Homework 7 Solutions
Chapter 12: #15b and 16b (15b and 16b count as 1 point together), 19, 85 (85 counts double)
Chapter 12: #62, 83, 101
Chapter 9: #66, 90, 91

Assigned Fri, Nov 12

12.15 **b.** H_0: $p = .15$ (same proportion as in other region)
H_a: $p \neq .15$ (different proportion than in other region)
In words:
Null: In the new region being studied, 15% of the population has the unique genetic trait.
Alternative: In the new region being studied, the percent with the unique genetic trait differs from 15%.
A two-side alternative is used because the anthropologist did not specify a particular way in which the proportion might differ from .15 in the new region.

12.16 **b.** Population consists of all people in the region being studied in the new research.
Proportion of interest = proportion of these people who have the unique genetic trait.

12.19 **a.** The p-value is .03.
b. The level of significance is $\alpha = 0.05$.
c. The sample proportion is $\hat{p} = 61/100 = .61$.
d. The sample size is $n = 100$.
e. The null value is .5. If there were no difference in preference, then 50% of the population of consumers would prefer each type.

12.85 **a.** H_0: $p = \frac{31}{365} = .0849$ (because there are 31 days in October)
H_a: $p > .0849$ (31/365)
p is the proportion of the population born in October (nine months after the cold January Max observed).
b. Step 2: It seems reasonable to assume the sample of birthdays is representative of the larger population of birthdays and the sample size is large enough so that both np_0 and $n(1-p_0)$ are greater than 10. Here, $n = 170$ and $p_0 = 31/365 = .0849$

The test statistic is $z = \frac{\text{Sample estimate - Null value}}{\text{Null standard error}} = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$.

Sample estimate = $\hat{p} = \frac{22}{170} = .1294$ (proportion of sample born in October)

$$z = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{.1294-.0849}{\sqrt{\frac{.0849(1-.0849)}{170}}} = \frac{.0445}{.02138} = 2.08$$

Step 3: p-value = .0188. This is the probability (area) to the right of 2.08. By symmetry this equals the probability to the left of –2.08. Table A.1 gives $P(z < -2.08) = .0188$.
Step 4: Reject the null hypothesis. The result is statistically significant because the p-value is less than .05.
Step 5: Conclude that people are more likely to be born in October than they would be if all 365 days were equally likely.

Assigned Mon, Nov 15

12.62 **a.** H_0: $p_1 - p_2 = 0$, or equivalently, $p_1 = p_2$ (no difference in proportions)
H_a: $p_1 - p_2 < 0$, or equivalently, $p_1 < p_2$ (proportion lower for men with no anger)
b. From the Minitab output, z = –2.79.
c. Because the *p*-value = .003 < .05, reject the null hypothesis. Conclude that the probability of developing heart disease for men with no anger is lower then it is for men with the most anger.

12.83 **a.** H_0: Student did not cheat (is not guilty)
H_a: Student cheated (is guilty)
b. A Type 1 error occurs if the student is found guilty, but actually did not cheat.
The consequences are that the student would be given a failing grade unfairly, would be forced to write an essay that might be viewed as an admission of guilt, and the student's reputation and future life would be affected.
c. A Type 2 error occurs if the student is found not guilty, but actually did cheat.
The consequence is that student would get a grade in the course that was not deserved.
d. The answer will vary. Most people on a panel like the one described (or on a jury in a court trial) would think a Type 1 error is more serious here. A guilty decision has serious consequences for the student, so we would not want the decision that the student is guilty to be wrong.

12.101 The consequence of a type 1 error would be that children might be given xylitol syrup to prevent ear infections, when in fact it is not effective for that purpose. The consequence of a type 2 error would be that xylitol syrup might not be given to children to prevent ear infections, when in fact it would be effective for that purpose. Assuming xylitol has no harmful side effects and that giving xylitol does not mean withholding a treatment that would work better, a type 2 error would be more serious.

Assigned Wed, November 17

9.66 **a.** The parameter is the difference in population means for independent samples, $\mu_1 - \mu_2$.
b. The parameter is the mean of paired differences, μ_d.
c. The parameter is one population mean, μ.
d. The parameter is the difference in population means for independent samples, $\mu_1 - \mu_2$.
e. The parameter is the mean of paired differences, μ_d.

9.90 Mean = μ = \$200,000 ; s.d. $\left(\bar{x}\right) = \frac{\sigma}{\sqrt{n}} = \frac{\$25{,}000}{\sqrt{25}} = \$5{,}000$; $z = \frac{208{,}000 - 200{,}000}{5000} = 1.6$.

9.91 **a.** Yes, the sample mean may differ from sample to sample.
b. No, this standard deviation is determined from the population standard deviation and the sample size, so it is the same for any two samples of the same size.
c. Yes, the standard error of $\bar{x}$ may differ from sample to sample. The formula is $\frac{s}{\sqrt{n}}$ and the sample standard deviation *s* may be different for different samples.
d. Yes, the standardized *z*-score for $\bar{x}$ may vary from sample to sample because the value of $\bar{x}$ can vary from sample to sample.
e. No, population mean is a single value that is not affected by the characteristics of any random sample.