Section 9.1

Example In an issue of U. S. News and World Report, an article on school standards stated that about half of all students in France, Germany, and Israel take advanced placement exams and a third pass. The same article stated that 6.6% of U. S. students take advanced placement exams and 4.4% pass. Test if the percentage of U. S. students who take advanced placement exams is more than 6.6%.

Section 9.2

Example Suppose the null hypothesis, H_0, is: Franks rock climbing equipment is safe.

- Type I error: Frank thinks that his rock climbing equipment may not be safe when, in fact, it really is safe.

- Type II error: Frank thinks that his rock climbing equipment may be safe when, in fact, it is not safe.

$\alpha =$ probability that Frank thinks his rock climbing equipment may not be safe when, in fact, it really is safe.

$\beta =$ probability that Frank thinks his rock climbing equipment may be safe when, in fact, it is not safe.

Example Suppose the null hypothesis, H_0, is: The victim of an automobile accident is alive when he arrives at the emergency room of a hospital.

- Type I error: The emergency crew thinks that the victim is dead when, in fact, the victim is alive.

- Type II error: The emergency crew does not know if the victim is alive when, in fact, the victim is dead.

$\alpha =$ probability that the emergency crew thinks the victim is dead when, in fact, he is really alive.

$\beta =$ probability that the emergency crew does not know if the victim is alive when, in fact, the victim is dead.

Section $9.4 - 9.6$

Example At wind speeds above 1000 cm/sec significant sand-moving events begin to occur. In particular, wind speeds above 1000 cm/sec move sand to new locations. The cyclic nature of wind and moving sand determines the shape and location of large sand dunes. At one test site, the prevailing direction of the wind did not change. However, the speed did change. Sixty wind speed readings gave an average speed of 1075 cm/sec. From long term experience, it can be assumed that $\sigma = 265$ cm/sec. Do these data indicate that sand is moving to new locations at this test site? Use $\alpha = 0.05$.

1. State the null and alternate hypotheses. What is the level of significance?

2. What is the value of the test statistic?

3. Find the P-value.

4. Will you reject or not reject the null hypothesis?

5. State your conclusion in the context of the application. Use the question itself in your answer.

Example Consumer Reports indicated that the mean acceleration time (0 to 60 mph) for a certain car was 10.2 seconds. In most tests of this type, regular gasoline is used. Suppose that 40 such tests were made using premium gasoline and that sample mean acceleration time, $\overline{x}$, was 9.8 seconds, assume a standard deviation, σ, of 2.1 seconds. Does this indicate that premium gasoline reduces acceleration time, on average? Use $\alpha = 0.01$.

1. State the null and alternate hypotheses. What is the level of significance?

2. What is the value of the test statistic?

3. Find the P-value.

4. Will you reject or not reject the null hypothesis?

5. State your conclusion in the context of the application. Use the question itself in your answer.

Example For healthy adults, the mean pH of arterial plasma is 7.4 pH. A new drug for arthritis has been developed. However, it is thought this drug might change blood pH. A random sample of 50 patients took this drug for 6 months. Blood tests showed that $\bar{x} = 7.1$ pH. Assume $\sigma = 0.6$ pH. Does the sample data indicate that that the drug has changed the mean pH of the blood? Use $\alpha = 0.05$.

1. State the null and alternate hypotheses. What is the level of significance?

2. What is the value of the test statistic?

3. Find the P-value.

4. Will you reject or not reject the null hypothesis?

5. State your conclusion in the context of the application. Use the question itself in your answer.

Example High airline occupancy rates on scheduled flights are essential to corporate profitability. Suppose a scheduled flight must average at least 80% occupancy in order to be profitable and examination of the occupancy rate for fifty 7AM weekday flights from San Jose to Los Angeles showed a mean occupancy rate of 78% with $s = 6\%$. Does this indicate that the scheduled flight is unprofitable? Use $\alpha = 0.05$.

Example A drug manufacturer claims that the mean potency of one of its antibiotics is 85%. A random sample of 45 capsules was tested and produced a sample mean of 85.3% and a sample standard deviation of 1.1%. Do the data provide sufficient evidence to refute the manufacturer's claim? Use $\alpha = 0.05$.

Example Isabel Myers was a pioneer in the study of personality types. In a random sample of 519 judges, it was found that 234 were extroverts. Do the data indicate that a minority of judges are extroverts? Use $\alpha = 0.05$.

Example According to the US Department of Transportation, 77% of all fatally injured automobile drivers in the US were intoxicated. A random sample of 50 records of automobile fatalities in Colorado showed that 41 were intoxicated. Do these data indicate that the population proportion of driver fatalities related to alcohol is higher in Colorado? Test using a 5% level of significance.

Section 9.10

Example Isabel Myers was a pioneer in the study of personality types. In a random sample of 519 judges, it was found that 285 were introverts. Do the data indicate that a majority of judges are introverts? Use $\alpha = 0.05$. State the null and alternate hypotheses. What is the level of significance?

Example Do runners have lower heart rates, on average? Assume that non-runners have an average heart rate of 72 beats per minute. Use $\alpha = 0.001$.

1. State the null and alternate hypotheses. What is the level of significance?

2. Suppose that we know that $\sigma = 7$ beats per minute. We randomly sample 50 runners and find that $\overline{x} = 68.25$ beats per minute. Find the test statistic.

3. Would it be likely to see $\overline{x} = 68.25$ (or less) if $\mu = 72$? Explain.

4. If we decide to "reject H_0" could we be doing this in error?

5. Is this hypothesis test statistically significant?

Example Jeffrey, as an eight-year old, established a mean time of 16.43 seconds for swimming the 25-yard freestyle, with a standard deviation of 0.8 seconds. His dad, Frank, thought that Jeffrey could swim the 25-yard freestyle faster by using goggles. Frank bought Jeffrey a new pair of expensive goggles and timed Jeffrey for 15 25-yard freestyle swims. For the 15 swims, Jeffreys mean time was 16 seconds. Frank thought that the goggles helped Jeffrey to swim faster than the 16.43 seconds. Conduct a hypothesis test using a preset $\alpha = 0.05$. Assume that the swim times for the 25-yard freestyle are normal.

Example A college football coach thought that his players could bench press a mean weight of 275 pounds. Three of his players thought that the mean weight was more than that amount. They asked 30 of their teammates for their estimated maximum lift on the bench press exercise. The data ranged from 205 pounds to 385 pounds. The actual different weights were (frequencies are in parentheses) 205(3); 215(3); 225(1); 241(2); 252(2); 265(2); 275(2); 313(2); 316(5); 338(2); 341(1); 345(2); 368(2); 385(1). (Source: data from Reuben Davis, Kraig Evans, and Scott Gunderson.)

Conduct a hypothesis test using a 2.5% level of significance to determine if the bench press mean is more than 275 pounds.

Example Toastmasters International cites a report by Gallop Poll that 40% of Americans fear public speaking. A student believes that less than 40% of students at her school fear public speaking. She randomly surveys 361 schoolmates and finds that 135 report they fear public speaking. Conduct a hypothesis test to determine if the percent at her school is less than 40%.