Stats Ch 9 A : 1, 3, 5, 7, 9, 11, 13

$p$ = % lefties

(1) $H_0$ $p = .12$ $H_a$ $p \neq .12$

(3) $H_0$ $\mu = 115$ $H_a$ $\mu > 115$ $\mu$ = mean on test

(5) $H_0$ $\sigma = 3$ $H_a$ $\sigma > 3$ $\sigma$ = standard deviation of temp.

(7) $H_0$ should be current $H_0$ $p = .37$
$H_a$ should be the other

(9) $H_0$ & $H_a$ describe $\mu$ not $\bar{x}$
$p$ not $\hat{p}$

(11) $p = .2184$
a) If $p = .12$, then the chance of getting this statistic is 21.84%
Chance of finding a sample this far from $p = .12$
with $n = 100$ in <u>either</u> direction is 21.84%

(13) $\bar{x} = 125.7$ $\sigma = 29.8$ $p = .0101$
$n = 45$
a) If $\mu$ is really 115, there is a 1.01% chance of finding a sample of 45 older students with a mean of at least 125.7

b) $\alpha = .05$ reject $H_0$ $.0101 < .05$
$\alpha = .01$ fail to reject $H_0$ $.0101 > .01$

Stats 9B 15, 19, 21, 23, 25

(15) ~~Test stat~~ A p-value of .01 means ~~the~~ if Ho is true we would expect to observe a test statistic with the value obtained or more extreme 1% of the time.

(19) a) $H_0: \mu = 6.7$ $H_a$ $\mu < 6.7$ $\mu$ = mean response time

b) Type 1: Ho correct, but rejected (they think times have improved - wrong.

Type 2: Ho wrong, but ~~accepted~~ not rejected (they think times have not improved - wron

c) Type 1 worse, city would stop trying to improve.

(21) a) Ho $\mu = 85{,}000$ $\mu$ = mean income of residents near rest.

Ha $\mu > 85{,}000$

b) Type 1: mean is 85 but conclude $\mu$ is higher, incorrectly open rest.

Type 2: mean is over 85, but conclude it is not. incorrectly chose not to open rest.

c) $\alpha = .01$ to reduce chance of type 1 error.

(23) Prob (Type 1 error) = $\alpha = .05$

Prob (Type 2 error) = 1 - power = 1 - .78 = .22

(25) Ho: $p = .10$ power = .64 if $p = .08$

Ha: $p < .10$

a) if $p = .08$, the prob of correctly rejecting the null ($p = .10$) is .64

b) More - if Ho is false, ~~more~~ larger sample = more evidence to reject Ho

Book is wrong. → c) Book says increase ~~Decrease~~ I say Decrease.

$\beta$ = prob of type 2 error

if $\alpha = .01$, then the prob of rejecting Ho goes down. This makes the prob of a type 2 error greater (Ho wrong, but not rejected) $\beta$ goes up so Power goes down

Power = $1 - \beta$

$.64 = 1 - \beta$. $\beta = .36$

d) Increase

If the true is ever further from Ho: $p = .10$ then the chance of rejecting Ho: $p = .10$ goes up Because the evidence (sample $\hat{p}$) will ~~be~~ show the Ho: $p = .10$ is wrong

Stats 9-2 C 27-30, 41, 43, 45

27 D

28 B

29 A

30 B

$\beta$ = prob of type 2 error
power $= 1-\beta$
$.9 = 1-\beta$ $\beta = .1$

41

**41. State:** $H_0: p = 0.37$ versus $H_a: p > 0.37$, where $p$ is the actual proportion of students who are satisfied with the parking situation. **Plan:** One-sample $z$ test for $p$. *Random:* The sample was randomly selected. *Normal:* The expected number of successes $np_0 = 74$ and failures $n(1 - p_0) = 126$ are both at least 10. *Independent:* There were 200 in the sample, and since there are 2500 students in the population, the sample is less than 10% of the population. **Do:** $z = 1.32$, $P$-value $= 0.0934$. **Conclude:** Since our $P$-value is greater than 0.05, we fail to reject the null hypothesis. We do not have enough evidence to conclude that the new parking arrangement increased student satisfaction with parking at this school.

43

**43.** (a) Type I error: Conclude that more than 37% of students were satisfied with the new parking arrangement when, in reality, only 37% were satisfied. *Consequence:* the principal believes that students are satisfied and takes no further action.

Type II error: Say that we do not have enough evidence to conclude that more than 37% are satisfied with the parking arrangements when, in fact, more than 37% are satisfied. *Consequence:* the principal takes further action on parking when none is needed. (b) If $p = 0.45$, the probability of (correctly) rejecting the null hypothesis is 0.75. (c) Increase the sample size or the significance level

45

**45.** (a) Firstborn children. (b) **State:** $H_0: p = 0.50$, $H_a: p > 0.50$ **Plan:** One-sample $z$ test for $p$. *Random:* The sample was randomly selected. *Normal:* $np_0 = 12{,}734$ and $n(1 - p_0) = 12{,}734$ are at least 10. *Independent:* Population more than 254,680. **Do:** $z = 5.50$, $P$-value $\approx 0$. **Conclude:** Since our $P$-value is smaller than 0.05, we reject $H_0$. It appears that boys are more prevalent among newborn firstborn children.

Stats 9-2 D 47, 49, 51, 53, 55

47

**47.** Corrections: Let $p =$ the true proportion of middle school students who engage in bullying behavior. $H_0: p = 0.75$ and $H_a: p > 0.75$. *Random:* The sample was randomly selected. *Normal:* $np_0 = 418.5$ and $n(1 - p_0) = 139.5$ are at least 10. *Independent:* Population more than 5580. $z = 2.59$, $P$-value $= 0.0048$. Since the $P$-value is small, we reject $H_0$ and conclude that more than 75% of middle school students engage in bullying behavior.

