Math 121 **Test #1** **Spring 2012**

1. (5 pts) A graduate student is designing a research study. She is hoping to show that the results of an experiment are statistically significant. What type of p-value would she hope to obtain?

   (a) A large p-value.

   (b) A small p-value.

   (c) The magnitude of a p-value has no impact on statistical significance.

2. (4 pts) A research article reports the results of a new drug test. The drug is to be used to decrease vision loss in people with macular degeneration. The article gives a p-value of 0.04 in the analysis section. For each of the following interpretations of the p-value, indicate whether it is valid or invalid.

   (a) The probability of getting results as extreme as or more extreme than the ones in this study if the drug is actually not effective.

   (b) The probability of getting results as extreme as or more extreme than the ones in this study if the drug is actually effective.

   (c) The probability that the drug is not effective.

   (d) The probability that the drug is effective.

3. (4 pts) A college official conducted a survey to estimate the proportion of students currently living in dormitories about their preference for single rooms, double rooms, or multiple (more than two people) rooms in the dormitories on campus. Which of the following does *not* affect the college official's ability to generalize the survey results to all dormitory students?

   (a) Five thousand students live in dormitories on campus. A simple random sample of only 500 were sent the survey.

   (b) The survey was sent only to first-year students.

   (c) Of the 500 students who were sent the survey, only 160 responded.

   (d) All of the above present a problem for generalizing the results.

4. (5 pts) In the previous problem, if the electrician rejects the null hypothesis, then he could be making

   (a) A Type I error.

   (b) A Type II error.

   (c) The correct decision.

   (d) Either (a) or (b).

   (e) Either (a) or (c).

   (f) Either (b) or (c).

5. (5 pts) The following situation models the logic of a hypothesis test. An electrician uses an instrument to test whether an electrical circuit is defective. The instrument sometimes fails to detect that a circuit is good and working. The null hypothesis is that the circuit is good (not defective). The alternative hypothesis is that the circuit is not good (defective). If the electrician rejects the null hypothesis, which of the following statements is true?

   (a) The circuit is definitely not good and needs to be repaired.

   (b) The electrician decides that the circuit is defective, but it could be good.

   (c) The circuit is definitely good and does not need to be repaired.

   (d) The circuit is most likely good, but it could be defective.

6. (4 pts) The purpose of a pie chart is to

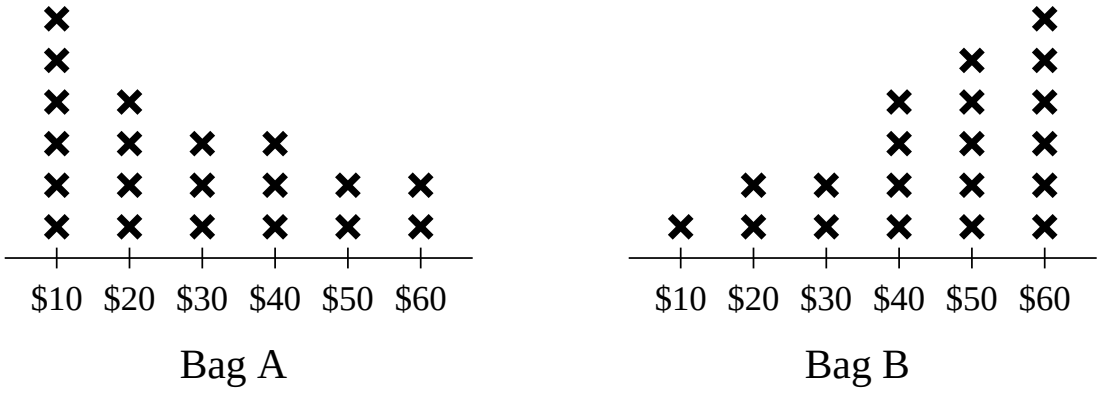
   (a) Show the shape of the distribution.

   (b) Facilitate the comparison of one category to another.

   (c) Facilitate the comparison of one category to the whole.

