PART 1:

CHAPTER 1:

- **1.1: Miles Per Gallon:**
  - **a)** The individuals in this sample are each one of the selected 2004 motor vehicles listed in the data set.
  - **b)** Each individual is listed with its make and model, vehicle type, transmission, type, number of cylinders, city MPG, and highway MPG. Of these variables, number of cylinders, city MPG, and highway MPG are all numerical.
- **1.3: Who Recycles?:**
  - Participation in a neighborhood recycling program could be measured based on the amount of individual items each household placed in their bins, or even how many houses within each neighborhood set out recycling bins.
- **1.9: Spending and Success in Schools:**
  - This study, which compares academic standards met by the school district and how much was spent on each student, is an observational study. If it were a sample study, the data might use schools from Ohio to represent all schools in the United States or only focus on a few schools within Ohio. If this were an experiment, a treatment would have been applied to the sample, such as allowing some schools to spend more per student and other schools to spend very little.
- **1.10 Power Lines and Leukemia:**
  - The study used in Example 3 that looked at power lines and leukemia was not an experiment because the researchers did not modify any variables. Instead, they looked at a sample of children with and without leukemia and the many factors that affected their upbringing over a span of time. Additionally, as the example mentions, it would be unethical and time consuming to expose children to magnetic fields to see if they develop leukemia.
- **1.15: Choose your Study Type:**
  - **a)** An observational study that is not a sample survey would be the best way to measure whether your school's football team called for fewer penalties in home games than away games. You would only need to compare the numbers of penalties called at home and away games to draw your conclusion.
  - **b)** One could perform an experiment on college students to see if playing Mozart in the background of an exam affects their test scores when compared to no music at all. One group could include students who take a

test while Mozart is playing and another group that takes a test in silence, then compare the test scores.

- **c)** A sample survey would be the best method for gathering data on whether or not college students are satisfied with the quality of education they are receiving because it is based on opinion. A sample survey would gather data on college student satisfaction from a sample of college students and then use that to represent the entire population of college students. An experiment would require the surveyor to modify a variable and somehow measure the satisfaction of college students. An observational study observes a quantifiable dataset and draws a conclusion from that.

CHAPTER 2:

- **2.1: Letters to Congress:**
  - I am not convinced that the majority of voters would oppose the legislation that would provide government-sponsored insurance for nursing home care because the results came from voluntary samples. I would explain to the congresswoman that by allowing people to submit letters rather than randomly reaching out to a certain number of people, only individuals with a strong opinion responded. There is also no way to prevent multiple letters from a single source.
- **2.3: Ann Landers Takes a Sample:**
  - The sample taken from Ann Landers's poll of whether or not female readers would be content with affectionate treatment from men with no sex ever is most definitely biased. Similar to question 2.1, this is an example of voluntary sampling, in which only responses from individuals with strong, often negative, feelings or opinions respond. In this survey, the vast majority of female readers responded that they would rather be treated more affectionately without sex. The women that felt the need to write in likely have had negative experiences with men. In reality, the result of 72% of women agreeing with the poll is likely much lower. While many women probably agree with Landers's question, many women who share a different opinion may not have felt strongly enough to reply and were thus not included in the sample.
- **2.5: Design your own Bad Sample:**
  - **a)** You could leave ballots near a building entry or provide a QR code for students to use. Students who feel strongly negative about parking will probably be the majority of responses to the survey.

    - **b)** You could choose students to survey as they walk to their cars in a particular parking lot. Convenience sampling lets you, the surveyor, choose who among the students gets chosen.
- **2.10: Is this an SRS?:**
    - **a)** The sampling method gives each student in the male and female groups an equally likely chance to get chosen. Any 100 of the 1000 male graduate students and 50 of the 150 female graduate students have an equal chance of getting picked
    - **b)** This is not an SRS though because the sampling method does not allow each graduate student an equal chance of being picked. An unbiased opinion would include the graduate student body as a whole and providing an equal opportunity for any student to be chosen, rather than dividing based on gender. The sample of 150 should be taken from a pool of 1500.
- **2.14: You call the Shots:**
    - The *USA Today* poll on handgun control is most definitely biased. It provides two numbers to call, one for yes and one for no, and includes a fifty cent fee for the first minute. Only people with strong enough feelings will be willing to pay fifty cents (or more) to call in and opinions may lean strongly in either direction. Individuals could even call the favorable phone number more than once.

CHAPTER 3:

- **3.4:**
    - In this question, the 18% of all voters in Philadelphia is a parameter. 60% of the 20 radio talk show callers is a statistic.
- **3.7: Canada's National Health Care**
    - **a)** The population in this question is the population of Canadian residents. The sample is the 61,239 individuals in Ontario that were interviewed by the Ontario Health Survey.
    - **b)** Yes, the sample is trustworthy because it was done randomly, which will minimize bias. It was also large, which would lower the variability between samples if further samples were taken.
- **3.8: Bigger Samples, Please:**
    - The advantages of a bigger random sample is that it increases the accuracy and confidence of the survey. Larger numbers paint a more accurate picture of the population by minimizing variation.
- **3.16: Polling Women**

    - **a)** The *New York Times* is 95% confident that the percentage of all adult women who believe that they do not get enough time to themselves is between 0.44 and 0.50.
    - **b)** We cannot say that 47% of all adult women believe that they don't get enough time to themselves because the margin of error must be taken into consideration.
    - c) The result of "47%" is 95% confident but not totally accurate because 5% of the results did not fall within the margin of error.
- **3.20: The Death Penalty:**
    - **a)** The number of people in the sample who said they believed in capital punishment was 685.
    - **b)** If the margin of error is "plus or minus 3 percentage points," that means the proportion of people surveyed who agree with capital punishment would fall between 0.66 and 0.72 if further samples were taken. This is assuming that the Harris Poll utilized 95% confidence.

