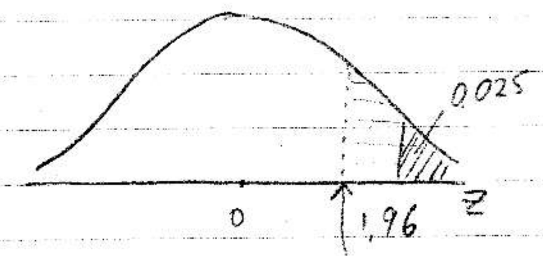
5/1

Ch 11-4

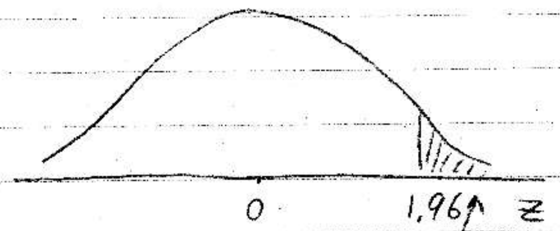
p-value approach to H.T.
- dased on computer output
- no critical value is reported
- instead, a "p-value" is reported

Critical Region



$H_1: p > 20$
rigth tail
$\alpha = 0.025$
"p-value" is area to the right (because it is a right tail test) is $> \alpha$

test statistic
stat value = 1.31
$p = 0.951$

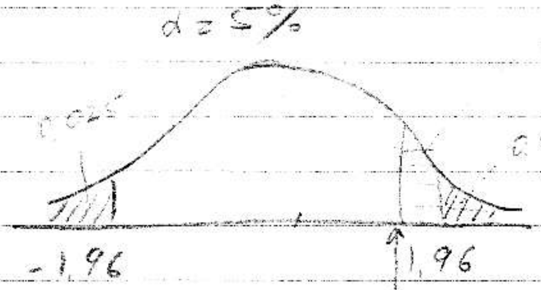


"p-value" is area to the right (because we have a right tail test) is $< \alpha$

if test stat = 2.14
$p = 0.0162$

If p-value is less than α, then reject H_0!

Oterwise, do not reject H_0!



take this area and double it

if test stat = 1.31

Ch. 11-2 } counts in categories
ch. 11-3 } Each category has a "p"
ch. 11-4 means for more than 2 treatments

ch. 11-2 Multi-nomial or Goodness-of-fit

Is this die fair?

p555

X	600 trials Frequency (observed)	Hypothesis Expected	Obs-Exp $\frac{(O-E)^2}{E}$
1	105	100	0.25
2	92	100	0.64
3	96	100	0.16
4	101	100	0.01
5	112	100	1.44
6	94	100	0.36
	600		$\Sigma = 2.86$

Test stat $\Sigma\left[\frac{(O-E)^2}{E}\right]$

H_0 : die is fair
H_1 : die is not fair

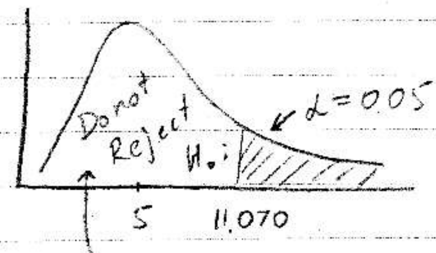
H_0 : $p_1 = 1/6$ $p_2 = 1/6$, $p_3 = 1/6$, $p_4 = 1/6$, $p_5 = \frac{1}{6}$, $p_6 = 1/6$

H_1 : not H_0 ;

$\alpha = 0.05$ Right tail

Critical Rejion
chi - square
d.f = number of categories − 1 = $k - 1$

d.f = 6 − 1



Do not Reject H_0!

$\Sigma = 2.86$

Quis 18 (2)
Example Exam Set p. 16 # 4

Contingency Tables

$$E = \frac{(\text{Row total})(\text{Cat. total})}{\text{Grand Total}}$$

8	3	14	25
2	17	16	35
10	20	30	60

$$df = (r-1)(c-1) = (2-1)(3-1) = 2$$

Tables

Gender	Toy	# kids
B	Ball	40
G	Ball	20
B	Doll	5
G	Doll	25
B	Bell	5
G	Bell	5
		100

	B	G	
Ball	40	20	60
Doll	5	25	30
Bell	5	5	10
	50	50	100

11-3 Test of Homogeneity

p. 573 We test the claim that different populations have the same proportion of some characteristics.

Example:

H_0: People in the different age groups use the slung terms in the same proportions

H_1:

12#1 Quiz 13(1)
Ex Exam Set p 15 #7 } Homogeneous in H_0:

Quiz 13(2) → independent in H_0:

11-4 Analysis of Variance

p.583 Treatment

p. 591

Blood pressure	1	2	3	4	5	$\bar{\bar{X}}$
	120	112				
	110	128				
	108	119				
		109				
		114				
$\bar{X}$ =						
S =						
n =	3	5				

$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 \equiv \mu$

H_1: not H_0:

Assume: $\sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \sigma_4^2 = \sigma_5^2 = \sigma^2$

homogeneous variances

μ

θ

Difference between treatments (groups)
Differences within treatments (groups)

Ex Exam Set p 17 # 6

$$\bar{X}_1 - \bar{X}_2$$

$$\downarrow \qquad \downarrow$$

$$\frac{\theta_1}{\sqrt{n_1}} \qquad \frac{\theta_2}{\sqrt{n_2}}$$

G_1	G_2
10	31
9	30
10	29
10	29
11	30

not random

G_1	G_2
10	12
30	31
41	39
22	25
50	52

doesn't mean much

$$\frac{\text{Variation Between groups}}{\text{Variation within groups}}$$

$$S^2_{pool} = \frac{(n_1-1)S_1^2 + (n_2-1)S_2^2 + (n_3-1)S_3^2 + (n_4-1)S_4^2 + (n_5-1)S_5^2}{(n_1-1)+(n_2-1)+(n_3-1)+(n_4-1)+(n_5-1)}$$

$$\sum_{i=1}^{k} n_i(\bar{x}_i - \bar{\bar{x}})^2 \rightarrow$$ treatment sum of squares

Total Variation = Explained variation + Unexplained variation

$$\Sigma(x-\bar{\bar{x}})^2 = \text{Total sum of squares} =$$

$$= \underset{\text{between groups}}{\text{Treatment } \underline{\underline{SS}}} + \underset{\text{withing groups}}{\text{Error } \underline{\underline{SS}}}$$

Sours of Variation	d.f.	sum of squares	Mean squares	test statistic F
Treatments	$k-1$	SS(treat)	$\frac{SS(treat)}{k-1}$	$\frac{MS(treat)}{MS(Error)}$
Error	$N-k$	SS(Error)	$\frac{SS(Error)}{N-k}$	
	$N-1$	SS(total)		

$$S^2_{pool} = \frac{SS(Error)}{N-k}$$

$$SS(treat) = MS(treat) \cdot d.f.$$

p. 618 F Distribution ($\alpha = 0.05$)