Unit 1 review

**Multiple Choice Questions**

1. A random sample of 25 birthweights (in ounces) is taken yielding the following summary statistics:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | N | Mean | Median | TrMean | StDev | SE Mean |
| Birthwt | 25 | 129.40 | 129.00 | 128.35 | 17.41 | 3.48 |
| Variable | Minimum | Maximum | Q1 | Q3 |  |  |
| Birthwt | 96.00 | 187.00 | 119.50 | 135.50 |  |  |

What can be said about the number of outliers for this data set?

1. 0
2. At least 1
3. No more than 1
4. At least 2
5. No more than 2
6. For a set of values, suppose the mean is 10 and the standard deviation is 2. If each value is multiplied by 9 and added by 10, what will be the mean and standard deviation for this new set of values?
7. mean 10; standard deviation 2
8. mean 10; standard deviation 18
9. mean 100; standard deviation 2
10. mean 100; standard deviation 18
11. mean 100; standard deviation 28
12. In this year’s county mathematics competition, a student scored 40; in last year’s competition, the student scored 35. The average score this year was 38 with a standard deviation of 2. Last year’s average score was 34 with a standard deviation of 1. In which year did the student score better?
13. The student scored better on this year’s exam
14. The student scored better on last year’s exam
15. The student scored equally well on both exams
16. Without knowing the number of test items, it is impossible to determine the better score.
17. Without knowing the number of students taking the exam in the county, it is impossible to determine the better score.
18. The heights of American men aged 18 to 24 are approximately normal with a mean of 68 inches and a standard deviation of 2.5 inches. About 20% of these men are taller than
19. 66 inches
20. 68 inches
21. 70 inches
22. 72 inches
23. 74 inches
24. The lengths (in innings) of 25 randomly selected Little League baseball games were recorded, and a *cumulative* frequency histogram was created from the results. What is the best conclusion that can be made from the graph?

Chart, histogram

Description automatically generated

1. The median game length is 5 innings
2. Fourteen games lasted 5.5 innings
3. A majority of the games lasted 6 or more innings
4. The distribution of game lengths is severely skewed left
5. Games lasting more than 6 innings occurred least frequently
6. Which statement is true about the boxplot below?



1. It is a left skewed distribution which has outliers
2. It is a symmetrical distribution which has outliers
3. The interquartile range is less than 1
4. Approximately 75% of the observations have a GPA less than 3
5. I only
6. II only
7. II and III
8. III and IV only
9. I, III, and IV
10. The scores of a standardized test designed to measure math anxiety are normally distributed with a mean of 100 and a standard deviation of 10 for a population of first year college students. Which of the following observations would you suspect is an outlier?
11. 90
12. 100
13. 150
14. 90, 100, and 150 are all outliers
15. None of 90, 100, and 150 are outliers
16. Which of the following distributions has a mean of 30 and a standard deviation of 7?
17. (B)



1. (D)

 (E)



1. A researcher interested in the age at which women are having their first child surveyed a simple random sample of 250 women having at least one child and found a approximately normal distribution with a mean age of 27.3 and a standard deviation of 5.4. Approximately 95% of the women had their first child between the ages of
2. 11.1 years and 43.5 years
3. 16.5 years and 38.1 years
4. 21.9 years and 32.7 years
5. 21.9 years and 38.1 years
6. 25.0 years and 29.6 years

Use the following for questions 10 and 11.

Chart, histogram

Description automatically generated

1. Which distribution above has the smallest standard deviation?
2. A
3. B
4. C
5. It cannot be determined from the graphs
6. All three distributions have the same standard deviation
7. In which distribution(s) would you be more likely to find the mean and median the same?
8. A only
9. B only
10. C only
11. A and B only
12. A, B, and C
13. A study was done to determine if the method of instruction (either lecture or discussion) depended on the type of class which was being taught. Twenty art classes, seventeen math classes and twenty-five science classes were observed. The method of instruction, discussion or lecture, was recorded. Which of the following best describes the relationship between method of teaching and type of class?