CHAPTER 4:

- **4.2: What kind of Error?**
    - **a)** A subject lying about past drug use is an example of nonsampling error, specifically response error, because the answer given was not truthful.
    - **b)** A mistake made while recording the data is also an example of a processing error, which is a form of nonresponse error. The individual inputting the data accidentally typed in wrong.
    - **c)** By asking people to visit a website and answer questions online may introduce sampling error because it is based on voluntary response.
- **4.7 Should He Go or Stay?**
    - The first question, which said "What do you think President Clinton Should do: fight the charges in the Senate, or resign from office?" likely garnered more answers in favor of resigning because of the connotation of the word 'fight.' By using the word 'fight,' it elicits a response that would influence responses to be lean favorably in that direction.
- **4.8: Amending the Constitution:**
    - If I were writing an opinion poll question about a proposed amendment to the constitution, I would gain a more favorable response by using the word "change" instead of "add." The word "change" insinuates a faster, more direct action that is appealing.
- **4.10: Wording Survey Questions:**
    - **a)** This question is clear but seems slanted towards response 2, "We have the right to keep and bear arms." Both questions proposed use first person

wording regarding the ownership of guns which makes it feel more personal.
    - **b)** This question, which proposed opening a small amount of Alaskan wilderness for oil exploration, is also slanted. The use of “skyrocketing gasoline prices” and vagueness of the environmental impact will result in strongly skewed answers favoring oil exploration.
    - **c)** Similarly to the other two questions, this question is very clear but will result in slanted responses. By using the word “excessive,” more people will likely choose to agree that the restrictions hampered the U.S. law enforcement agencies.
- **4.14: Closed vs. Open Questions:**
    - The advantages of an open question is that the subject has the freedom to respond exactly as they please. They may also be able to explain themself or provide a new perspective that may not be available in a closed question.
    - A closed question, however, would reduce variability by introducing categories that the subjects can place themselves into.

CHAPTER 5:

- **5.1: Treating Breast Cancer**
    - **a)** The explanatory variable is the method of breast cancer treatment: removing the whole breast or just the tumor and nearby lymph nodes. The response variable is the survival times of the women who received treatment.
    - **b)** This study is not an experiment because the medical team is only exampining records rather than interfering. An experiment would require the team to administer treatment and a placebo to some women, rather than just look over medical records.
    - **c)** Confounding will prevent this study from discovering which treatment is more effective because of many lurking factors that cannot be accounted for due to this being an observation study rather than an experiment. Other factors, such as age, drug use, and cancer severity, could have played a role in survival time as well.
- **5.2: Using Songs to Teach Math:**
    - An educator dividing a class of kindergartners up to test which form of education is more effective in teaching number and counting skills is an experiment because he is modifying a variable and comparing it to a control. The explanatory variable in this case is whether or not the kindergarten students were taught through the standard curriculum or

through song. The response variable is how well the students did on the educators retest at the end of the year.

- **5.13: Sealing Food Packages:**
  - **a)** The individuals studied in this experiment were food packages instead of people.
  - **b)** The explanatory variable in this experiment was the temperature, in Fahrenheit, at which the packages were sealed with heated jaws. The values are 250°F, 275°F, 300°F and 325°F.
  - **c)** The response variable in this experiment is the force needed to open the food
- **5.17: Statistical Significance:**
  - The experiment using the drug Memantine to improve the cognition of patients with Alzheimer's Disease showed positive results. We randomly assigned each subject to a group, which either got Memantine or a placebo. The randomization minimizes or eliminates the impact that lurking factors, such as height, weight, and history could have on the results. This allowed us to be confident that cognitive improvement resulting from continuous treatments of Memantine did not occur by chance.
- **5.22: Exercise and Bone Loss:**
  - Between the two proposed experiments for studying if regular exercise reduces bone loss in postmenopausal women, the second experiment will produce more trustworthy data because it reduces more lurking variables and has a larger sample size. While experiment one does make an effort to match each experimental subject to a placebo subject, this is not always reliable.

CHAPTER 6:

- **6.1: Medical News:**
  - The study from the Multicenter Study of Hydroxyurea in Sickle Cell Anemia (MSH) was a double-blind study, which means that, each subject was assigned to a group: treatment of non-treatment, in which neither the experimenters nor the subjects were aware of the treatment they received. This reduces bias from either party. By utilizing a placebo, the experiment became a "placebo-controlled" study, which compares the effects of hydroxyurea to non-treatment patients.
- **6.3: Treating Acne:**
  - In a split-faced, single-blind study looking at the effectiveness of pulse dye laser therapy on acne, the term "single-blind" refers to

the fact the only the subjects were not made aware of which treatment was being applied. The doctor applying the treatment was made aware. The study was likely not a double-blind study because both treatments occurred on one subject that the doctor was treating. There is no way to divide the subject to instill a double-blind study.

- **6.7: Testing a Natural Remedy:**
  - **a)** We should not simply give all 60 participants Dr. Moore's Old Indiana Extract because we need to make sure that the treatment actually has some kind of effect.
  - **b)** To test the pain-relieving effectiveness of Dr. Moore's Old Indiana Extract, we must compare it to other standards such as Aspirin, a known pain reliever, and a placebo. To start, the 60 participants in the study should be randomly divided into three groups of 20 and asked about the percentage of pain they are experiencing. Group A will receive Dr. Moore's Old Indiana Extract, Group B will receive Aspirin, and group C will get a placebo. After one hour, each patient should be asked about the percentage of pain relief they experienced.
  - **c)** No, the patients should be blind to the treatment they are receiving because they may introduce bias. They may minimize the effect of a placebo or amplify the benefit of the natural remedy subconsciously.
  - **d)** I believe that it would be a good idea to make this a double-blind study in order to minimize any bias in observation from experimenters.
- **6.8: Testing a Natural Remedy:**
  - **a)** In a study looking at the effectiveness of a natural remedy against depression, you could use the Beck Depression Inventory as a response variable to measure a change in the severity of depression.
  - **b)** To start, each subject should be asked how they would rate themselves on the Beck Depression Index. Each subject should be randomly assigned to a group so that each treatment has 110 subjects. A placebo should be given to all subjects for a reasonable time span in order to eliminate non-adherers. After say, one month, treatments should begin with Group A receiving Saint-John's-wort, Group B receiving a placebo, and Group C receiving Zoloft. As the study goes on, each subject should be regularly asked how they rate their depression.

