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:

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

$$= \frac{53.46 - 80}{20}$$

$$= -1.33$$

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. (You 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.