   (d) Facilitate the comparison of one sample to another.

7. (18 pts) There are two bags: Bag A and Bag B. Each bag contains 20 vouchers worth various amounts from \$10 to \$60. The distributions in the two bags are shown in the following diagrams.



   We are handed one of the bags, but we do not know which one it is. The two bags are identical in appearance. We will draw one voucher at random from the bag we are holding and, based on its value, we will decide which bag we believe it to be. The two hypotheses are

$$H_0: \text{ We are holding Bag A.}$$
$$H_1: \text{ We are holding Bag B.}$$

(a) (3 pts) What is the direction of extreme?

(b) (8 pts) Our decision rule is to reject H_0 if the value of the selected voucher is \$50 or more. Find the values of α and β.

(c) (4 pts) What is the p-value of 30?

(d) (3 pts) Describe a Type I error in this situation.

8. (15 pts) A recent study[1], reported in The Globe and Mail[2], concludes that doctors are not always honest with their patients. Among the study's conclusions are the following.

   - One third of physicians did not completely agree with the need to reveal serious medical errors to patients.
   - Nearly two fifths did not completely agree that they should disclose their financial ties to drug and device companies.
   - Almost one fifth did not completely agree that physicians should never tell a patient something untrue.
   - Just over one tenth said they had told patients something false in the previous year.

   (a) (3 pts) The article in The Globe and Mail goes on to say "Of course, that accounts only for doctors who told interviewers the truth." To what type of bias does this statement allude?

   (b) (3 pts) The article says that "just over one tenth said they had told patients something false in the previous year." Is this figure of 10% a parameter, a statistic, a variable, or a p-value? (Choose one)

   (c) (3 pts) The article says that the researchers surveyed "1,891 practicing physicians throughout the United State." Based on this statement, describe the population of interest.

   (d) (3 pts) Suppose that the 1891 physicians had intentionally been chosen from the alumni of the Harvard Medical School. What type of bias would be present?

   (e) (3 pts) Suppose that the researchers intentionally selected 500 physicians from hospital staffs, 1000 physicians from private practice in metropolitan areas, and 391 physicians from private practice in small towns. What type of sample would this be?

[1] `http://content.healthaffairs.org/content/31/2/383.abstract`

[2] `http://www.theglobeandmail.com/life/the-hot-button/is-your-doctor-lying-to-you-probably-according-to-a-new-study/article2338707/`

9. (24 pts) A college administrator wishes to study the relation between sleep and academic performance. He selects 100 college students and asks each student to tell him the average number of hours of sleep the student gets per night and the administrator also looks up the student's GPA. He finds that of the students who get an average of at least 7 hours of sleep per night, their average GPA is 3.2 and of those who get less than an average of 7 hours of sleep per night, their average GPA is 2.9.

   (a) (4 pts) Describe verbally the statistics in this study.

   (b) (4 pts) Describe verbally the variables in this study.

   (c) (4 pts) Which variable(s) are explanatory and which are response?

   (d) (3 pts) Is this study observational or is it experimental? Explain.

   (e) (6 pts) Suppose that the 100 students comprised a systematic 1-in-20 sample of the 2000 students at the college and that the administrator used his TI-83 with a seed of 25 to select the sample. Using a seed of 25, give the labels of the first 5 students selected to be in this study.

   (f) (3 pts) Which type of bias is this sampling method designed to eliminate?

10. (16 pts) The following data are the final exam scores of a class of 21 students.

55	55	56	64	65	69	72
74	78	80	81	81	82	83
84	85	87	87	87	91	92

   (a) (4 pts) Of the different types of graph that we studied, which ones would be appropriate for these data? (List all appropriate types.)

   (b) (8 pts) Using one of the types that you named in part (a), draw a graph of these data.

   (c) (4 pts) Which of the following terms would you use to describe your distribution in part (b)?

      (i) Symmetric
      (ii) Uniform
      (iii) Unimodal
      (iv) Bimodal
      (v) Skewed right