    - **c)** In this trial, experimenters should take into account that there is some debate in the actual effectiveness of antidepressants. Environment. The enthusiasm of the doctor, and many other factors can manipulate the effects these medications might have and how their results can present.
- **6.9: The Placebo Effect:**
    - Medical school researchers that claimed that doctors didn't understand the placebo effect after giving patients a placebo treatment and determining that patients' pain had no physical basis is valid. The placebo effect happens because of the patient's expectation and is always present. That is why studies usually include a placebo control.

CHAPTER 7:

- **7.1: Minimal Risk?:**
    - I believe that example A, drawing blood by pricking a finger in order to measure blood sugar, is the lowest risk to subjects. Many people must prick their fingers multiple times per day so it is not a dangerous, or even painful, procedure.
- **7.5: Is Consent Needed?**
    - A social psychologist attending the public meetings of religious groups in order to study the members' behavior patterns would not require informed consent beforehand because it would alter the behaviors of the subjects. Studying the behavior does hurt the subjects in any way either.
- **7.6: Students as Subjects**
    - Psychology students being required to sign up as experiment subjects is something that I do not fully disagree with. As a psychology student, it may be useful to understand what being a subject is like but it should not be a requirement. All students should be given an alternative option for credit, especially since they may not even be accepted as subjects since they are dependents.
- **7.11: Human Biological Materials**
    - **a)** I believe that it would violate the principle of informed consent if doctors drew my blood for later use and stored it with my name on it without telling me first. Since I am dead, there is no way for them to tell me after the fact either. My anonymity has been removed by including the sample with my name.

    - **b)** If the name is removed, I do believe it is okay to use the blood sample. The researchers using the blood have the information they need about me without my identity. My anonymity is maintained.
- **7.22: Deceiving Subjects:**
    - I believe that this study was ethically OK because the subjects knew they signed up for an unspecified study. No harm was to come to the subjects in this study and if they had known more, their behavior could have been altered. Most importantly, the subjects were made aware of the study's intentions after the robbery took place.

CHAPTER 8:

- **8.3: School Bus Safety:**
    - In order to compare the rates of child safety between private automobiles and school buses, there are many other rates that could prove to be useful, such as the rate of fatalities to the number of students utilizing each method of transportation. A comparison of accidents that each vehicle type gets into and the number of children present in each may also be good information to have when coming up with a measurement of safety, since school buses tend to transport more students at a time than private vehicles.
- **8.4: Rates vs. Counts:**
    - **a)** Even though more coats were returned to Sears than to La Boutique Classique, Sears sold a much higher number of coats.
    - **b)** Sears has a 3% return rate of coats while La Boutique had 17%.
- **8.5: Capital Punishment:**
    - The rate per million of death penalty executions are arranged as follows, from highest to lowest: Oklahoma (0.021), Delaware (0.017), Texas (0.016), Arkansas (0.010), Alabama (0.006), Nevada (0.005), Florida (0.004), Indiana (0.002). As you can see, despite Texas and Florida having the highest number of executions, neither are the highest. Florida is actually second to lowest.
- **8.18: Measuring Crime:**
    - The presence of other people in a room results in a biased measurement of the National Crime Victimization Survey likely because it deals with sensitive topics that the individual may not wish to share, leading to underreporting. Other people may also encourage additional sharing or end up sharing their own account of the same crime, resulting in overreporting.
- **8.20: Tough Course?:**

- The conclusion that my friend drew that the American History professor is a tougher grader than the Russian professor based on student failure may not be completely accurate. The toughness of grading is not a valid way to measure because it is difficult to define what “tough grading” is without introducing personal bias or opinion. It would be helpful to come up with a more reliable way to measure using quantitative information, such as average grades in the class, class size, or test scores and coming up with a rate.

CHAPTER 9:

- **9.4: Deer in the Suburbs:**
  - It is implausible that Westchester county has 800,000 deer as the garden magazine says because the county is too small to support all of those deer. That would be 1,826 deer per square mile.
- **9.6: Trash at Sea:**
  - These numbers are not nearly plausible. This would require each passenger to consume about 32 cups of coffee, 10 cans of soda, about 8 cans and bottles of beer, and about 1.5 bottles of wine per day. Even if the crew is as large as the number of passengers, each person would still need to drink almost 16 cups of coffee per day to equal 222,000 cups.
- **9.14: Rinse your Mouth:**
  - It is impossible that this mouth rinse reduces plaque by 300% because things can be reduced no further than 100%. After 100% reduction, there is no more plaque to remove.
- **9.16: Don’t Dare to Drive?**
  - The chances that someone will die in a motor accident this year is about 0.01%, far from the 1.3% proposed in the “What is the Chance?” column.
- 9.20: Too Good to be True?:
  - Cyril Burt’s data on the IQ of twins being reared apart is suspicious because the correlation of data between the two listed publication dates, 1955 and 1966, are exactly the same, 0.771 in twins reared apart and 0.944 in twins reared together.

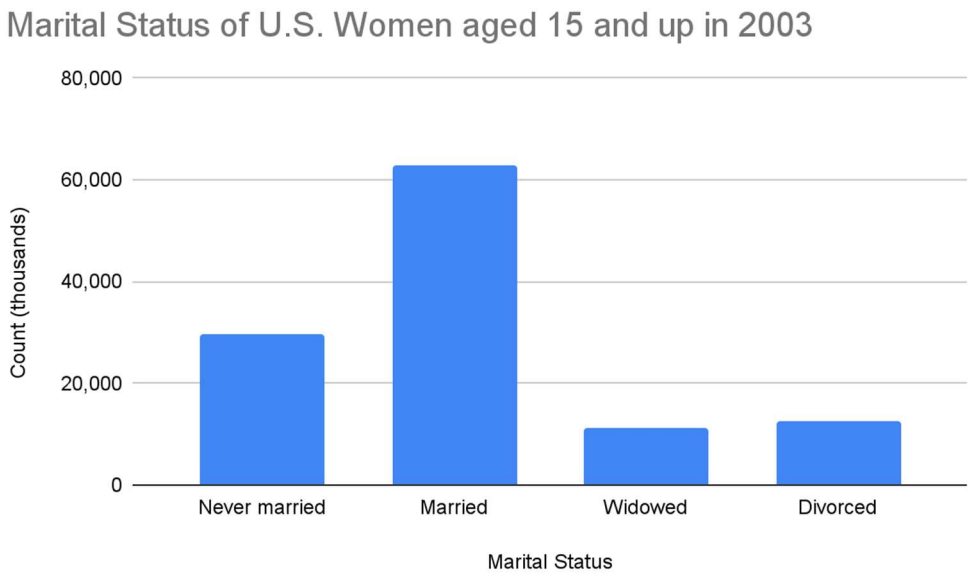
PART II:

CHAPTER 10:

- **10.2: Consistency?:**

- The sum of the amount of money spent on each game in sales is equal to $2078.2 million. In the table, the sum is written as $2078.3 million, likely to round off errors made while calculating the totals.