|  |  |  |
| --- | --- | --- |
|  | Discuss | Lecture |
| Arts | 5 | 15 |
| Math | 12 | 5 |
| Science | 15 | 10 |

1. There appears to be no relationship since the number of discussion class and the number of lecture classes was exactly the same
2. No association can be determined since the number of art, math, and science classes were not exactly the same
3. There appears to be an association since the art class was less likely to use discussion than either math or science
4. There appears to be an association since the number of math and science classes is greater than the number of arts classes
5. A measure of association cannot be determined from these data
6. Polly takes three standardized tests. She scores 600 on all three. Using standard scores, or z-scores, rank her performance on the three tests from best to worst if the means and standard deviations for the tests are as follows:

|  |  |  |
| --- | --- | --- |
|  | Mean | Standard Deviation |
| Test I | 500 | 80 |
| Test II | 470 | 120 |
| Test III | 560 | 30 |

1. I, II, and III
2. III, II, and I
3. I, III, and II
4. III, I, and II
5. II, I, and III
6. Which of the following will most likely approximate a uniform distribution?
7. Heights of students at a particular high school
8. Weights of students at a particular high school
9. SAT scores of seniors at a particular high school
10. IQ scores of students at a particular high school
11. Ages of students at a particular high school
12. Which of the following is more likely to be true of this distribution?

Chart, histogram

Description automatically generated

1. Mean = 3 Median = 3 Mode = 3
2. Mean = 3.5 Median = 4 Mode = 3
3. Mean = 4 Median = 3.5 Mode = 3
4. Mean = 3.5 Median = 3.5 Mode = 5
5. Mean = 3 Median = 2 Mode = 5
6. If the standard deviation of a distribution is 4, the variance is:
7. 4
8. 2
9. 8
10. 16
11. 0
12. The distribution of pregnancy length (in days) from conception to birth for humans follows a normal model with a mean of 266 days and a standard deviation of 16 days.
13. Sketch and label the normal model

Shape

Description automatically generated

1. Find the length of the longest 16% of all pregnancies.
2. Find the length of the middle 99.7% of all pregnancies.
3. Find the length of the shortest 2.5% of all pregnancies.
4. What z-score does a pregnancy of 257 days have?
5. What percent of humans have a pregnancy lasting less than 257 days?
6. What percent of humans have a pregnancy lasting longer than 280 days?
7. What percent of humans have a pregnancy lasting between 260 and 270 days?
8. How long would a pregnancy have to last to be in the longest 10% of all pregnancies?
9. How short would a pregnancy be to be in the shortest 25% of all pregnancies?
10. The life expectancy of a particular brand of light bulb is normally distributed with a mean of 1500 hours and a standard deviation of 75 hours.
11. What is the probability that a light bulb will last less than 1350 hours?
12. What is the probability that a light bulb will last more than 1700 hours?
13. What is the probability that a light bulb will last between 1600 and 1780 hours?
14. 22% of the time a light bulb will last more than how many hours?

Unit 2 REVIEW

15. Given the following data about variables x and y calculate by hand (using AP formulas) the LSR line. Show all work! Write the line in the form y = b0 + b1x .

## X Y

**Mean**  45.6 37.2 **r =** 0.765

**St. Dev** 3.2 2.1

16. Below is a Minitab statistical analysis. The data is looking at clothes salespersons and examining the effect that the number of minutes spent with a customer has on the total dollar amount that the customer buys. In other words, if a salesperson spends more time with a customer, does the customer buy more clothing (increasing the commission of the salesperson)?

## Predictor Coeff s.e. T P

Constant -1.731 2.4065 -0.876 0.4561

Minutes 0.5679 0.00456 6.6898 1.2358

S = 1.3425 R-Sq = 0.7896 R-Sq (adj) = 0.7748

(a) What is the equation of the LSR line?

(b) What is the value of the correlation coefficient?

(c) What does the correlation tell you about the relationship of your two variables?

(d) Interpret the slope in the context of the problem

(e) What is the coefficient of determination? Interpret this value in context of the problem.

