Lesson 8.2.1

8-27. a. H_0: the defendant is innocent. H_A: the defendant is guilty.

b. The defendant could be guilty but not proven guilty, so is allowed to go free and potentially commit another crime. Or, the defendant could be innocent but sent to jail or worse.

c. The Type I error is convicting the innocent person. The Type II error is releasing the guilty man.

d. In the United States, most believe the Type I error to be a worse mistake.

8-28. a. Most people think of money as being less important than lives!

b. Changing the significance level, α, to something higher.

8-29. a. Answers may vary.

b. The significance level, α.

c. The significance level $\alpha = P(\text{Type I Error})$

d. Answers may vary, but the long-run percentage of innocent convictions will be approximately equal to α. Scary!

8-30. a. It definitely will!

b. There is no way to calculate this! It depends on too many external factors: how much evidence was left behind, how good the investigators are, etc.

8-31. a. $H_0: p = 0.75$, $H_A: p \neq 0.75$

b. Declaring Mrs. Hoppenheimer wrong even when she is right.

c. Letting Mrs. Hoppenheimer's claim stand, even if the true proportion is not 75%.

d. 10%, since $\alpha = 0.10$.

8-32. a. Very common! There is very little chance that a sample will be able to tell the difference between 75% and 74.8%.

b. Very rare! The chances of getting a sample anywhere near the 75% mark in this case are almost 0.

c. The probability of a Type II error depends on an assumed effect size—how wrong the null hypothesis actually is.

8-33. a. A Type I error would mean deciding that Mars is incorrect in their advertised proportion when they are actually correct. A Type II error would mean deciding they could be correct when in fact they are not. In this context, neither is likely to cause any major problems; Abigail would just be wrong.

b. For her claim $z = -2.96$ and p-value = 0.003, which is less than 0.01.

c. The random condition was not met—the bag does not represent a random sample from the population.

d. No, they do not. If conditions are not met then a Type I error may be significantly more likely, since samples could be biased.

8-34. a.

	Card Stock Misses	Card Stock Hits	Total
Tracing Paper Hits	0.1054	0.0646	0.17
Tracing Paper Misses	0.5146	0.3154	0.83
Total	0.62	0.38	

b. Using the binomial cdf with $n = 5$ and $p = 0.38$, $P(x \geq 3) = 1 - P(x \leq 2) \approx 0.283$

c. Since $np = 40(0.17) = 6.8$, which is NOT > 10, the conditions for normal approximation are not satisfied. Using the binomial cdf with $p = 0.17$, $n = 40$, and looking for $x \geq 8$ (20% hit rate), can find the probability is about 0.37.

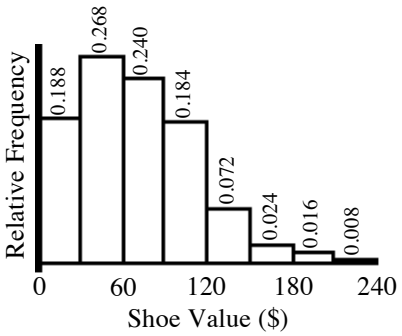
d. $np = 120(0.38) > 10$ and $n(1 - p) = 120(0.62) > 10$, so the normal approximation is allowed. Using $\mu = 0.38$ and $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.38(0.62)}{120}} \approx 0.0443$ and checking for $P(\hat{p} \geq 0.45)$ yields a probability of 0.0570. Interesting thing to note: in this case, a binomial calculation (looking for 54 or more hits) actually yields a probability more like 0.070; even though the normal is "good enough" here, it is still not great. The difference is due to the need for a continuity correction. See problem 6-77.

8-35. a. It would be unethical to bully students so an observational study is most appropriate in this situation.

b. A stratified random sample could account for the variability among students due to age.

c. The superintendent could divide the student body into three age groups: elementary, middle school, and high school. She could obtain a list of students in each group and label them with numbers. Using a random number generator, the superintendent could then select an SRS of students from each group and have them each take a survey on bullying.

8-36. a.



b. Q1: \$30 to \$60, Med: \$60 to \$90, Q3: \$90 to \$120

c. The distribution is positive or right skewed so the median and IQR would describe the center and spread. You would need the actual data points to find these values precisely but the center is approximately \$70 and the IQR is about \$60. There are no gaps the highest two observations may be outliers.

d. $\frac{6+4+2}{250} = 0.048$ or 4.8%

