. Use it to answer the following questions.

Cost	f
50,000	2
48,000	1
30,000	4
25,000	9
22,000	22
19,000	37
14,000	21
12,000	14
11,000	21
9,000	35
8,000	48
5,000	17

i. The most frequently observed cost in this dataset is how much for a wedding? (p17)

8,000

ii. Create a new column of data and calculate the relative frequency (20, 21)

Cost	f	rf
50,000	2	0.87%
48,000	1	0.43%
30,000	4	1.73%
25,000	9	3.90%
22,000	22	9.52%
19,000	37	16.02%
14,000	21	9.09%
12,000	14	6.06%
11,000	21	9.09%
9,000	35	15.15%

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8,000	48	20.78%
5,000	17	7.36%

Chapter 2: Types of Data

Outline

I. Data, Data, Everywhere
- A. Relationship between data type and measurement
- B. Statistics in history
  1. S.S. Stevens
  2. Scales of measurement
     a. Nominal
     b. Ordinal
     c. Interval
     d. Ratio
- C. Measures of quality (nominal and ordinal scales)
  1. Measure of category membership rather than amount or count
  2. Nominal level measurement
     a. Numbers vs. numerals
     b. Categorical measurement
  3. Ordinal level measurement
     a. Categorical data
     b. Categories put in order
  4. Application on mathematical operations of qualitative data
- D. Measures of quantity (interval and ratio scales)
  1. Interval level measurement
     a. Categorical data
     b. Categories put in order
     c. Interval between adjacent measures is constant
     d. No true zero point
  2. Ratio level measurement
     a. Categorical data
     b. Categories put in order
     c. Interval between adjacent measures is constant
     d. True zero point

II. Frequency Distributions (Organizing Data)
- A. Ungrouped frequency distributions
  1. Simple
  2.Cumulative
  3. Relative (percentage)
  4. Cumulative relative (percentile rank)
- B. Grouped frequency distributions
  1. Construction of intervals
  2. Simple
  3. Cumulative
  4. Relative (percentage)
  5. Cumulative relative (percentile rank)

III. Statistics in Context
- A. The “Qualitative vs. Quantitative Debate” and scales of measurement

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B. Frequency distributions in scientific writing
IV. Summary
V. References
VI. Writing Project #2: Writing with Frequency Distributions
VII. Glossary of Equations
VIII. Terms You Should Know
IX. Practice Problems

Summary

S.S. Stevens proposed four scales of measurement: nominal, ordinal, interval, and ratio. Nominal and ordinal scales measure quality by putting observations into categories (nominal) and by putting those categories into some kind of logical order (ordinal). Stevens also proposed that interval and ratio scales were appropriate to measurement of quantity—amount or count. Interval scales began at an arbitrarily determined zero point while ratio scales began at a true or real zero.

Frequency distributions or tables listing unique observations and the frequency of each observation are discussed. The tables can list the observations individually or in intervals or groups. Frequency can be displayed as the frequency of each individual observation or group (simple frequency), as a percentage (relative frequency), as frequency at or below a given observation (cumulative frequency), or as the percentage of observations at or below a given observation (cumulative relative frequency or percentile rank). General rules for constructing both ungrouped and grouped frequency distributions are discussed.

Activity for Chapter 2

Answers to the questions posed in the class activity are in italics.

1) Class questionnaire revisited—scales of measurement

Equipment needed for this activity:

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- Results of the in-class survey

The purpose of this activity is to provide students with practice in identifying the various types of measurement scales used in social science research. By now, students have already completed a short survey and have access to a small data set (*n* is obviously determined by the size of the current class, or by the number of previous semesters of survey data that has already been collected by the instructor) that can be used to explore creating frequency distributions. This relatively small data set is also useful in introducing students to whatever statistical analysis software they have available to them.

Ask students to create a data file for the responses to the questions on the in-class survey. They should then identify the type of measurement used in each question (nominal, ordinal, interval, ratio).

