HW Type I + Type II Error

p. 727, p 731, p. 763, p 771

(49) H_0: paramedics arrive on the scene of accidents 75% of the time within 8 minutes

a) H_0: $p = .75$

H_a: paramedics arrive on the scene of accidents more than 75% of the time within 8 minutes.

H_a: $p > .75$

b) Type I - Manager decides paramedics are responding more than 75% of the time within 8 minutes when in fact they're not.

Type II - Manager decides paramedics are not responding more than 75% of the time within 8 minutes when in fact they are.

c) Type I - Manager is satisfied. Feels no need for improvement

Type II - Manager not satisfied. Implements improvement measures when not necessary.

d) Type I is more serious. Lives are in danger if paramedics are not responding in time (8 minutes).

(50) H_0: mean systolic blood pressure is 130

a) H_0: $\mu = 130$

H_a: mean systolic blood pressure is greater than 130

H_a: $\mu > 130$

b) Type I - Device reads blood pressure above 130 when it is not

Type II - device reads blood pressure at or below 130 when it is above

Type I - Employee seeks medical attention that is not needed. ($$)

Type II - Employee does not seek medical attention that is needed. Could cost employee his life

c) You would want to make the probability of Type II error as small as possible. Type I error is causes inconvenience and expense, but Type II error could cause death.

(51) a) Type I - decide mean sales is larger than \$40 when it is not

Wastes money by redesigning cover to boost sales

b) Type II - decide mean sales is \$40 when it is higher

Won't make as much money as possibly could have.

c) Type I is more serious because you lose money. Type II results in only not making more money, you don't lose money.

d) omit

(53) a) H_0: mean income is \$85,000
H_0: $\mu = \$85,000$

H_a: mean income is greater than \$85,000
H_a: $\mu > \$85,000$

b) Type I - decide mean income is greater than \$85,000 when it's not

Type II - decide mean is not greater than \$85,000 when it is

c) Type I - decide to open restaurant and lose money

Type II - decide to not open restaurant and don't make money

Type I is more serious because you lose money by opening the restaurant. Type II not as serious because money is not lost, only not made.

d) Choose $\alpha = .01$ because that decreases the probability of Type I error.

p. 763

(19) Type I - experts conclude there is a mean difference in the yield when in fact there is none

a) Type II - experts conclude there is no mean difference in the yield when in fact there was one

b) Type II more serious. Experts may see need to plant more tomatoes which would be costly.

p. 771

(25) • p = proportion of free throws Shaq made

a) • 1-sample z-test for proportions

• Conditions: SRS - no reason to assume

Normal - $np \geq 10$ $(.533)(39) \geq 10$ $21 \geq 10$ $n(1-p) \geq 10$ $(39)(.467) \geq 10$ $18 \geq 10$ met

Independence - all free throws $\geq 10(39)$ met

• Hypotheses:

Ho: proportion of free throws made by Shaq is 53%

Ho: $p = .53$

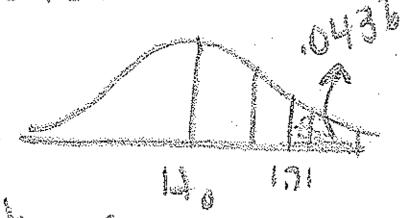
Ha: proportion of free throws made by Shaq is greater than 53%

Ha: $p > .53$

• Calculation: $p = .53$ $\hat{p} = 26/39 = .667$ $se = \sqrt{\frac{(.53)(.47)}{39}}$

$\alpha = .05$ $= .0799$

$$P\left(Z > \frac{.667-.53}{.07992}\right) = P(Z > 1.71) = .0436$$



Since our pvalue of .0436 is smaller than our significance level of $\alpha = .05$, we have evidence to reject the null. We can conclude that Shaq has improved his free throw shooting and the proportion of made free throws is greater than 53%.

b) Type I - conclude Shaq improved his free throw shooting when in fact he didn't.

Type II - conclude Shaq hadn't improved his free throw shooting

c) OMIT

d) P(Type I error) = .05 Recall it's α

P(Type II error) → You won't have to calculate, just know it is $1-\beta$. "They" will give you β in problem.

(26) • p = proportion of patients who suffered adverse reactions when taking a pain reliever

• 1 sample z-test for proportions

a) • Conditions:

SRS – no reason to assume

Normal – $np \geq 10$ $\quad n(1-p) \geq 10$

$440(.10) \geq 10 \quad 440(.90) \geq 10$ met

$44 \geq 10 \quad 396 \geq 10$

Independence – all patients taking pain reliever $\geq 10(400)$

• Hypotheses:

H_0: proportion of patients who suffered adverse reactions when taking a pain reliever is 10%

$H_0: p = .1$

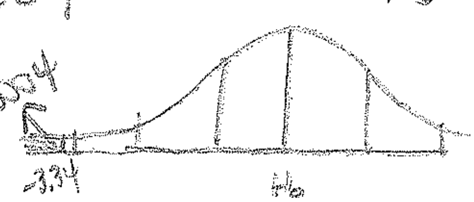
H_a: proportion of patients who suffered adverse reactions when taking a pain reliever is less than 10%

$H_a: p < .1$

• Calculations: $p = .1$, $\alpha = .05$, $\hat{p} = 23/440 = .0523$, $se = \sqrt{\frac{(.1)(.9)}{440}} = .0143$

$$P\left(z < \frac{.0523 - .1}{.0143}\right) = P(z < -3.34) = .0004$$

Since the p-value of .0004 is smaller than our significance level $\alpha = .05$ we have evidence to reject the null.



We can conclude the proportion of patients who suffer from adverse reactions when taking the pain reliever is less than 10%.

b) Type I error – researchers conclude the proportion of patients having adverse reactions is less than 10% when in fact it is not.

Type II error – researchers conclude the proportion of patients having adverse reactions is equal to 10% when in fact it is less than.

Type I is more serious. Researchers would mislead consumers and make them think less adverse reactions may occur than actually do. Could be a health risk.