Applied Statistics in Business and Economics 7th edition Doane Solutions Manual

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Chapter 2

Data Collection

2.1 a. Categorical
b. Categorical
c. Discrete numerical
Learning Objective: 02-2

2.2 a. Continuous numerical
b. Discrete numerical
c. Categorical
d. Continuous numerical
Learning Objective: 02-2

2.3 a. Continuous numerical
b. Continuous numerical (often reported as an integer)
c. Categorical
d. Categorical
Learning Objective: 02-2

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2.4 Answers will vary.
Learning Objective: 02-2

2.5 a. Cross-sectional
b. Time series
c. Time series
d. Cross-sectional.
Learning Objective: 02-3

2.6 a. Time series
b. Cross-sectional
c. Time series
d. Cross-sectional
Learning Objective: 02-3

2.7 a. Time series
b. Cross-sectional.
c. Time series.
d. Cross-sectional.
Learning Objective: 02-3

2.8 Answers will vary.
Learning Objective: 02-3

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2.9 a. Ratio. The number of hits is an integer with zero a possibility.
b. Ordinal. Ranking but difference in ranks is not meaningful.
c. Nominal. Positions on the field have no ranking implied.
d. Interval. Celsius is an interval measure because the zero is not meaningful.
e. Ratio. Salary has a meaningful zero.
f. Ordinal. Ranking but differences are not meaningful.
Learning Objective: 02-4

2.10 a. Ratio. The number of employees is a count and you can have zero employees.
b. Ratio. The number of returns is a count and you can have zero returns.
c. Interval. The temperature difference from 70 degrees to 80 degrees is the same increase as 80 degrees to 90 degrees. However, zero temperature does not mean no temperature exists, therefore it is interval.
d. Nominal. It is not a number and you could not rank order this cashier with others.
e. Ordinal. Ratings of employees generally fall into categories such as "exceeds standards", etc. Therefore, we know it is either nominal or ordinal and since we can rank order this employee with others given their rankings, we can say it is ordinal.
f. Nominal. There is no meaningful zero and distance between social security numbers has no meaning. We also would not rank order based on social security number so this is nominal even though it is a number.
Learning Objective: 02-4

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2.11 a. Ratio. The number of passengers is a count and the zero point means absence of passengers.
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b. Ratio. The waiting time is a continuous variable and you can have a waiting time equal to zero.
c. Nominal. Brand names are categories with no ranking.
d. Ordinal. Ticket class is a nonnumerical category and there is a ranking implied.
e. Interval. The temperature difference from 70 degrees to 80 degrees is the same increase as 80 degrees to 90 degrees. However, zero temperature does not mean no temperature exists, therefore it is interval.
f. Interval most common answer. Likert scales are typically assumed to be interval. Ordinal is a possible answer if the assumption is that the differences between ratings are not equal.
Learning Objective: 02-4

2.12 a. Ordinal (possibly interval). There is no meaningful zero so we can eliminate ratio. There is a rank order to the "categories" so we can eliminate nominal. With only three responses on the scale most statisticians would call this ordinal meaning the intervals between responses are not equal.
b. Ordinal. There is no meaningful zero so we can eliminate ratio. There is a rank order to the "categories" so we can eliminate nominal. But we cannot assume the difference between Rarely and Often is the same as the difference between Often and Very Often.
c. Nominal. There is no meaningful zero or distance or ranking.
d. Ratio. This is a number not a category and zero has meaning.

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Learning Objective: 02-4
Learning Objective: 02-5

2.13 a. Interval, assuming intervals are equal, otherwise ordinal.
b. Yes (assuming interval data)
c. 10 point scale might give too many points and make it hard for guests to choose between.
Learning Objective: 02-4
Learning Objective: 02-5

2.14 a. Interval because it is a ranking with meaningful intervals between scale points.
b. No, we can only say that the difference between 3 and 4 is the same as the difference between 4 and 5.
c. Yes, a 5 point Likert scale would work just as well. In fact, a 5 point scale might be preferred. It might be difficult for customers to differentiate between a 1 and a 2 on 10 point scale whereas a 5 point scale would make it easier for the customer to answer.
Learning Objective: 02-4
Learning Objective: 02-5

