Chapter 4 – Sampling Distributions and Hypothesis Testing

4.1 Was last night's game an NHL hockey game?

a. Null hypothesis: The game was actually an NHL hockey game.

b. On the basis of that null hypothesis I expected that each team would earn somewhere between 0 and 6 points. I then looked at the actual points and concluded that they were way out of line with what I would expect if this were an NHL hockey game. I therefore rejected the null hypothesis.

4.3 A Type I error would be concluding that I had been shortchanged when in fact I had not.

4.5 The critical value would be that amount of change below which I would decide that I had been shortchanged. The rejection region would be all amounts less than the critical value—i.e., all amounts that would lead to rejection of H_0.

4.7 Was the son of the member of the Board of Trustees fairly admitted to graduate school?

$$z = \frac{X - \mu}{\sigma}$$

$$z = \frac{490 - 650}{50} = -3.2$$

z score	*p*
3.00	0.0013
3.20	0.0007
3.25	0.0006

The probability that a student drawn at random from those properly admitted would have a GRE score as low as 490 is .0007. I suspect that the fact that his mother was a member of the Board of Trustees played a role in his admission.

4.9 The distribution would drop away smoothly to the right for the same reason that it always does—there are few high-scoring people. It would drop away steeply to the left because fewer of the borderline students would be admitted (no matter how high the borderline is set).

4.11 *M* is called a test statistic.

4.13 The alternative hypothesis is that this student was sampled from a population of students whose mean is not equal to 650.

4.15 The word "distribution" refers to the set of values obtained for any set of observations. The phrase "sampling distribution" is reserved for the distribution of outcomes (either theoretical or empirical) of a sample statistic.

4.17 **a.** *Research hypothesis*—Children who attend kindergarten adjust to 1st grade faster than those who do not. *Null hypothesis*—1st-grade adjustment rates are equal for children who did and did not attend Kindergarten.

b. *Research hypothesis*—Sex education in junior high school decreases the rate of pregnancies among unmarried mothers in high school. *Null hypothesis*—The rate of pregnancies among unmarried mothers in high school is the same regardless of the presence or absence of sex education in junior high school.

4.19 Finger-tapping cutoff if $\alpha = .01$:

$$z = \frac{X - \mu}{\sigma}$$
$$-2.327 = \frac{X - 100}{20}$$
$$53.46 = X$$

z score	*p*
2.3200	0.9898
2.3270	0.9900
2.3300	0.9901

For α to equal .01, z must be -2.327. The cutoff score is therefore 53. The corresponding value for z when a cutoff score of 53 is applied to the curve for H_1:

$$z = \frac{X - \mu}{\sigma}$$
$$= \frac{53.46 - 80}{20}$$
$$= -1.33$$
$$z = \frac{X - \mu}{\sigma}$$
$$= \frac{53.46 - 80}{}$$

Looking z = -1.33 up in Appendix z, we find that .9082 of the scores fall above a score of 53.46. β is therefore 0.908.

4.21 To determine whether there is a true relationship between grades and course evaluations I would find a statistic that reflected the degree of relationship between two variables. (The students will see such a statistic (r) in Chapter 9.) I would then calculate the sampling distribution of that statistic in a situation in which there is no relationship between two variables. Finally, I would calculate the statistic for a representative set of students and classes and compare my sample value with the sampling distribution of that statistic.

4.23 **a.** You could draw a large sample of boys and a large sample of girls in the class and calculate the mean allowance for each group. The null hypothesis would be the hypothesis that the mean allowance, in the population, for boys is the same as for girls.

b. I would use a two-tailed test because I want to be able to reject the null hypothesis whether girls receive significantly more or significantly less allowance than boys.

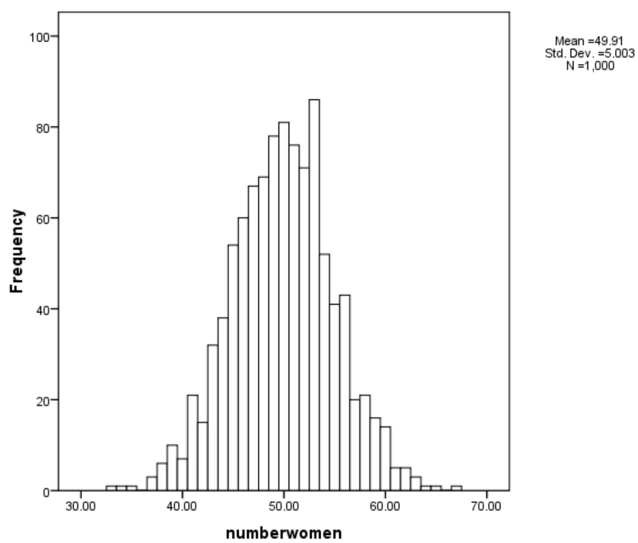
c. I would reject the null hypothesis if the difference between the two sample means were greater than I could expect to find due to chance. Otherwise I would not reject.

d. The most important thing to do would be to have some outside corroboration for the amount of allowance reported by the children.

4.25 In the parking lot example the traditional approach to hypothesis testing would test the null hypothesis that the mean time to leave a space is the same whether someone is waiting or not. If their test failed to reject the null hypothesis they would simply fail to reject the null hypothesis, and would do so at a two-tailed level of $\alpha = .05$. Jones and Tukey on the other hand would not consider that the null hypothesis of equal population means could possibly be true. They would focus on making a conclusion about which population mean is higher. A "nonsignificant result" would only mean that they didn't have enough data to draw any conclusion. Jones and Tukey would also be likely to work with a one-tailed $\alpha = .025$, but be actually making a two-tailed test because they would not have to specify a hypothesized direction of difference.

4.27 Distribution of proportion of those seeking help who are women.

The sampling distribution of proportion of women in the sample.



a. It is quite unlikely that we would have 61% of our sample being women if $p = .50$. In my particular sampling distribution as score of 61 or higher was obtained on 16/1000 = 1.6% of the time.

b. I would repeat the same procedure again except that I would draw from a binomial distribution where $p = .75$.