(f) How much is a customer expected to buy if a salesperson spends 45 minutes with them?

(g) A salesperson spent 35 minutes with a customer and the total sale was $78.50. What is the residual?

17. What does a residual plot tell us? What do we look for in a residual plot?

18. What type of relationship does r measure?

19. For the graph below, what would be the closest approximation to the correlation coefficient?

![Chart, scatter chart, box and whisker chart

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1. 0.2 (b) 0.88 (c) –0.9 (d) –0.2 (e) 0 (f) 0.5

20. What is the difference between outliers, influential points, and high leverage points?

24. Describe the following plots:

1. ![Chart, waterfall chart

   Description automatically generated](data:image/png;base64,iVBORw0KGgoAAAANSUhEUgAAAMAAAACAAQMAAABnSvQoAAAAAXNSR0IArs4c6QAAAAlwSFlzAAAXEgAAFxIBZ5/SUgAAAAZQTFRFAAAA////pdmf3QAAAN5JREFUSMft1FsKAyEMBVAXUHArQhfg1rMAwa0I/gqtDjgvX7nDYGmpvwdujMmMeDWO+MMdECQMFoYYVYnrQDqVuB4EGR4SA1u7cRdk7VV6MGu0TqPgMYj9ORBs47ptkChce8TivkPwMDilQfBPFPAaU1b0XH0M5w7HkKLytIgFaVJ5WoYDMcnpNYoYEFN2+2AY4PR+54gBc34yx9ocOPbHgdTishBU1qjDuhCm7KMJOYoPH/tw7oVtVMSEbVSGCXiNSw2mUREEaR0MBE4pJQiBJcxgEC9MGPzAJn4zvAHhJ4JS3dOyxgAAAABJRU5ErkJggg==) (b) ![Chart

   Description automatically generated](data:image/png;base64,iVBORw0KGgoAAAANSUhEUgAAAMAAAACAAQMAAABnSvQoAAAAAXNSR0IArs4c6QAAAAlwSFlzAAAXEgAAFxIBZ5/SUgAAAAZQTFRFAAAA////pdmf3QAAAJZJREFUSMft1c0JwzAMBWBDB9AwHUCrawCBVgn4GlDSBNKLX/E7FJoiH/2B/kB2S3BawXfAaHAa+Bz/0LmhUBAclQvBaMhVaAga5CxhHg5yEgKFGsIe52xxHgIMEYOwUM9SQcEt4NrheQgayByv6wcHe+onB01BKATZFQwRwqLvP2sanIFVuppREIt6UiA5qPYT1Kr9Emx6KcP++lze+wAAAABJRU5ErkJggg==) (c) ![Chart, waterfall chart

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25. Look at the following residual plot.

![Chart, scatter chart

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generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RD6RXhpZgAATU0AKgAAAAgABAE7AAIAAAAQAAAISodpAAQAAAABAAAIWpydAAEAAAAgAAAQ0uocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAE1DTkVMSVMsIExBVVJFTgAABZADAAIAAAAUAAAQqJAEAAIAAAAUAAAQvJKRAAIAAAADMzcAAJKSAAIAAAADMzcAAOocAAcAAAgMAAAInAAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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* 1. Would you expect the model to overestimate or underestimate for a prediction from an x-value of 13? Explain.
  2. Are there any outliers, high leverage points, or influential points? Identify any, and tell what type of point it is.

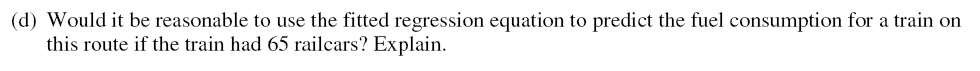
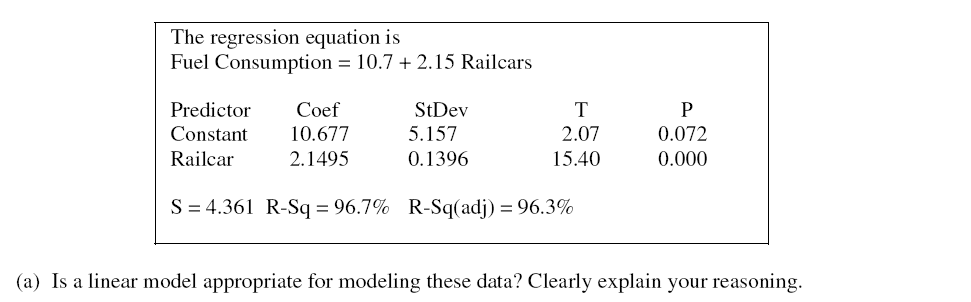
Table