T B E X A M . C O M

2.15 a. Census. You can easily ask each of your friends this question.
b. Census or Sample. If your class is large you might take a sample.
c. Sample. The number of students at a university is too large to take a census.
d. Census. You most likely have fewer than 7 classes so fewer than 7 professors.
Learning Objective: 02-6

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2.16 a. Sample. Over the lifetime of your computer you will recharge your battery a very high number of times. A sample makes sense in this case.
b. Census or sample. If your class is large you might take a sample.
c. Sample. The number of students at a university is too large to take a census.
d. Census. You can easily ask each of your friends this question.
Learning Objective: 02-6

2.17 a. Parameter. The S&P is the population.
b. Parameter. Same as above. The S&P is the population.
c. Statistic. We clearly stated a random *sample*.
d. Statistic. This isn't random but it could be considered a sample.
Learning Objective: 02-6

2.18 Use the formula: $N = 20 \times n$
a. $N = 20 \times 10 = 200$
b. $N = 20 \times 50 = 1000$
c. $N = 20 \times 100 = 2000$
Learning Objective: 02-7

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2.19 a. Convenience.
b. Systematic.
c. Judgment or biased.
Learning Objective: 02-7

2.20 a. Random
b. Convenience
c. Systematic
Learning Objective: 02-7

2.21 Answers will vary.
Learning Objective: 02-7

2.22 a. There were 24 ages under 30. The proportion is 24/48 = 0.50.
b. Answers will vary.
c. Answers will vary.
Learning Objective: 02-7

2.23 Answers will vary.
Learning Objective: 02-7

2.24 a. Response bias. The students might exaggerate the number of dates they've had.
b. Self-selection bias, coverage error. By only asking folks outside of a church you might get a number that is higher than the number from the general public.
c. Coverage error, self-selection bias. Same reasons as in part b.
Learning Objective: 02-9

2.25 a. Telephone or web. A web-based survey might overestimate the numbers who prefer a web-based course.
b. Direct observation of students on campus.
c. Interview, web, or mail. Response rates would most likely differ with the three methods. Mail surveys tend to have lower response rates.
d. Interview or web.
Learning Objective: 02-9

2.26 a. Mail or interview. You would most likely have a list of customer addresses but you could also just ask customers that come in. A mail survey might have a lower response rate.
b. Direct observation, through customer invoices/receipts.
c. If you track zip codes as well as invoices/receipts this could be done via direct observation of your records. However, mail would be another option if that data is unavailable.
d. Interview since you only have to ask seven employees.
Learning Objective: 02-9

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2.27 Version 1: Most would say yes. Version 2: More varied responses.
Learning Objective: 02-9

2.28 Does not include all possible responses or allow for the responder to pick something other than those presented.
Learning Objective: 02-9

2.29 a. Continuous numerical. Age can be measured with fractions.
b. Categorical. Nationality is not a numerical measure.
c. Discrete numerical. We can count the double-faults using integers.
Learning Objective: 02-2

2.30 a. Discrete numerical. We can count the number of spectators using integers.
b. Continuous numerical. The amount of water can be fractions of liters.
c. Categorical. Gender is a category, not a number.
Learning Objective: 02-2

2.31 a. Ordinal. We do have a ranking but the differences between rankings would not be equal.
b. Interval measure if using a noise meter to measures decibels (20dB is not twice as much as 10dB; 0dB does not mean no sound). But if the noise level is based on a word description such as "noisy" or "quiet" then the measurement scale would be ordinal.
c. Ratio because this is a count.
Learning Objective: 02-4

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2.32 a. Ratio because this is a count.
b. Ratio if there were a way to measure the actual amount. Most likely this would be an ordinal measure because one would characterize the consumption as high, medium or low.
c. Categorical. Type of vehicle is not a numerical measure and no ranking is implied.
Learning Objective: 02-4

2.33 Q1 Categorical, nominal. Not numerical and no ranking.
Q2 Continuous, ratio. Can take on decimal values and has a clearly defined zero value.
Q3 Continuous, ratio. Can take on decimal values and has a clearly defined zero value.
Q4 Discrete, ratio. Integer, clearly defined zero.
Q5 Categorical, ordinal or interval. Interval if differences are equal.
Learning Objective: 02-4
Learning Objective: 02-5