49

**49. State:** $H_0: p = 0.60$, $H_a: p \neq 0.60$ **Plan:** One-sample $z$ test for $p$. *Random:* The sample was randomly selected. *Normal:* $np_0 = 75$ and $n(1 - p_0) = 50$ are at least 10. *Independent:* Population more than 1250. **Do:** $z = 2.01$, $P$-value $=$ 0.0444. **Conclude:** Since our $P$-value is less than 0.05, we reject $H_0$. It appears that a proportion other than 0.60 of teens pass the driving test on their first attempt.

51

**51.** (a) **State:** We want to estimate the actual proportion $p$ of all teens who pass the driving test on the first try at a 95% confidence level. **Plan:** One-sample $z$ interval for $p$. *Random:* The teens were selected randomly. *Normal:* 86 successes and 39 failures are both at least 10. *Independent:* Population more than 1250. **Do:** (0.607, 0.769). **Conclude:** We are 95% confident that the interval from 0.607 to 0.769 captures the true proportion of teens who pass the driving test on the first try. (b) The interval doesn't contain 0.60 as a plausible value of $p$, which gives convincing evidence against the DMV's claim.

53 NO, because .2 is contained in the interval

55

**55.** (a) $p =$ the true proportion of teens who think that young people should wait to have sex until marriage. (b) *Random:* The sample was randomly selected. *Normal:* $np_0 = 219.5$ and $n(1 - p_0) = 219.5$ are at least 10. *Independent:* There are more than 4390 U.S. teens. (c) If the true proportion of teens who think that young people should wait to have sex until marriage is 0.50, there is a 1.1% chance of getting a sample of 439 teens that is as different from that proportion as the sample we found. (d) Yes. Since the $P$-value is less than 0.05, we reject the null hypothesis and conclude that the actual proportion of teens who think that young people should wait is not 0.50.

Stats    9-3 E    57-60, 71, 73

57 C
58 C
59 D
60 B

**71.** **State:** $H_0: \mu = 0$ versus $H_a: \mu > 0$, where $\mu$ is the actual mean amount of sweetness loss. **Plan:** One-sample $t$ test for $\mu$. *Random:* The sample was randomly selected. *Normal:* Previous experience tells us that sweetness losses will be close to Normal. *Independent:* There are at least 100 batches of the new soda available. **Do:** $t = 2.70$, $P$-value $= 0.0122$. **Conclude:** Since our $P$-value is less than 0.05, we reject $H_0$. It appears that there is an average loss of sweetness for this cola.

**73.** (a) No, $IQR = 458.2$, which is greater than max $- Q_3$ and $Q_1 -$ min. (b) If the mean daily calcium intake for women 18 to 24 years of age is really 1200 mg, then the likelihood of getting a sample of 36 women with a mean intake of 856.2 mg or smaller is roughly 0. (c) **State:** $H_0: \mu = 1200$ versus $H_a: \mu < 1200$, where $\mu$ is the actual mean daily calcium intake of women 18 to 24 years of age. **Plan:** One-sample $t$ test for $\mu$. *Random:* The sample was randomly selected. *Normal:* The sample size was 36, which is at least 30. *Independent:* There are clearly many more than 360 women in the United States. **Do:** $t = -6.73$, $P$-value is approximately 0. **Conclude:** Since our $P$-value is less than 0.05, we reject $H_0$. It appears that women in this age range are getting less than 1200 mg of calcium daily, on average.

Stats 9-3 F 75, 77, 89, 94-97, 99-104

**75.** **State:** $H_0: \mu = 0$, $H_a: \mu > 0$ **Plan:** *Random:* Random assignment. *Normal:* Graph of the data is roughly symmetric with no outliers. *Independent:* There are more than 100 plants of each variety. **Do:** $t = 1.295$, $P$-value $= 0.1138$. **Conclude:** Since $P$-value $> 0.05$, we fail to reject $H_0$. We do not have enough evidence to conclude that Variety A has a higher mean yield than Variety B.

**77.** (a) Type I error: experts conclude that Variety A has a higher mean yield when it actually doesn't. Type II error: experts conclude that there is no mean difference in yields when in fact Variety A has a higher mean yield. Type II error, since we failed to reject $H_0$. (b) Increasing the significance level, decreasing the standard deviation $\sigma$, or increasing the sample size.

**89.** (a) So that we average out any effect due to doing the activity better the second time no matter which knob is used second. (b) **State:** $H_0: \mu_d = 0$ seconds versus $H_a: \mu_d > 0$ seconds, where $\mu_d$ is the actual mean difference (left − right) in the time it takes to turn the knob with the left-hand thread and with the right-hand thread. **Plan:** Paired $t$ test for $\mu_d$. *Random:* This was a randomized experiment. *Normal:* The sample size was only 25, but the histogram below indicates no strong skewness or outliers. *Independent:* We aren't sampling, so it isn't necessary to check the 10% condition. The difference in times for individual subjects should be independent if the experiment is conducted properly.

**94.** The study may have rejected the null hypothesis, but with such a large sample size, such a rejection might occur even if the actual parameter differs only slightly from the hypothesized value. For example, the difference between $\mu = 10$ and $\mu = 10.5$ might have no practical importance.

**95.** Any number of things could go wrong with this convenience sample. Depending on the time of day or the day of the week, certain types of shoppers would or would not be present.

**96.** We have information about the whole population of interest.

**97.** (a) No, we would expect about 5 of 500 subjects who don't have ESP to do better than random guessing just by chance. (b) The researcher should repeat the procedure on these four to see if they again perform well.

99 B
100 A
101 D
102 C
103 A
104 A