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Description automatically generated



**NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Unit 3 Review**

1. What are the 3 principles of experimental design?
2. What does it mean when two variables are confounded?
3. What is the difference between subjects and individuals (or experimental units)?
4. What is the placebo effect?
5. What is the difference between a placebo and a control?
6. What is a lurking variable?
7. We have 21 people that we need to assign to 3 different treatments (trt1, trt2, trt3). Use the section of the table of random digits below and assign the 21 people to the 3 treatment groups. List the numbers that are selected under each of the 3 headings below. **Clearly explain your procedure!!**

TABLE OF RANDOM DIGITS:

0

1. 11202 34859 09217 18194 45621 05078 66813 65461 50416 99742 08657
2. We want to test the effectiveness of a new cream designed to help healing of cuts and scrapes, against the current cream on the market (Neosporin). We do not feel the need for a placebo cream. We also want to test a new pill that is on the market that claims to speed in healing. There are 80 patients available for the experiment, of which 35 have cuts, and 45 have scrapes/abrasions.
   1. What is are the factors? What are the levels of the factors?
   2. What are the treatments?
   3. What is the response variable?
   4. What are the individuals/subjects?
   5. Design a completely randomized experiment, with blocking included.
3. A researcher wants to see if more expensive mattresses really give a better night’s sleep than the discount mattress brand. So they recruit 110 adult volunteers to participate in their study. They will have the adults sleep on the mattresses for 10 nights and then rank their overall quality of sleep (due to the mattress only).
   1. What is the explanatory variable?
   2. What are the treatments?
   3. What is the response variable?
   4. What are the individuals/subjects?
   5. Do you think you should use a placebo group? How about a control group?
   6. Design a matched pairs experiment:
4. An investigator wants to study the effects of two different on fertilizers plant growth (call them A and B). There are 20 plots in a field that are available to test the fertilizers on. The investigator will measure the amount of growth by the plants after 3 months.
   1. What is the explanatory variable?
   2. What are the treatments?
   3. What is the response variable?
   4. What are the individuals/subjects?
   5. Do you think you should use a placebo group? How about a control group?
   6. What are some lurking variables when it comes to plant growth?
   7. It is known that the plots get different amounts of sunlight because of where they are located on the field. Some have high sun exposure, others have medium, and some have very low sun exposure. Using this information, design a block design experiment:
5. An investigator wants to study the effectiveness of two surgical procedures to correct nearsightedness. Procedure A uses cuts from a scalpel and procedure B uses a laser. The data to be collected are the degrees of improvement in vision after the procedure is performed. There are 80 nearsighted people available for the experiment.
   1. What is the explanatory variable?
   2. What are the treatments?
   3. What is the response variable?
   4. What are the individuals/subjects?
   5. Do you think you should use a placebo group? How about a control group?
   6. Design a completely randomized experiment:
   7. There are two treatments. Why is it NOT ok to do a matched pairs design for this experiment?
6. A study is being done to see if magnets can help relieve back pain. Participants will sleep on top of a pad that has magnets sewn into it. There are 200 people with chronic back pain that are available for the experiment.
   1. We want to use a placebo in this experiment.
      1. How can we do this? Describe the placebo.
      2. Why is a placebo necessary in this experiment?
   2. What is the factor? What are the levels of the factor?
   3. What are the treatments?
   4. What is the response variable?
   5. What are the individuals/subjects?
   6. Design a completely randomized experiment.
   7. Design a matched pairs experiment instead.
   8. Which design is the better design (CRD or matched pairs)? Justify.
7. It is known that in a specific city the chance that a person has a red hair is only 1 in 7. A researcher wants to conduct a study to see on average how many people in Philadelphia have red hair in a sample of 5 people. Write instructions for a simulation and conduct 10 trials. Clearly label each trial and state your conclusion for the average number of people with red hair in Philadelphia.