1. What is your height (to the nearest ¼ inch)? *Ratio* .
2. What is your pulse rate in beats per minute? *Ratio* .
3. What is the circumference of your head (to nearest ¼ inch)? *Ratio* .
4. How much did you spend on your last haircut (including any tip)? *Ratio* .
5. How much did you spend on your last restaurant meal (including any tip)? *Ratio* .
6. Do you have a job in which you work at least 10 hours per week (yes or no)? *Nominal* .
7. Do you smoke (yes or no)? *Nominal* .
8. What time did you go to bed last night (in military time)? *Ratio* .
9. How long do you think it took you to fall asleep last night (in minutes)? *Ratio* .
10. What time did you wake up (note: not when you *got* up, just when you *woke* up) this morning (in military time)? *Ratio* .
11. What is the capital of Belarus? *Nominal* .
12. Estimate the percentage of students who know the capital of Belarus. *Ratio* .
13. Do you have any siblings (yes or no)? *Nominal* .
14. If you answered yes to question 13, what is your birth order (first-born, second, third, etc.)? *Ordinal* .

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15. Have you ever taken the Stanford–Binet Intelligence Test, (yes or no)? *Nominal .*
16. If you answered yes to question 15, what IQ score did you receive on your most recent attempt on the Stanford–Binet test ? *Ordinal .*
17. What is your current overall GPA? *Ratio .*
18. What social class do you think your family belongs to (upper, middle, or working)? *Ordinal .*

2) Seasickness and You

The purpose of this activity is to provide students with the opportunity to practice creating frequency distributions. Using the data from a small data set such as the one shown in Table 2.1 ask the students to create frequency distributions (ungrouped simple, relative, cumulative, and cumulative relative). The data in Table 2.1 comes from Hand, Daly, Lunn, McConway, and Ostrowski (1994.). The original study was conducted by Burns (1984). Burns was examining the causes of motion sickness at sea. Volunteers were placed in a cubical cabin mounted on hydraulic pistons and subjected to wavelike motion for two hours. The time that elapsed until the first subject vomited was recorded (called "survival time"). In experiment 1, participants experienced motion at a frequency of 0.167 Hz and 0.111g acceleration (a slow roll or swell). In experiment 2, participants moved at a frequency of 0.333 Hz and an acceleration of 0.222g (a choppier sea).

1) Create simple, relative, cumulative and cumulative relative frequency distributions for the results from the two experiments.

2) Does the frequency/acceleration of the up and down motion matter? Describe any important differences you see in the data from the two experiments.

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Yes, there is evidence that frequency and acceleration matter. Most of the participants in experiment 1 (66.67%) were able to withstand the full two hours of the slow swell motion. In experiment 2, slightly fewer than half of the participants lasted the full two hours (46.43%). Roughly a quarter of the participants in each study withstood the motion for half of the total allotted time (roughly 23% in experiment 1 and 25% in experiment 2 lasted 60 minutes), but many more participants who experienced the "choppy seas" (roughly 20%) lasted less than 30 minutes, while only one participant in experiment 1 (slow swells) dropped out after 30 minutes.

Answer Sheet: All four frequency distributions

Experiment 1					Experiment 2				
X	***f***	***%***	***CF***	***CRF***	***x***	***F***	***%***	***CF***	***CRF***
30	1	4.76	1	4.76	5	1	3.57	1	3.57
50	2	9.52	3	14.29	6	1	3.57	2	7.14
51	1	4.76	4	19.05	11	2	7.14	4	14.29
66	1	4.76	5	23.81	13	1	3.57	5	17.86
82	1	4.76	6	28.57	24	1	3.57	6	21.43
92	1	4.76	7	33.33	63	1	3.57	7	25.00
120	14	66.67	21	100.00	65	1	3.57	8	28.57
					69	2	7.14	10	35.71
					79	1	3.57	11	39.28
					82	2	7.14	13	46.43
					102	1	3.57	14	50.00
					115	1	3.57	15	53.57
					120	13	46.43	28	100.00

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Additional Topics for Classroom Discussion

1) Measurement of psychological characteristics: quantitative or qualitative?