- **10.3: Marital Status:**
  - **a)** In 2003, according to the U.S. Census Bureau's document *America's Families and Living Arrangements: 2003,* there were 29,499,000 women aged 15 years or older that were never married.
  - **b)**

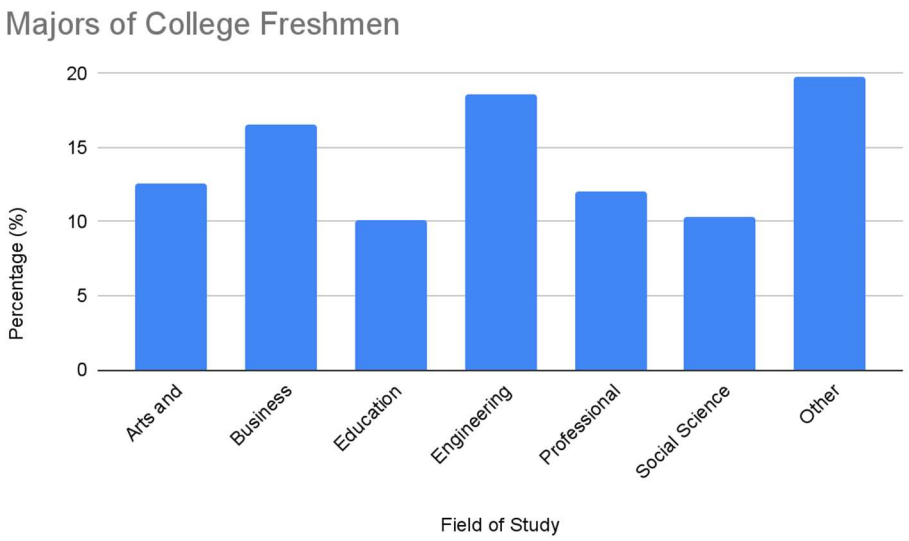


  - **c)** The bar chart is a better choice for the data in this case because we are comparing different values rather than showing how much of a whole they make up. A pie chart might be a better option if the total population and marital status of all women in the U.S. were available and we wanted to visualize the percentages each category makes up.

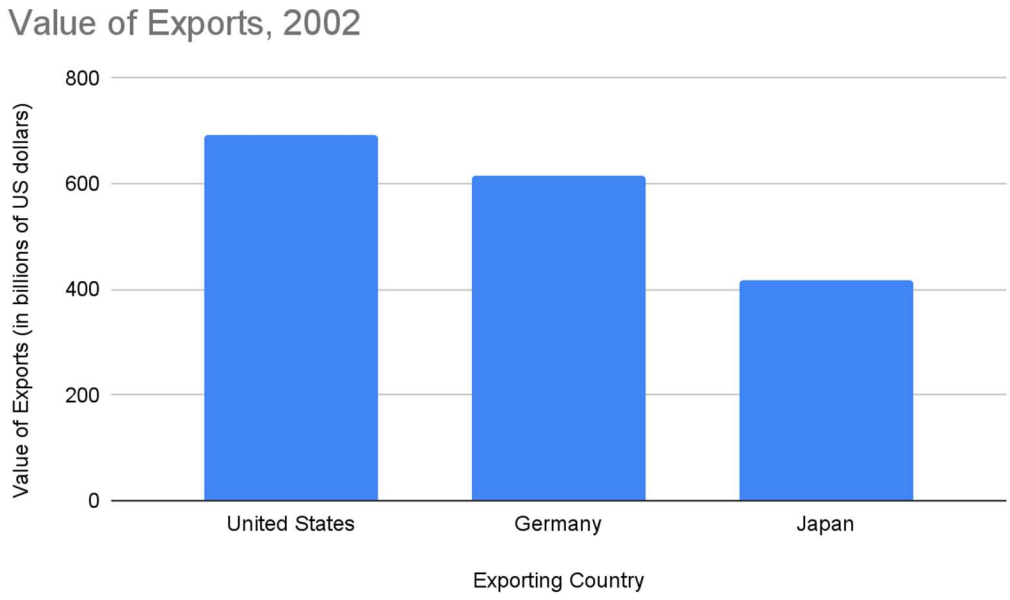
- **10.5: We Sell CDs:**
  - According to the graph, CDNow was the top market leader with 33% of market sales. However, the data is not fairly represented because it is displayed as a pictogram. Pictograms are misleading because the widths of each subject are not the same, which is what makes the data presented in other graphs (like bar charts) easy to compare. The CD representing CDNow appears overwhelmingly larger than those depicting N2K and CUC.

- **10.8: College Freshmen:**

- **a)** Totaled up, the college freshman interviewed equalled 80.2% of the population, which means that 19.8% of freshman college students intend on studying something other than the majors listed.
- **b)**



- **10.9: Exports:**
  - **a)** The pictogram in figure 10.14 is not accurate because it is a pictogram. Pictograms are notoriously misleading because they display the data as an image, increasing height and width and making it difficult for the observer to accurately visualize the data. A bar graph would have been a better option.
  - **b)**



CHAPTER 11:

- **11.1: Lightning Strikes:**
  - The histogram depicting the number of lightning strikes during the day in Colorado is roughly symmetric because of the single peak in the middle, which sits at about noon. The spread of the histogram ranges from 7 A.M. to 5 P.M. and there do not appear to be any obvious outliers.
- **11.2: Where do the Young Live?**
  - **a)** In the stemplot displaying the percentages of people between the ages of 18 and 24 in each state, Utah and North Dakota have the highest percentages at 13.3% and 12.0%.
  - **b)** If we ignore Utah and North Dakota, the stemplot becomes more symmetrical, with the center being somewhere between 9.2% and 10.8%. The total spread of the stemplot ranges from 8.4% to 11.2%.
  - **c)** In comparison to Figure 11.7, which displays the percentages of adults 65 years and older, young adults have a much smaller spread Adults 65 years and older have a spread of 8.6% to 15.4% (ignoring outliers of 6.3% in Alaska and 17.0% in Florida).
- **11.3: Minority Students in Engineering**
  - In Figure 11.10, the number of minority students who earned engineering doctorate degrees at universities between 2000 and 2002 is extremely skewed to the left, with the majority of students falling between 0-5. The spread is between 0 and 35, or 0 to 50 if you include the outlier sitting between 45 and 50.
- **11.5: Histogram or Stem Plot**
  - To describe the returns on 1528 common stocks, a histogram would portray the data in the easiest manner because of the large dataset. Stem Plots are very useful when datasets are smaller.
- **11.13: How Many Calories Does a Hotdog Have?**

10	7			
11				
12				
13	5	6	8	9
14	0	6	7	
15	3			
16				
17	2	3	5	9

18	2			
19	0	1	5	

- Based on the distribution of numbers on my stem plot, I would guess that the Eat Slim Veal Hot Dog is the data point that sits at 107 calories. This is because it is an outlier compared to the calories in the hot dogs using a mixture of beef, pork, and poultry.

CHAPTER 12:

- **12.1: Median Income:**
  - In plain language, the “median income” describes the central income of the dataset, so half of the U.S. households have an income of $43,318 while the other half has more.
- **12.4: College Tuition:**
  - **a)**The five-number summary of college tuition in Illinois has a minimum of $1,500, a first quartile of $2,200, a median of $9,500, a third quartile of $17,300, and a maximum of $30,700.
  - **b)** Since the data displayed in the stem plot is heavily skewed to the left, I would suspect that the mean tuition will be lower than than the median, However, there is also a smaller set of peaks above the median, so it might not be too much lower.
- **12.5: Where are the Young Most Likely to Live?**
  - **a)** The shape of the distribution of the peaks on the graph indicate that the mean and median will not likely be far off from each other because they are nearly symmetrical.
  - **b)** The median percentage of people between the ages of 18 and 24 in each state is 10.0% and the mean is 9.5%.
- **12.9: How Many Calories Does a Hotdog Have?**
  - (See the answer to 11.13 for stem plot). The minimum is 107 calories, Q_1 is 138.5 calories, median is 153 calories, Q_3 is 180.5 calories, and maximum is 195 calories. The stem plot shows the distribution across all data points whereas a numerical summary only shows the minimum, first quartile, median, third quartile, and maximum.
- **12.15: State SAT Scores**
  - The mean or median would not be an accurate way to describe the data in Figure 12.9 because the graph does not show much symmetry. The SAT scores of the students peak at three different points rather than at just one.

CHAPTER 13:

- **13.2: Mean and Median**

- a) This density curve has two peaks but a symmetrical distribution. Point B is the median and the mean.
- b) The density curve is skewed to the left, so median is point A and mean is point B
- c) The distribution on this density curve is symmetrical, so median and men are both A.
- d) This curve is skewed to the right. Point A is the mean and point B is the median

- **13.4**
  - The IQ score values that 95% of rural Midwest seventh-graders lie roughly between 89 and 133.
- **13.5**
  - The percentage of IQ scores for rural Midwest seventh-graders that are below 100 is about 16%
- **13.6**
  - The percentage of students that have an IQ score of 144 or higher would be 0.13%. None of the students in the sample scored higher than 144, which is no surprise because a score this high is very rare.
- **13.8: A Normal Curve**
  - The mean of the normal curve in figure 13.14 is probably somewhere around 10, assuming it is perfectly symmetrical. The standard deviation seems to be close to 3.

CHAPTER 14:

- **14.1: What Number Can I Be?**
  - a) All of the values that a correlation *r* can possibly take lie between -1 and 1.
  - b) Standard deviation *s* can be any positive number from 0 to infinity.
- **14.2: Measuring Crickets**
  - a) The correlation between length and weight will be positive because longer crickets are probably bigger, and therefore weigh more.
  - b) Even if the length of the crickets is measured in inches, the correlation would not change because *r* uses standard scores rather than units of measurement.
- **14.4: Calories and Salt in Hot Dogs**
  - The overall pattern shown in figure 14.9 is a positive correlation between calories and sodium content per hot dog brand. There are two groups of points and an outlying Point A. Point A is a notable

outlier because it shows a significantly low sodium and calorie content, sitting around 105 calories and 150mg of Sodium.

- **14.6 Calories and Salt in Hot Dogs**
  - The correlation *r* for the hot dogs in Figure 14.9 is positive and near 1 because there is clear degree association on the scatterplot that more sodium increases calories.
- **14.21: Guess the Correlation**
  - a) The age of secondhand cars and their prices will have a substantial negative correlation.
  - b) The weight of new cars and their gas mileage will probably have substantial negative correlation
  - c) The heights and weights of adult men will probably show substantial positive correlation.
  - d) The heights and IQ scores of adult men will show little to no correlation.

CHAPTER 15:

- **15.3: IQ and School GPA**
  - The percentage of the observed variation among GPAs of the 78 students sampled is about 40%. 60% of the variation is explained by differences in GPA of students with similar IQs.
- **15.5: IQ and School GPA**
  - The slope *b*=0.101 means that the GPA of the school increases by 0.101 for each IQ point. If this is true, then a student with an IQ of 115 should have a GPA of 8.05.
- **15.12: Wine and Heart Disease**
  - Some differences among nations that may be confounded with wine drinking habits include amount each individual person drinks, how often, and strength of wine.
- **15.19: Going to Class Helps**
  - The numerical value of the correlation between percentage of classes attended and grade index is *r*=4 because that is the square root of *r*^2=0.16.
- **15.22: Do Firefighters Make Fires Worse?**
  - The presence of lots of firefighters making a fire worse based on the amount of damage a fire causes is wrong because it is using the firefighters as an explanatory variable and damage as the response variable. However, there are many lurking variables that this statement does not consider, including severity and size of the fire.