58280 17867 07990 85055 55279 83390 37598 93350 05666

|  |  |
| --- | --- |
| # red heads | frequency |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

55402 87042 55080 76185 19947 79551 77594 87381 99430

44251 30896 72183 39850 94385 55160 50680 68443 95437

74302 06204 71004 76768 16066 94109 90685 92058 81744

99133 36354 34292 90092 21703 64616 03431 47610 31968

1. The World Series ends when a team wins 4 games. Suppose the Phillies are in the World Series and that sports analysts consider the Phillies to have a 65% chance of winning any individual game over their opponent. We want to estimate the likelihood of the underdog (not the Phillies) winning the World Series. We also want to see how many games are played on average. Write instructions for a simulation and conduct 10 trials. Clearly label each trial and state your conclusion.

|  |  |  |
| --- | --- | --- |
| # games played | frequency | winner of series |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |

31968 61593 36259 70600 53491 95542 78269

12087 32204 81177 30333 83630 06026 89308

94179 54907 58280 17867 07990 85055 55279

83390 37598 93350 05666 55402 87042 55080

76185 19947 79551 77594 87381 94109 90685 92058 81744 99133 36354

34292 90092 21703 64616 03431 47610 99430 44251 30896 72183 39856

***MULTIPLE CHOICE:***

**The next three questions** concern this situation: *Does using a cell phone while driving make an accident more likely? Researchers compared telephone company and police records to find 699 people who had cell phones and were also involved in an auto accident. Using phone billing records, they compared cell phone use in the period of the accident with cell phone use the same period on a previous day. Result: the risk of an accident was 4 times higher when using a cell phone.*

1. This study is

(a) a randomized comparative experiment. (b) an experiment, but without randomization.

(c) a simple random sample. (d) an observational study, but not a simple random sample.

2. The explanatory variable in this study is

(a) whether or not the subject had an auto accident. (b) whether or not the subject was using a cell phone.

(c) the risk of an accident. (d) whether or not the subject owned a cell phone.

3. An example of a lurking variable that might affect the results of this study is:

(a) whether or not the subject had an auto accident. (b) whether or not the subject was using a cell phone.

(c) whether or not the subject was talking to a passenger in the car. (d) whether or not the subject owned a cell phone.

11. Confounding often defeats attempts to show that one variable causes changes in another variable. Confounding means that

(a) this was an observational study, so cause and effect conclusions are not possible

(b) the effects of several variables are mixed up, so we cannot say which is causing the response

(c) we don't know which is the response variable and which is the explanatory variable

(d) we would get widely varied results if we repeated the study many times

24. The drug manufacturer Merck recently stopped testing a promising new drug to treat depression. It turned out that in a randomized, double-blind trial a dummy pill did almost as well as the new drug. The fact that many people respond to a dummy treatment is called

(a) confounding (b) nonresponse (c) comparison (d) the placebo effect

**The next six questions** concern this situation: *Want to stop smoking? Nicotine patches may help, and so may taking a drug that fights depression. A report in a recent issue of the New England Journal of Medicine describes a study of what works best. Here is part of the summary: Use of nicotine replacement therapies and the antidepressant bupropion helps people stop smoking. We conducted a double-blind, placebo-controlled comparison of sustained-release bupropion (244 subjects), a nicotine patch (244 subjects), bupropion and a nicotine patch (245 subjects), and placebo (160 subjects) for smoking cessation.*

***Results****. The abstinence rates at 12 months were 15.6 percent in the placebo group, as compared with 16.4 percent in the nicotine patch group, 30.3 percent in the bupropion group, and 35.5 percent in the group given bupropion and the nicotine patch*.