2.34 Q1 Categorical, ordinal or interval. Interval if differences are equal.
Q2 Discrete, ratio. Integer, clearly defined zero.
Q3 Continuous, ratio. Can take on decimal values and has a clearly defined zero value.
Q4 Discrete, ratio. Integer, clearly defined zero.
Q5 Categorical, ordinal. Ranking but not numerical so no calculations possible.
Learning Objective: 02-4
Learning Objective: 02-5

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2.35 Q1 Continuous, ratio. Can take on decimal values and has a clearly defined zero value.
Q2 Discrete, ratio. Integer, clearly defined zero.
Q3 Categorical, ordinal or interval. Interval if differences are equal.
Q4 Categorical, nominal. Binary, no ranking.
Q5 Categorical, ordinal or interval. Interval if differences are equal.
Learning Objective: 02-4
Learning Objective: 02-5

2.36 a. Cross-sectional. A single point in time: end of 2017.
b. Time series. Data is collected over an 8 year time period.
c. Time series. Data collected over 52 weeks.
d. Cross-sectional. Single point in time: Christmas Day 2017.
Learning Objective: 02-3

2.37 a. Time series. Data collected over 31 days in January.
b. Cross-sectional. Single point in time: start of a particular semester.
c. Cross-sectional. Single point in time: summary for a particular week.
d. Time series. Data collected for the past 10 years.
Learning Objective: 02-3

2.38 a. Census. It would be easy enough to count all of them.
b. Sample. It would be too costly to track each can.
c. Census. You can count them all quickly and cheaply.
Learning Objective: 02-6

2.39 a. Census. This is assuming the company can easily generate the value from its human resource center.
b. Sample. Impossible to observe prices of all cans in grocery stores.
c. Census. This should be in Campbell Soup's data base.
Learning Objective: 02-6

2.40 a. Statistic. The data collected at your local supermarket would be a sample for the population of all soup sold by the company.
b. Parameter. The population is all soup sold last year.
c. Statistic. The sample consists of 10 students.
Learning Objective: 02-6

2.41 a. Statistic. The week of visits is the sample.
b. Parameter. The population is all books sold to date.
c. Parameter. The population is all books sold.
Learning Objective: 02-6

2.42 No, a census would be too difficult since this is an infinite population (people can continue to send e-mails).
Learning Objective: 02-6

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2.43 a. The patient's complaint.
b. The number of patient visits is discrete numerical. The waiting time is continuous.
Learning Objective: 02-3

2.44 a. Simple Random Sample. It is easy enough to use a computerized random number generator to choose 15 ports of entry.
Learning Objective: 02-7

2.45 No a census could not be used. It would be impossible to ask each taxpayer how much time they spent in preparation. A sample is more appropriate.
Learning Objective: 02-6

2.46 b. Cluster sampling. Easier to define geographic areas within a state where gasoline is sold. Gasoline stations are not everywhere, thus simple random sample or stratified sampling doesn't make sense.
Learning Objective: 02-7

2.47 a. Cluster sampling. It makes sense to take samples from geographic regions.
b. No, population is effectively infinite.
Learning Objective: 02-7

2.48 a. Sample – this information is most likely collected by a survey of a sample of customers.
b. Census – this information can be collected from the point-of-sale system.
c. Sample – this is most likely monitored by sampling coffee served.
d. Census – this can be tracked on the point-of-sale system and will be population data.
Learning Objective: 02-6

2.49 a. Census – this information is collected for all restaurants.
b. Sample – this cannot be tracked for all customers, must be taken from a sample.
c. Sample – this cannot be tracked for all customers, must be taken from a sample.
d. Census – this can be tracked on the point-of-sale system and will be population data.
Learning Objective: 02-6

2.50 Simple random sample or systematic sampling. A simple random sample is always best because it reduces bias. If it is truly random, every major stock fund was equally likely to be chosen. One way to do that is to:

- Create an excel spreadsheet with the funds listed and numbered
- Click on a separate cell and use the excel function =RANDBETWEEN(1,1699).
- This will give you one random number between 1 and 1,699. Whatever that number is can represent the first randomly chosen fund. For example, if the random number is 42, you would select the fund that you had listed under the #42.
- To get the other 20 randomly chosen funds, you would simply drag the bottom right corner of the cell that has the first number, to the next 19 cells below it.