Question 16 of the classroom activity offers an opportunity for class discussion of Stevens' scales of measurement. The question of how to define the various scales of measurement is the subject of the "Statistics in Context" section for Chapter 2 in the textbook. Stevens himself thought that measures of psychological characteristics were usually ordinal. Researchers continue to debate whether tests like the IQ test produce quantitative (interval or ratio measurements) or qualitative (ordinal measurements) data. Those that support the qualitative side of the argument about IQ scores suggest that these measurements are only meaningful in comparison with one another rather than "units of intelligence." There are some useful resources for this discussion listed at the end of this chapter as well as at the end of Chapter 2 in the textbook. I've included Lord's somewhat "tongue-in-cheek" article in the appendix of this manual. It's very short (only two pages) and often serves as a good conversation starter in a discussion of what Stevens meant, or thought he meant, when he developed his theory of the scales of measurement.

2) Joint frequency distributions

There are occasions when you have frequency counts for a set of subjects or participants on more than one variable—a "multivariate" situation. For example, suppose we wanted to examine handedness as a function of gender. One of the theories of handedness has suggested a complex genetic explanation. For example, Annett (2009) proposed the "Right Shift Theory" of handedness. This theory suggests that a "Right Shift" (or RS) gene is responsible for left hemisphere dominance and right handedness. In the absence of this gene, hemispheric

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dominance would be established at random. Suppose we thought that one of the factors that might push the brain toward right hemisphere dominance was gender.

As a first step in finding out we gather a sample of males and females and determine whether they are right or left handed. If gender is a factor in determining handedness, we ought to see that the frequency of left-handedness is higher for one gender than it is for the other. We have two categorical variables here: gender (female or male) and handedness (left or right). We'll construct a joint frequency distribution to examine the data. Table 2.2 shows the data (note: this data is fictional and was created using a random number generator). The students should create a joint frequency distribution of the data and discuss the results.

Ask students to: (*Answers to the questions are in italics)*

- Create Joint Frequency Distribution.
- Answer the following questions about the data:
    - How many males were in the sample? *(13)*
    - How many females were in the sample? *(12)*
    - How many left-handers were in the sample? *(11)*
    - How many right-handers were in the sample? *(14)*
    - In your opinion, is there any evidence that handedness is linked to gender? Explain your answer.

Creating Joint Frequency Distributions: *To create a joint frequency distribution or a contingency table, determine the frequency of each level of each variable. In this example, we have two variables, each with two levels. Variable 1 is gender and variable 2 is handedness. The frequencies for each of these variables should be written in the table as shown below:*

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	Right-Handed	Left-Handed	Row Totals
Females	5	7	
Males	9	4	
Column Totals			$n = 25$

The "marginal frequencies" (the row and column totals) are then entered into the chart (see below).

	Right-Handed	Left-Handed	Row Totals
Females	5	7	12
Males	9	4	13
Column Totals	14	11	$n = 25$

Notice that both the row totals and the column totals must each sum to the overall total (n = 25).

Discussion questions:

- There are more right-handed males than there are right-handed females. Ask students to determine the relative frequency of being male and right-handed, and then being female and right-handed. As the students are doing this, discuss which total (the overall total of 25 or the total number of right-handed participants (14) should be used and why. Discuss the relative difference in right-handedness.
- There are also more left-handed females than there are left-handed males. Ask the students to determine the relative frequency of being left-handed for the two genders.

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- In this example, we have two bivariate variables (both variables have two levels). Discuss the possibility of creating a joint frequency distribution for two variables that each have more than two levels. Some examples of this situation are listed below. Ask the students to consider how many levels each of the variables would have. If you have time you could also discuss what the expected outcome of each comparison might be.
    - Income (measured as poor, middle class, and upper class) and IQ (measured as shown below)

- 140 and higher ….. Genius
- 120–140 ….. Very superior intelligence
- 110–120 ….. Superior intelligence
- 90-110 ….. Normal or average intelligence
- 80–90 ….. Dull
- 70–80 ….. Borderline deficiency
- Below 70 ….. Feeble-minded.

