Answer Key

> Show your work wherever some is required. Do not assume I will know what you did.
> You may use a graphing calculator where appropriate, your tables, and 3"x5" card.

1. On the first practice exam, we discussed a psychologist has become concerned about post traumatic stress disorder (PTSD) in military veterans. While he has observed people from various occupations that have PTSD, he feels that it is much more common among veterans. To study this, he randomly selects 20 veterans from his patient records and records whether each of the patients has PTSD. He is interested in the total number of PTSD cases. Is this a binomial setting?

    1. Fixed number? Yes, 20 veterans were selected

    2. Independent? Yes, random. (but less than 10% of his veteran clients?)

    3. Two outcomes? Yes, PTSD or not

    4. Counting one of the two? Yes, Those with PTSD

    5. Fixed probability? Yes, as long as there are at least 200 veteran patient record for the 10% condition.

    <div align="center">Yes, it is binomial.</div>

2. A study of college students wanted to study how religious views change during the four (approximately) years of college. During their first week on campus, a group of randomly selected students at a large university are asked a series of questions about their beliefs on various issues. The same students are then asked the same questions about their beliefs in the week between their last final and graduation, whenever they reach that point. Would you expect these two variables (views during the first week on campus and views during the last week on campus) to be independent of each other? Explain in one sentence.

    No, while opinions may change, the students are the same. This implies that there is useful information gained.

3. A company that offers GMAT preparation courses gives the probability that one of its customers is currently an undergraduate student in business is 0.20. The probability that one of its customers is an undergraduate major in another field is 0.15. A third group of customers are college graduates who are currently employed, and the probability that a customer is in this group is 0.60. The only group that is unaccounted for is college graduates who are currently unemployed. What is the probability that a randomly selected customer would be in this group if the company is correct?

    The company has four groups. The three given probabilities add up to 0.20+0.15+0.60=0.95. This implies that the probability for the remaining group must be 1-0.95=0.05.

4. In the previous example, consider the groups as individual events such as: Event A = a randomly chosen customer is an undergraduate student in business, etc. What term describes the relationships between any subset of two of the events?

    Since no two events cover all possibilities, they are not complements. However, since they also do not overlap, we can say that any pair are mutually exclusive.

5. A state agency is concerned with nutrition in low or no income families. They believe that encouraging families to eat at least one meal together all gathered around a table (called a "family meal") will help to naturally encourage better habits. The buy billboards to promote the idea, as well as providing literature at various county assistance offices where resident would come to sign up for state benefits related to food needs. After a period of three months in which the resources are available, an employee is sent to several assistance offices in the areas targeted and asks anyone who stops by the office on the day that she is there if they will fill out a survey about their views on eating family meals. What type of sampling method is the agency using?

Convenience

6. As part of the survey administered to students at a certain university just before graduation, one of the questions asks respondents who classify themselves as Christian to list their denominational affiliation (if any). What level of measurement is this variable?

Nominal

7. The body mass index (BMI) for 24 month old girls has been shown to be 15.9 with a standard deviation of 1.6. Answer the following questions about this setting, assuming that a normal distribution can be used.

   (a) 24 month old girls with a BMI below 13 are required to get nutritional screenings due to their low BMI. What is the probability that a randomly selected 24 month old girl would be required to get the screenings?

$$P(X \leq 13) = P\left(Z \leq \frac{13 - 15.9}{1.6}\right) = P(Z \leq -1.81) = .5 - .4649 = .0351$$

   (b) Suppose the government would like to set a limit above which 24 month old girls would be considered obese. They would like the limit to label the top 1% of all 24 month old girls as obese. What limit should we use?

$$\text{Top 1\%: } .5 - .01 = .49 \Rightarrow Z = 2.33 = \frac{X - 15.9}{1.6} \Rightarrow X = 19.628 \rightarrow \text{ BMI at least } 19.628$$

   (c) A pediatrician walks into a patient room to meet a new patient. She finds a 24 month old girl with a BMI that yields a Z-score of 1.00. What is the BMI for this girl?

$$\text{z-score of } 1.00 \Rightarrow Z = 1.00 = \frac{X - 15.9}{1.6} \Rightarrow X = 17.5 \text{ is the girl's BMI.}$$

   (d) What is the probability that a randomly selected girl would have a z-score of at most 1.00?

$$P(Z \leq 1.00) = .5 + .3413 = .8413$$

8. For 12-16 year old girls, a study found that the average BMI was 22.8 with a standard deviation of 1.42. Answer the following questions about this setting, again assuming that a normal approximation is appropriate.

   (a) For the 21 multiracial girls in this study, the average BMI was 19.9. What is the probability that a group of 21 randomly selected girls in this age group would have a mean BMI of 19.9 or less?

$$P(X < 19.9) = P\left(Z < \frac{19.9 - 22.8}{\frac{1.42}{\sqrt{21}}}\right) = P(Z < -9.36) \approx 0$$

   (b) Does your answer cause you to suspect that multiracial girls in this age range have a lower than expected BMI, on average? (explain briefly)

   This is so surprising that we should conclude that multiracial girls in this age range do have a lower than expected BMI, on average.

   (c) For the 25 non-Mexican Hispanics girls in this study, the average BMI was 25.2. What is the probability that a random group of girls from this study would have an average BMI of 25.2 or more?

$$P(X > 25.2) = P\left(Z < \frac{25.2 - 22.8}{\frac{1.42}{\sqrt{25}}}\right) = P(Z > 8.45) \approx 0$$

   (d) Does your answer in the previous part cause you to think that non-Mexican Hispanics should be thought of as surprisingly high with regard to their average BMI?

   This is so surprising that we should conclude that non-Mexican Hispanic girls in this age range do have a surprisingly high BMI, on average.

9. In a study of skin grafts in burn victims, it is desired to compare two methods of treatment for the "donor" site (the area where skin is taken to graft over the burn location). Since is it known that having diabetes affects the response of patients to skin grafts and healing, the available subjects are separated into two groups: those with diabetes and those who do not have diabetes. Within each group, subjects are then randomized such that half receive each treatment to the area where skin is grafted to repair the burned skin. What method of experimental design is this?

   Blocking (on the presence or absence of diabetes)

10. We said in class that double blinding is the ideal in medical studies. Why is that impossible in the setting in the previous problem?

   The doctor has to know which graft to do and treat.