CHAPTER 16:

- **16.1: The Price of Gasoline**
  - The gasoline price index numbers for 1983 was 112, for 1993 it was 100, and for 2003 it was 143.
- **16.3: The Price of Gasoline**
  - a) The gasoline price index changed by 31 points between 1983 and 2003. This is roughly a 28% increase.
  - b) The gasoline price index changed by 43 points between 1993 and 2003. This is a 43% increase.
- **16.4: Toxic Releases**
  - The index numbers of amounts of toxic chemicals released were 100 in 1988, 57 in 1998, and 51 in 2002. Between 1988 and 2002, the releases decreased by about 51%.
- **16.7: The Food Faddist**
  - In 2005, the fixed market basket Food Faddist Price Index would be 126.
- **16.8: The Guru Price Index**
  - The fixed market basket Guru Price Index for 2005 would be 164.

PART III:

CHAPTER 17

- **17.1: Pennies Spinning**
  - In my trials, I got 27 heads and 23 tails, so I had a probability of 0.54 for heads.
- **17.2: Pennies Falling Over**
  - In my trials, my penny fell on heads 31 times and tails 19 times, so I had a probability of 0.62.
- **17.7: From Words to Probabilities**
  - a) “This event is impossible” corresponds with 0
  - b) “This event is certain” corresponds with 1
  - c) “ This event is very unlikely” corresponds with 0.01
  - d) “This event will occur more often than not” corresponds with 0.99
- **17.9: Will You Have an Accident?**
  - a) I believe the probability of me getting into an accident this year is pretty low.
  - b) My personal probability is lower than others because I recently got into a major car accident. This event has made me much more cautious on the roads than I previously was.

    - c) I think that it is true that most people believe their risk of an accident is lower than the random driver probability because the lower driver probability is guaranteed to happen. There is a very high likelihood that one of the millions of drivers on the road will have an accident but the odds that it will be me are lowered.
- **17.13: Personal Random Numbers**
    - The numbers that my friends chose were 69, 3, 420, 69, 1, 5, 12, 42, 25, and 10 (as you can tell, my friends think they have a sense of humor). The proportion of numbers that started with 1 or 2 were 0.3 and 8 or 9 were 0.

CHAPTER 18:

- **18.1: Moving Up**
    - The probability that the son of a lower-class father moves up to a higher class is 0.54 because 1-0.46=0.54.
- **18.3: Land in Canada**
    - a) The probability that the randomly selected acre of Canadian land is not forested is 0.55 because 1-0.45=0.55
    - b) The probability that the randomly selected acre of Canadian land is either forest or pasture is 0.48 because 0.45+0.03=0.48.
    - c) The probability that the randomly chosen acre of Canadian land is something other than forest or pasture is 0.52 because 1-0.45-0.03=0.52.
- **18.5: Rolling a Die**
    - The probabilities in Model 1 are not legitimate because each outcome has a probability of 1/7, but there are only 6 options. The total proportions don't equal 1.
    - Model 2 is legitimate because the sum of the probabilities is equal to 1.
    - In Model 3, the sum of the outcomes equals 7/6, which is greater than 1, making it illegitimate
    - Model 4 is also illegitimate because all of the probabilities are equal to or greater than 1. Probabilities must lie between 0 and 1.
- **18.9: Roulette**
    - a) The probability of any of the 38 possible outcomes is 1/38 because the ball has an equal chance of landing on any number.
    - b) If I bet on "red," the chance that I win is 0.47.
    - c) If I place my bet on a column that contains all multiples of 3, the probability of winning is 0.32
- **18.11: Colors of M&M's**
    - a) The probability of drawing a blue milk chocolate M&M is 0.24

- b) The probability of choosing a blue peanut M&M is 0.23
- c) The probability of drawing a red, yellow, orange milk chocolate M&M is 0.47. For the same colors of peanut M&M's, the proportion is 0.50.

CHAPTER 19:

- **19.2: A Small Opinion Poll**
  - a) The probability model for whether or not evening exams should be abolished is similar to a coin toss because each student has a probability of 0.9 in favor of abolishing and 0.1 in favor of continuing. Student opinions are independent of each other.
  - b) Digits 0-8 represent "abolish" and 9 represents "in favor"
  - c) In a simulation using line 129 from Table A, the probability that results will be unanimous towards abolishing evening exams will be 0.28.
- **19.5: Course Grades**
  - a) The probabilities that students who took beginning statistics at Upper Wabash Tech got a D or and F is 0.2.
  - b) To simulate the grades of randomly chosen students, you could assign digits 0-9 to represent each category. 0-1=A, 2-4=B, 5-7=C, and 8-9=D of F.
- **19.10: Tonya's Free Throws**
  - a) The probability that Tonya will make a free throw is 0.8 so we can use random digits to represent the probability. 0-7 shows that she made the free throw and 8-9 shows she missed.
  - b) In a simulation starting at row 125 of Table A, Tonya will miss 3 out of 5 shots on only 3 of the 50 simulations, so 0.06.
- **19.11: Repeating an Exam**
  - The probability that Elaine will pass her exam in three attempts is around 0.5.
  - a) I would use random digits to simulate one attempt of Elaine's exam using 0-7 to represent her failing and 8-9 to represent passing since her probability is 0.2.
  - b) To simulate one repetition of Elaine's tries, we should read 3 digits at a time, or until an 8 or 9 appears, starting on line 120 of Table A. After 50 repetitions of this, Elaine passed on 23, so her probability of passing the exam is 0.46.
  - c) The assumption that Elaine's probability of passing the exam is the same on each trial is unrealistic because she will likely learn after each attempt and better prepare herself. Her likelihood of

passing on attempt 3 is higher than on attempt 1 because she will know what to expect.

- **19.13: Gambling in Ancient Rome**
  - a) In order to simulate a single throw of the astragali, we should use digits 0-9 to represent the various sides. 0 will represent the narrow and flat side, 1-4 will represent the broad concave side, 5-8 will represent the broad convex side, and 9 will represent the hollow side. On Table A, I will use four digits at a time to represent the results of the four astragali thrown.
  - b) I used row 130 of Table A to simulate the probability of a Venus throw. In 25 simulations, I had 0 that landed on a Venus throw. We know that it is not impossible for a Venus throw to occur, but in my simulation, it is 0.