    - Age (measured in decades beginning at 20 and ending at 100) and body weight (ask students how they might measure body weight using a categorical [nominal or ordinal] scale).
    - Body weight (measured as underweight, average weight, obese, and morbidly obese) and gender.

References and Resources

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Burns, K.C. (1984). Motion sickness incidence: distribution of time to first emesis and comparison of some complex motion conditions. *Aviation Space and Environmental Medicine, 56*, 521–527.

Hand, D.J., Daly, F., Lunn, A.D., McConway, K.J., and Ostrowski, E. (Eds.). *A Handbook of Small Data Sets*. Chapman & Hall, London, 1994.

Terms You Should Know

cumulative frequency

cumulative relative frequency

frequency distribution

grouped frequency distribution

interval scale

nominal scale

number

numeral

ordinal scale

percentile rank

qualitative data

quantitative data

ratio scale

relative frequency

ungrouped frequency distribution

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Table 2.1: Survival time in motion sickness

Experiment # 1		Experiment # 2	
Subject Number	Survival Time (in min.)	Subject Number	Survival Time (in min.)
1	120	1	11
2	30	2	6
3	51	3	69
4	120	4	69
5	120	5	102
6	50	6	82
7	120	7	115
8	50	8	11
9	120	9	120
10	120	10	120
11	120	11	79
12	120	12	5
13	92	13	120
14	120	14	63
15	120	15	65
16	120	16	120
17	66	17	120
18	82	18	120
19	120	19	120
20	120	20	120
21	120	21	120
		22	13
		23	120
		24	120
		25	82
		26	120
		27	120
		28	24

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Table 2.2: Handedness and Gender for 25 participants.

Gender	Handedness
F	L
M	L
F	L
F	R
M	R
M	R
F	R
M	L
M	R
F	L
F	L
F	R
F	L
F	L
M	R
F	R
M	R
F	R
F	L
M	R
M	L
M	R
M	L
M	R
M	R

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Quiz Questions

Multiple Choice:

Use the following mini-data set to answer the next three questions.

7, 17, 20, 25, 25, 14, 9, 10, 11, 12, 11, 5, 6, 5, 8, 10, 25, 25, 21, 20

1) The frequency of the observation 25 is
   a. 4 (four)
   b. 3 (three)
   c. 2 (two)
   d. Unable to determine from the information provided

2) The relative frequency of the observation 20 is
   a. 20/20 or 100%
   b. 2/20 or 10%
   c. 1/20 or 5%
   d. 2/20 or 20%

3) If you decided to create 5 groups in a grouped frequency distribution for this data, the width of each group would be ____
   a. Five
   b. Ten
   c. Four
   d. Unable to determine from the information provided

4) What, if anything, is wrong with the frequency distribution shown below?

Intervals	Frequency
118-125	4
126-135	6
134-141	3
142-149	2
150-157	2

   a. Unequal intervals
   b. Overlapping intervals
   c. Insufficient intervals
   d. Both a and b

5) When an observation is measured by categorizing it, and those categories are in logical order, a ____ scale has been used
   a. Nominal
   b. Ordinal

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c. Interval
d. Ratio

6) The frequency of an event at or below a specified value is called the
   a. Cumulative Relative Frequency or CRF
   b. Relative Frequency
   c. Summed Frequency
   d. Cumulative Frequency

7) Measuring smoking behavior by asking students how many cigarettes they smoked per day uses a(n) ____ scale
   a. Nominal
   b. Ordinal
   c. Interval
   d. Ratio

8) Measuring smoking behavior by asking students if they smoked 0, fewer than 10, or more than 10 cigarettes per day uses a(n) _____ scale
   a. Nominal
   b. Ordinal
   c. Interval
   d. Ratio