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Another way to get a random sample is to use systematic sampling. For example, I might decide to take every 5th fund until I have 20. Pick a random starting point and then take every 20th fund from the starting point.
Learning Objective: 02-7

2.51 a. Cluster sample. Most likely choose businesses within a geographic region then take a random sample within the region.
b. Cluster sample. Most likely choose practices within a geographic region then take a random sample within the region.
c. Simple Random Sample (SRS), fairly accurate.
d. The statistic is most likely based on sales data reported by cigarette companies. While the data does not come from a random sample, this information is available for almost all companies and therefore fairly accurate.
Learning Objective: 02-7

2.52 a. This is a simple random sample. This population is effectively infinite because $n = 780$ and $780 \times 20 = 15{,}600$. This value is much less than $N = 999{,}645$.
Learning Objective: 02-7

2.53 a. Cluster sampling, neighborhoods are natural clusters.
b. Picking a day near a holiday with light trash.
Learning Objective: 02-7
Learning Objective: 02-9

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2.54 Yes, the population is effectively infinite. The population size, 30000, is at least 20 times greater than the sample size: $20 \times 600 = 12000 < 30000$.
Learning Objective: 02-6

2.55 a. Yes, the population is effectively infinite because $18 \times 20 < 11{,}000$. b. 1/39 is the value from the sample therefore it is the statistic.
Learning Objective: 02-6

2.56 Because $1200 \times 20 = 24{,}000$ and this value is less than the population we can consider the population effectively infinite.
Learning Objective: 02-6

2.57 Education and income could affect who uses the no-call list.
a. They won't reach those who purchase such services. Same response for b and c.
Learning Objective: 02-9

2.58 For each question, the difficulty is deciding what the possible responses should be and giving a realistic range of responses.
Learning Objective: 02-9

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2.59 a. Rate the effectiveness of this professor. 1 – Excellent to 5 – Poor.
b. Rate your satisfaction with the President's economic policy. 1 – Very Satisfied to 5 – Very dissatisfied.
c. How long did you wait to see your doctor? Less than 15 minutes, between 15 and 30 minutes, between 30 minutes and 1 hour, more than 1 hour.
Learning Objective: 02-4
Learning Objective: 02-9

2.60 Ordinal measure. There is no numerical scale and the intervals are not considered equal.
Learning Objective: 02-4
Learning Objective: 02-9

2.61 a. Ordinal.
b. That the intervals are equal.
Learning Objective: 02-4
Learning Objective: 02-9

2.62 a. A binary response scale.
b. A Likert scale would be better.
c. Self-selection bias. People with very bad experiences might respond more often than people with acceptable experiences.
Learning Objective: 02-5
Learning Objective: 02-9

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2.63 Answers will vary.
Learning Objective: 02-2

2.64 Answers will vary.
Learning Objective: 02-3

2.65 Answers will vary.
Learning Objective: 02-7

2.66 Answers will vary.
Learning Objective: 02-7

2.67 Answers vary for a-c; most appropriate method is simple random sampling (or stratified based on department).
Learning Objective: 02-7

2.68 We can use the =RANDBETWEEN(1,52) function in excel to get random numbers which will allow us to choose 5 random cards. A stratified sample would not work since the cards are listed in order and spades and hearts are listed first. Therefore, if I chose every 5th card and stopped after 5 cards, I would not have any clubs or diamonds represented. Stratified sampling doesn't really make sense since there is already an equal number of each suit and the same numbers within each suit. Cluster sampling

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doesn't make sense since we are not concerned with geographic region. Judgment is not necessary when choosing playing cards, and convenience would be possible but not necessary and we want to avoid it if possible.
Learning Objective: 02-7

2.69 Answers will vary.
Learning Objective: 02-7

2.70 Answers will vary.
Learning Objective: 02-7

2.71 Answers will vary.
Learning Objective: 02-7

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