Pg. 727 49-50, 53a-d, 59

11.4 Using Inference to make Decisions

Type I Errors - If we reject H_0 when H_0 is actually true

Type II Errors - If we fail to reject H_0 when H_0 is false

population

sample	H_0 true	H_a true
Reject H_0	Type I	correct
Fail to reject H_0	correct	Type II

(Discuss Ex. 11.19, 11.20)

Innocent until proven Guilty — H_0: innocent, H_a: guilty

Type I Error: Innocent but found guilty

Type II Error: Guilty but found innocent

Significance and Type I Error

The significance level α of any fixed level test is the probability of a Type I error.

α is the probability that the test will reject H_0 when H_0 is actually true

Power and Type II Error

The probability that a fixed level α significance test will reject H_0 when a particular alternative value of the parameter is true is the power of the test against that alternative

Power = 1 − B

B = probability of a Type II error for that alternative

Increasing power

- Increase sample size
- Increase α (increases likelihood of a Type I Error)
- Decrease σ
- Consider an alternative farther from μ_0

Discuss pg 731 "Power calculations are important..."

Standard

95% confidence intervals

5% significance tests

80% power

Example 11.20 Describe errors and determine consequences

$H_0: \mu = 6.7$ min $H_a: \mu < 6.7$ min

Type I: City mgr concludes the mean response time is less than 6.7 min when the response time is still 6.7 min.

Consequences: Response times haven't actually improved. Additional loss of life

Type II: City mgr concludes the mean response time is still 6.7 min when it is actually less than 6.7

Consequences: Increase city expenses for training. Disgruntled paramedics

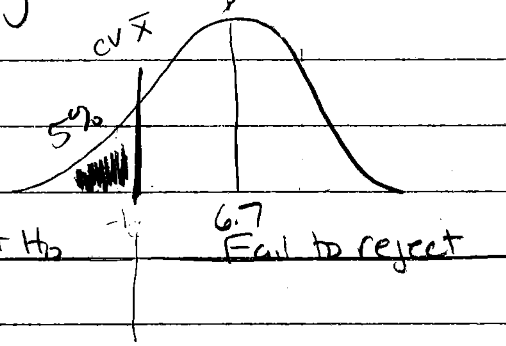
11.4 cont'd

Example 11.21

$H_0: \mu = 6.7$ min $\quad H_a: \mu < 6.7$ min $\quad \alpha = .05$

City manager wants $\mu \le 6.4$ min

z @ 5%
-1.645

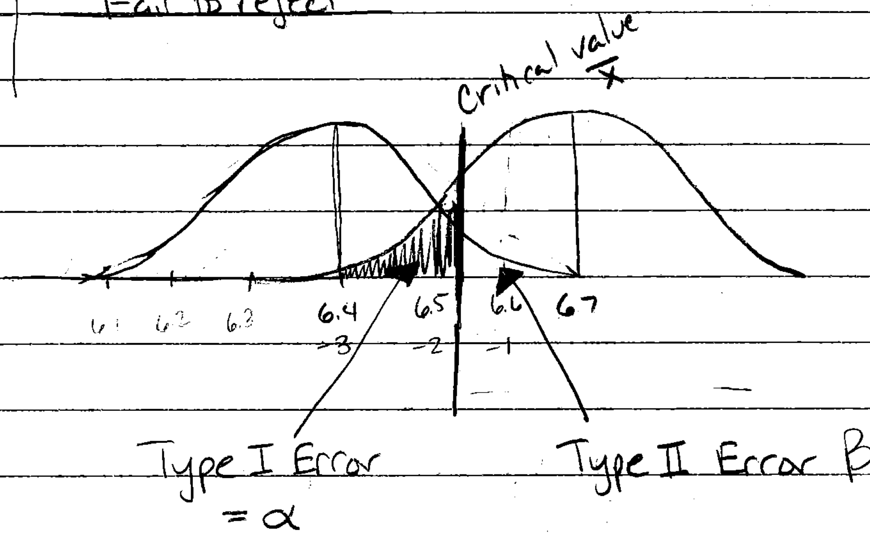


pg. 726

$\bar{X} = 6.4$

$$z = \frac{6.4 - 6.7}{.1}$$

$$= -3$$



Finding critical value

$$z = \frac{x - \mu}{\sigma} \qquad -1.645 = \frac{x - 6.7}{.1}$$

using $\bar{x} = 6.7$ curve

$$-.1645 = x - 6.7$$

$$6.5355 = x$$

$$z = \frac{6.5355 - 6.4}{.1}$$

using $\bar{x} = 6.4$ curve

$$= 1.355 \Rightarrow .9123$$

Power $= .9123$

$\beta = 1 - .9123$

$= .0877$

8.77% chance of Type II Error

Power - measures the ability of a significance test to detect an alternative hypothesis. The power against a specific alternative is the probability that the test will reject H_0 when the alternative is true

HW 11.49

(a) $H_0: p = .75$ $H_a: p > .75$

(b) Type I: mgr determines paramedics were responding to more than 75% within 8 min when they were responding to less

Type II: mgr determines they were responding to 75% or less within 8 min when they were responding to more than 75% within 8 min

(c) Type I consequences: City officials may believe they are doing well responding to over 75% when they need to improve

Type II consequences: resources may be utilized to try and improve times when that is not necessary

(d) Type I consequences could cost lives

(e) Answers vary