9) Susan's SAT test scores came back saying that she'd scored in the 90th percentile on the math section of the test. Susan can now tell the admissions office of her first-choice college that
   a. She'd gotten 90% of the math questions on the exam correct
   b. She'd scored at least as high as the very best students who were applying for admission
   c. She'd scored as higher or higher than 90% of the students who had taken the SAT when she took it
   d. She would be happy to take the test again given the poor grade she'd gotten on the math section of the SAT

10) Generally speaking, you should use a grouped frequency distribution if you have
   a. Data with a range greater than 20
   b. Data with a range greater than 50
   c. More than 15 participants in your sample
   d. At least 100 participants in your sample

True/False:

1) _____ Grouped frequency distributions are always preferred over ungrouped.
2) _____ Grouped frequency distributions should ALWAYS start at zero, regardless of the value of the lowest score in the set.
3) _____ Cumulative Relative Frequency is the same as Relative Frequency.

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4) _____ Another name for Percentile Rank is Cumulative Relative Frequency.
5) _____ Percentages show the "part" out of a "whole" of one.
6) _____ Proportions and percentages are always the same value.
7) _____ The property of *Magnitude* in a measurement scale means that each value on the scale has a unique meaning.
8) _____ Ratio scales have an arbitrary zero point.
9) _____ You can add, subtract, multiply and divide ordinal data because it has the property of being ordered.
10) _____ S.S. Stevens conducted research on learning and memory.

Short Answer:

Moira Teed, et al. (2011), were interested in assessing effect of belief in the law of contagion on gambling behavior. The law of contagion says that the essence of an object might be transferred to you by contact with that object. For example, if you play golf with the actual ball that Tiger Woods used to win his first U.S. Open tournament, then your golf game will improve. One hundred and eighteen undergraduate students were asked to play a slot machine game after viewing a prior player (a confederate with a script "acting" as though they were winning [the "lucky" condition] or losing [the "unlucky" condition]). To maintain the cover story about the purpose of the experiment (participants were told that the study was about arousal and risky behavior like gambling), the students were first asked to provide measures of their arousal on a ten-point scale before viewing the confederate. Then, after viewing the confederate play, each participant had the opportunity to use the coin holder that had been used by the prior player (marked with a black stripe), or a brand-new coin holder that had not been used and that was marked with a white stripe. Participants were then allowed to play the slot machine themselves for five minutes. Participants in the "lucky" condition were much more likely to choose the previously used coin holder than were participants in the "unlucky" condition.

Answer the following questions about this study.

1) What were the independent and dependent variables in this study?
2) How many levels were there in this study?
3) State the hypothesis for this study.
4) What kind of measurement scale was used to assess belief in the law of contagion? Does it make sense to calculate a mean for the dependent variable here?
5) Name one possible confounding variable that these researchers controlled in their study.

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Answers to Quiz Questions

Multiple Choice	True/False
1) A	1) F
2) B	2) F
3) C	3) F
4) D	4) T
5) B	5) F
6) D	6) F
7) D	7) F
8) B	8) F
9) C	9) F
10) A	10) F

Short Answer

1) The independent variable was the condition (lucky vs. unlucky). The dependent variable was the number of times the previously viewed coin holder was chosen.
2) There were two levels to the independent variable.
3) The hypothesis was that participants in the lucky condition would show susceptibility to the law of contagion by choosing the previously used "lucky" coin holder. Participants in the unlucky condition would avoid the previously used coin holder.
4) Belief in the law of contagion was measured using a ratio scale—the number of times a specific coin holder was selected. Calculating a mean for the dependent variable does make sense.
5) Participants were deliberately misled so that they would not assume that their own gambling behavior was being assessed.

Reference:

Teed, M., Finley, K.A., Marmurek, H.H.C., Colwell, S.R., and Newby-Clark, I.R. (2012). Sympathetic magic and gambling: Adherence to the law of contagion varies with gambling severity. *Journal of Gambling Studies, 28*, 691–701.

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