CHAPTER 20:

- **20.2: Pick 4**
  - The expected winnings from a $0.50 Tri-State Daily Numbers Pick 4 wager would be $0.25
- **20.4: More Pick 4**
  - The expected amount of winnings in the StraightBox (24-way) bet would be $0.50
- **20.6: Making Decisions**
  - a) The expected number of people saved by Tversky's public health program that has a probability of ½ to save all 600 people or ½ that it will kill all 600 is expected to save 300 people.
  - b) Tversky's first (a) and second (b) offers differ in language. The outcomes of the public health programs in the (a) and (b) share the same outcome.
  - c) The subjects are likely not using expected values in their choices and are instead using the language and the promise of the alternative to guide them.
- **20.11: The Asian Stochastic Beetle**
  - a) The expected number of female offspring for the Asian Stochastic Beetle is 1.3
  - b) The law of large numbers explains that the population of Asian Stochastic beetles should grow because the number, 1.3, is greater than 1. If the number were to be below 1, the population would die out.
- **20.13: The Asian Stochastic Beetle Again**

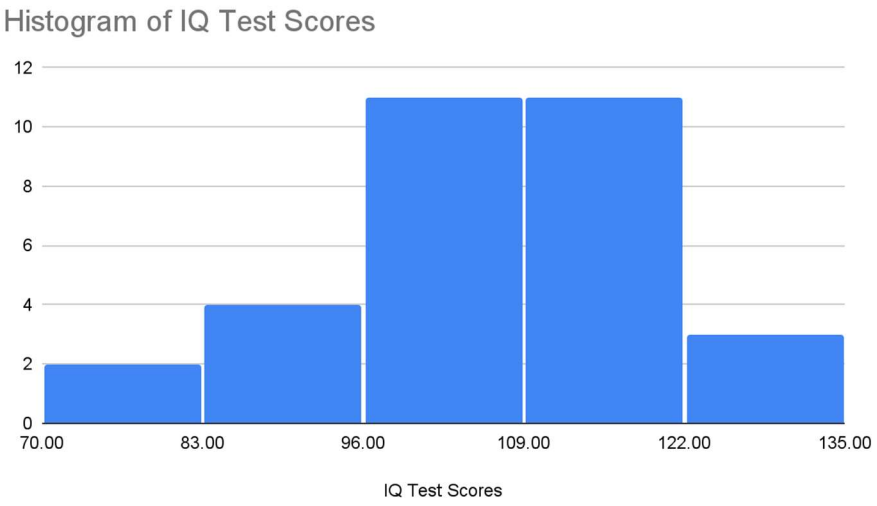
- To simulate the offspring of 100 Asian Stochastic Beetles, we can use digits 0-9 to represent each outcome, with 0-1 representing no female offspring, 2-4 representing one female offspring, and 5-9 representing two female offspring. I used Line 101 on Table A to run this simulation and resulted with 130 female offspring total, a mean of 1.3, which matches the mean I got in 20.11.

PART IV:

CHAPTER 21:

- **21.1: A Student Survey**
  - a) The population that Tonya wants to draw conclusions about is the number of dorm-residing students who like the school's food.
  - b) The population proportion *p* in this setting is 0.28 because 14 of the 50 students interviewed said they liked the food.
  - c) The numerical value of the sample proportion $\hat{p}$ from Tonya's sample is 0.28.
- **21.11 Count Buffon's Coin**
  - With a 95% confidence interval, the probability that Count Buffon's coin will land on heads is between 0.49 and 0.52. I am confident that the probability is not ½ because the coin landed on heads more than half of the time.
- **21.12: Teens and their TVs**
  - a) OThe proportion of teenagers with a TV in their room is between 0.63 and 0.69 with a 95% confidence interval. Of these, 0.16 to 0.20 said Fox was their favorite channel.
  - b) I agree with the article saying that in 19 out of 20 cases, the poll's results will differ by no more than three percentage points because the poll used a 95% confidence interval, meaning the results will fall into that range 95% of the time.
- **21.15: The Quick Method**
  - The proportion of registered motorcycles that are HArley-Davidson are 0.09 to 0.18 using the quick method with a 95% confidence interval. Using the method in this chapter, the population proportion is between 0.11 and 0.17. This is a difference of 0.01.
- **21.25: IQ Test Scores**
  - a) My plot doesn't show much but I can assume that the lower 70's points are a bit outlying. The mean is about 105.8 and the standard deviation is around 14.03

- b) The 95% COnfidence interval of the 31 girls in an SRS of all middle-school girls in the school district has a mean score of 100.8 to 110.9.
- c) We can't trust the confidence interval from (b) because the sample size isn't large enough.



CHAPTER 22:

- **22.1: Ethnocentrism**
  - The report that says that ethnocentrism was significantly higher (P< 0.05) among churchgoers than among nonattenders means that the sample has strong evidence. The probability that this is not true is less than 0.05.
- **22.3: Diet and Diabetes**
  - P=0.02 is an extremely valid answer to counter the doctor's argument that a 6.7% drop in cholesterol isn't much. The probability of this drop occurring by chance is less than 0.02, so it is probably not a coincidence.
- **22.5: Pigs and Prestige in Ancient China**
  - The burials that contained the skulls of pigs often had grave goods that indicated wealth in comparison to graves without pigs. The confidence of this lies in a probability of 0.01, indicating that the chance of this occurring by chance is less than 0.01.
- **22.6: Ancient Egypt**
  - The conclusion that the two dates from Site KH6 occurred at the same point in time is significant because, statistically, it would have been highly improbable to have occurred at different dates.
- **22.9: Body Temperature**

- The population proportion *p* represents that number of people from the sample who have a body temperature lower than 98.6 degrees farenheit.
- b) My null hypothesis would be $p=0.5$ and my alternate hypothesis would be $p>0.5$

CHAPTER 23:

- **23.4 How Far Do Rich Parents Take Us?**
  - a) "Statistically insignificant" means that it is likely due to chance rather than any significant correlation that explains the relationship between SES of a parent and their child going on to pursue further education after college. Basically, it is not the SES of parents that will encourage a student to pursue higher education.
  - b) It is important that the effects were small in size and insignificant because it shows that these results are irrelevant. There isn't much data or confidence to determine that there is any kind of relationship.
- **23.7: Color Blindness in Africa**
  - In order to decide if I accept the claim that color blindness is less common in hunter-gatherer societies, I will need more information, such as the sample size and information to figure out the statistical significance. We don't know how many people the anthropologist tested, but small sample sizes can lead to inaccurate information about a population as a whole.
- **23.8: Blood Types in South East Asia**
  - Before I agree with the anthropologist about whether or not people in Malaysia should be considered to be a different population based on blood type, I will need to know the *p* value and sample size taken. Without this information, I can't figure out the statistical significance for myself.
- **23.9: Why We Seek Significance?**
  - The statement made by the student is not correct because significance does not completely rule out chance. Additional information is required to minimize the risk that chance is causing the results we get.
- **23.10: What is Significance Good For?**
  - a) Whether or not a sample or experiment is properly designed is not answered by statistical significance.
  - b) Whether or not an observed effect is due to chance can't be answered by statistical significance

- c) The importance of the observed effect is also not determined by statistical significance.

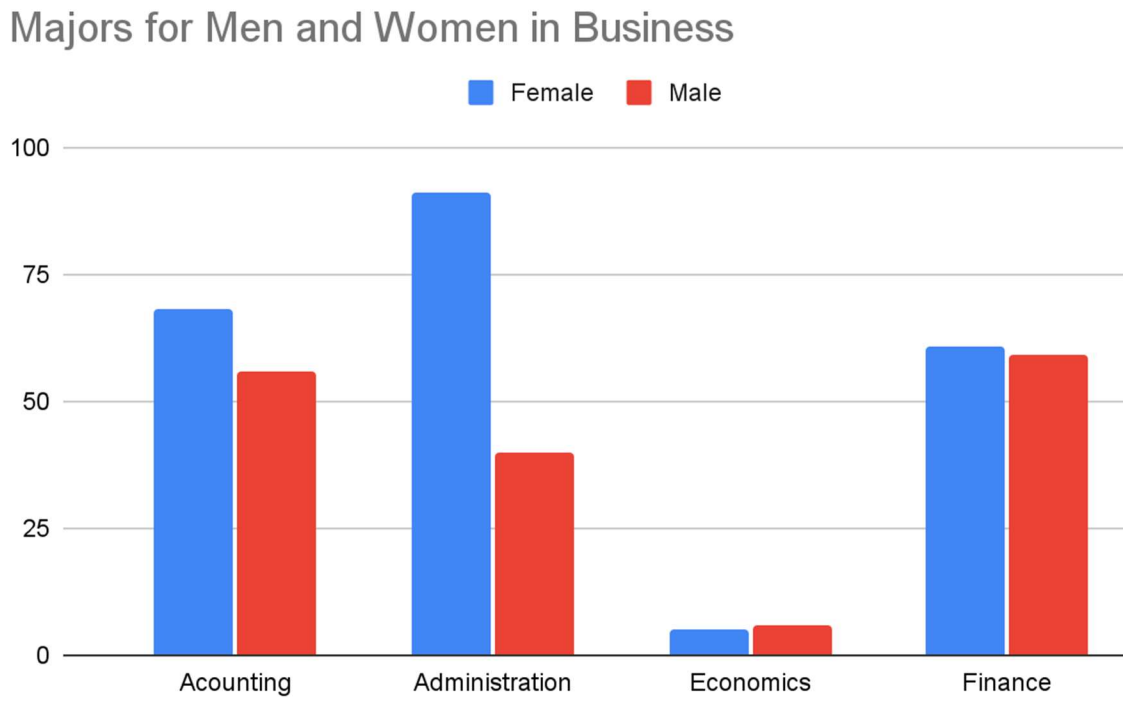
CHAPTER 24:

- **24.1: Extracurricular Activities and Grades**
  - The percentages that describe the nature of the relationship between time spent on extracurricular activities and course performance are as follows: 68.9% of students involved in extracurricular activities got a C or higher. Of the students that spent less than two hours per week involved in these extracurricular activities, 55% got a C or higher. Students involved in anywhere between 2-12 hours of extracurricular activities, 74.7% got a C or higher. Finally, only 37.5% of students who spent more than 12 hours per week on extracurricular activities got a C or higher.
- **24.3: Python Eggs**
  - a)

	Hatched	**Not Hatched**
Cold	16	11
Neutral	38	18
Hot	75	29

  - b) The percentages of the eggs that hatched in each category are 59.3% in cold, 67.9% in neutral, and 72.1% in hot. This does not support the researchers' anticipation that the eggs would not hatch in the cold environment. Although fewer eggs hatched, more than half did successfully.
- **24.6: Majors for Men and Women in Business**
  - The percentage distributions of the majors of men and women are as follows: In accounting there were a total of 124 students, with 54.8% being female and 45.2% being male. Administration had a total of 131 students which consisted of 69.5% being female and 30.5% being male. Economics had a total of 11 students, 45.5% female and 54.5% male. Finally, finance had a total of 120 students, with 50.8% female and 49.2% male.Overall, each major is fairly evenly distributed, except of administration which has a higher

percentage of females.



- **24.10: Majors for Men and Women in Business**
  - a) The two observed cell counts that were small fell in Economics. However, the expected count based on the table is 6 for women and 5 for men. This is still safe for use on a chi-square test.
  - b) Based on the chi-square, there is a statistically significant relationship ($P<0.05$) between gender and major of business students. The value of the chi-square statistic was calculated to be 10.83 with a degree of freedom of 3. This was done using Table 24.1.
  - c) There are 722 students in the university's business program but only 386 students respond to the questionnaire. That means that 47% of the students did not respond.
- **24.13: Python Eggs**
  - In my calculations, temperature seems to not have much of an effect on the hatching success of water python eggs. To get to this conclusion, I created a two-way table showing the eggs that hatched versus the ones that didn't hatch and included the total counts for each row and column. I then created another set of tables comparing the expected hatch and the observed hatch. Then, I found the value of the chi-square, which came out to be 1.70 and the degree of freedom, which was 2 because the table

had three rows and two columns. Using Table 24.1, I found that the chi-square value for 0.05 would be 5.99. Because the hi-square value was lower than the critical value, this proves that there is no significant correlation between temperature and hatching success of water python eggs.