Chapter 11

11.4)

	1	2	Total
1	20 / 25	30 / 25	50
2	30 / 25	20 / 25	50
Total	50	50	100

a)

$$f_e = \frac{rowtotal * columntotal}{n}$$

$f_{11} = \frac{50*50}{100} = 25$, $f_{12} = \frac{50*50}{100} = 25$, $f_{21} = \frac{50*50}{100} = 25$, $f_{22} = \frac{50*50}{100} = 25$

b)

Test statistic: $\chi^2_{STAT} = \sum_{\text{All Cells}} \frac{(f_0 - f_e)^2}{f_e} = \frac{(20-25)^2}{25} + \frac{(30-25)^2}{25} + \frac{(30-25)^2}{25} + \frac{(20-25)^2}{25}$

$= 1.00 + 1.00 + 1.00 + 1.00 = 4$

Decision rule: If $\chi^2 > 3.841$, reject H_0.

Decision: Since $\chi^2_{STAT} = \sum_{\text{All Cells}} \frac{(f_0 - f_e)^2}{f_e} = 4$ is greater than the critical value of 3.841, reject H_0. It is significant at the 5% level of significance.

11.5)

	Male	Female	Total
Yes	195 / 250	305 / 250	500
No	305 / 250	195 / 250	500
Total	500	500	1000

1- H_0: $\pi_1 = \pi_2$ H_1: $\pi_1 \neq \pi_2$ where population: 1 = males, 2 = females

2- $\alpha=0.01$

3- $\chi^2_{STAT} = \sum_{\text{All Cells}} \frac{(f_0 - f_e)^2}{f_e}$

$$f_e = \frac{rowtotal * columntotal}{n}$$

$f_{11} = \frac{500*500}{1000} = 250$, $f_{12} = \frac{500*500}{1000} = 250$, $f_{21} = \frac{500*500}{1000} = 250$, $f_{22} = \frac{500*500}{1000} = 250$

Test statistic: $\chi^2_{STAT} = \sum_{\text{All Cells}} \frac{(f_0 - f_e)^2}{f_e} = \frac{(195-250)^2}{250} + \frac{(305-250)^2}{250} + \frac{(305-250)^2}{250} +$

$\frac{(194-250)^2}{250} = 48.4$

4- Decision rule: $df = 1$. If $\chi^2_{STAT} > 6.6349$, reject H_0.

5- Decision: Since $\chi^2_{STAT} = 48.4$ is larger than the upper critical bound of 6.6349, reject H_0. There is enough evidence to conclude that there is significant difference between the proportions of males and females who buy clothing from their mobile devices at the 0.01 level of significance.

11.12)

	A	B	C	Total
1	10 20	30 30	50 40	90
2	40 30	45 45	50 60	135
Total	50	75	100	225

a)

$$f_e = \frac{rowtotal * columntotal}{n}$$

$f_{11} = \frac{90*50}{225} = 20$, $f_{12} = \frac{90*75}{225} = 30$, $f_{12} = \frac{90*100}{225} = 40$,
$f_{21} = \frac{135*50}{225} = 30$, $f_{22} = \frac{135*75}{225} = 45$, $f_{12} = \frac{135*100}{225} = 60$,

b)

Test statistic: $\chi^2_{STAT} = \sum_{\text{All Cells}} \frac{(f_0 - f_e)^2}{f_e} = \frac{(10-20)^2}{20} + \frac{(30-30)^2}{30} + \frac{(50-40)^2}{40} + \frac{(40-30)^2}{30} + \frac{(45-45)^2}{45} + \frac{(50-60)^2}{60} = 12.500$

Decision rule: If $\chi^2 > 5.991$, reject H_0.

Decision: Since $\chi^2_{STAT} = \sum_{\text{All Cells}} \frac{(f_0 - f_e)^2}{f_e} = 12.500$ is greater than the critical value of 5.991, reject H_0. It is significant at the 5% level of significance.

11.25)

	Under 36	36-50	50+	Total
Local TV	109	118	138	365
National TV	73	105	125	303
Radio	77	98	111	286
Local newspaper	52	78	101	231
Internet	93	87	75	255
Total	404	486	550	1440

1- H_0: Age group and where people primarily get their news are independent
H_1: Age group and where people primarily get their news are dependent

2- $\alpha = 0.05$

3- $\chi^2_{STAT} = \sum_{\text{All Cells}} \frac{(f_0 - f_e)^2}{f_e}$

$$f_e = \frac{rowtotal * columntotal}{n}$$

	Under 36	36-50	50+	Total
Local TV	102.403	123.188	139.410	365
National TV	85.008	102.263	115.729	303
Radio	80.239	96.525	109.236	286
Local newspaper	64.808	77.963	88.229	231
Internet	71.542	86.063	97.396	255
Total	404	486	550	1440

*The table contains expected frequency values associated with each cell

Test statistic: $\chi^2_{STAT} = \sum_{\text{All Cells}} \frac{(f_0 - f_e)^2}{f_e} = \frac{(109-102.403)^2}{102.403} + \cdots + \frac{(75-97.396)^2}{97.396} =$
0.425+0.218+0.014+1.696+0.073+0.743+0.131+0.023+0.028+2.531+0.000+1.849+6.436+0.010+5.150=19.328

4- Decision rule: $df = 8$. If $\chi^2_{STAT} > 15.07$, reject H_0.

5- Decision: Since the test statistic is greater than the critical value, reject the null hypothesis and conclude there is a significant relationship.