17. How many treatments did this experiment compare?

(a) two. (b) three. (c) four. (d) can't tell from the information given.

18. The response variable in this experiment is

(a) the combination of drug (bupropion or placebo) and nicotine patch. (b) 893 people who want to quit smoking.

(c) bupropion. (d) whether or not a subject was able to abstain from smoking for a year.

19. One group received a placebo. Why not just give this group no treatment at all?

(a) It is not ethical to give no treatment at all in this setting.

(b) Just thinking you are getting a treatment may have an effect, and we want to see if the real treatments do better than this.

(c) A placebo is the same thing as no treatment at all. (d) Subjects would be disappointed if not given a pill.

20. The experiment was "double-blind." This means that

(a) neither the subjects nor the people who worked with them knew whether they were taking bupropion or placebo.

(b) the subjects did not know that the treatments were intended to reduce their smoking.

(c) the subjects did not know whether they were taking bupropion or placebo.

(d) subjects were not allowed to see cigarette ads.

21. The subjects of the study included both men and women. All of the subjects were randomly assigned among all the treatments with one use of the table of random digits. This design is called

(a) a simple random sample (b) a completely randomized design.

(c) a matched pairs design. (d) a block design.

22. The subjects of the study included both men and women. If the men and women were separately assigned to treatments, using the table of random digits twice, the design would be

(a) a simple random sample (b) a completely randomized design.

(c) a matched pairs design. (d) a block design.

52. You work for an advertising agency that is preparing a new television commercial to appeal to women. You have been asked to design an experiment to compare the effectiveness of three versions of the commercial. Each subject will be shown one of the three versions and then asked her attitude toward the product. You think there may be large differences between women who are employed and those who are not. Because of these differences, you should use

(a) a completely randomized design. (b) a categorical variable.

(c) a block design. (d) a matched pairs design. (e) a multistage sample.

97. The essential difference between an experiment and an observational study is

(a) observational studies may have confounded variables, but experiments never do.

(b) in an experiment, people must give their informed consent before being allowed to participate.

(c) observational studies are always biased. (d) observational studies cannot have response variables.

(e) an experiment imposes treatments on the subjects, but an observational study does not.

The Pennsylvania Department of Education (PDE) wants to survey high school students regarding their opinions on the new Keystone exams. They create a simple survey for students to complete. Below are different sampling methods that they are thinking of using. Identify each sampling method. Assume that PDE has accurate lists of all school districts and all schools in the state of PA.

1. Randomly select one county in Pennsylvania and then survey every high school student in that county.
2. Randomly select two high schools in each county in the state to participate.
3. Take a list of all high schools in the state and select every 3rd high school on the list.
4. Ask each high school if they would like to be a part of the survey.
5. Take a list of all high schools in the state and randomly select 30 of them to participate.
6. Send out surveys to **every** high school in the state and make them have **every** student in their school complete them.
7. Direct all the Harrisburg area high schools to complete the survey. *(PDE is located in Harrisburg, PA)*
8. Identify the following numbers as parameters or statistics:
   1. A scientist is interested in whether a new light bulb lasts longer than the old brand. So he tests 100 old and 100 new bulbs. He finds that the old bulbs last on average **603.24 hours** and the new bulbs last on average **713.76 hours.**
   2. According to Snapple.com, **13%** of adults are left-handed. At a school administrator’s conference, **16%** of those attending were left handed.
   3. In an experiment to test the effectiveness of single-sex classrooms, girls assigned at random to a co-ed chemistry class gained an average of **12.2** points from a pretest to a posttest. Girls assigned randomly to a single-sex chemistry class taught by the same teacher gained **15.1** points.
9. Look at the pictures below and identify for each one whether it has high or low bias, and high or low variability. The arrow represents the true population parameter.

a) b)

c)

1. The two graphs below have different sample sizes. One was made with repeated samples of size 55 and the other was made with repeated samples of size 180. Identify which is which.

a) b)

True parameter

True parameter

A close-up of a document

Description automatically generated with low confidence