Note: Graphs are not to scale and are intended to convey a general idea.

Answers may vary due to rounding, TI-83's, or computer programs.

EXERCISE SET 11-1

1.
The variance test compares a sample variance to a hypothesized population variance; the goodness-of-fit test compares a distribution obtained from a sample with a hypothesized distribution.

2.
The degrees of freedom is the number of categories minus one.

3.
The expected values are computed based on what the null hypothesis states about the distribution.

4.
The classes should be combined with another class.

5.
H_0: The students show no preference for class times.
H_1: The students show a preference for class times. (claim)

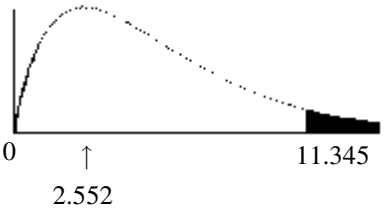
C. V. $= 11.345$ d. f. $= 3$ $\alpha = 0.01$

$E = \frac{116}{4} = 29$

$\chi^2 = \frac{(24-29)^2}{29} + \frac{(35-29)^2}{29} + \frac{(31-29)^2}{29} + \frac{(26-29)^2}{29}$

$\chi^2 = 2.552$

5. continued



Do not reject the null hypothesis. There is not enough evidence to support the claim that that the students show a preference for class times.

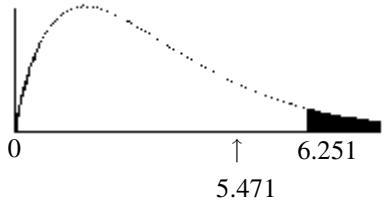
6.
H_0: The distribution of the blood type of the patients were as follows: type A, 20%; type B, 28%; type O, 36%; and type AB, 16%. (claim)
H_1: The distribution differs from those of the general population.

C. V. $= 6.251$ d. f. $= 3$ $\alpha = 0.10$

O	E
12	0.20(50) = 10
8	0.28(50) = 14
24	0.36(50) = 18
6	0.16(50) = 8

$\chi^2 = \frac{(12-10)^2}{10} + \frac{(8-14)^2}{14} + \frac{(24-18)^2}{18} + \frac{(6-8)^2}{8}$

$\chi^2 = 5.471$



Do not reject the null hypothesis. There is not enough evidence to reject the claim that the distribution is the same as the general population.

7.

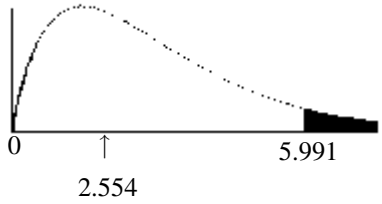
H_0: The distribution is as follows: 45% favor extending the school year, 47% do not want the school year extended, and 8% have no opinion.

H_1: The distribution is not the same as that stated in the null hypothesis. (claim)

C. V. = 5.991 d. f. = 2 $\alpha = 0.05$

O	E
46	0.45(100) = 45
42	0.47(100) = 47
12	0.08(100) = 8

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(46-45)^2}{45} + \frac{(42-47)^2}{47} + \frac{(12-8)^2}{8} = 2.554$$



Do not reject the null hypothesis. There is not enough evidence to support the claim that the percentages are different from the ones stated in the null hypothesis.

8.

H_0: The performance of airlines is that 70.8% were on time, 12% were delayed for various reasons, 8.2% were delayed by the National Aviation System, and 9% were delayed by other aircraft arriving late.

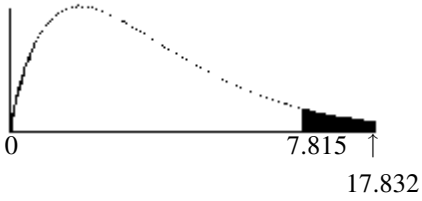
H_1: The proportions of delays are different from those stated in the null hypothesis. (claim)

Status	O	E
On time	125	0.708(200) = 141.6
Delayed	40	0.12(200) = 24
NAS Delay	10	0.082(200) = 16.4
Late	25	0.09(200) = 18

8. continued

C. V. = 7.815 d. f. = 3 $\alpha = 0.05$

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(125-141.6)^2}{141.6} + \frac{(40-24)^2}{24} + \frac{(10-16.4)^2}{16.4} + \frac{(25-18)^2}{18} = 17.832$$



Reject the null hypothesis. There is enough evidence to support the claim that the proportions are different.

9.

H_0: The proportions are distributed as follows: safe, 35%; not safe, 52%; no opinion, 13%.

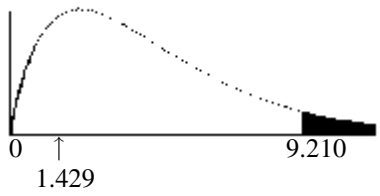
H_1: The distribution is not the same as stated in the null hypothesis. (claim)

C. V. = 9.210 d. f. = 2 $\alpha = 0.01$

O	E
40	0.35(120) = 42
60	0.52(120) = 62.4
20	0.13(120) = 15.6

$$\chi^2 = \frac{(40-42)^2}{42} + \frac{(60-62.4)^2}{62.4} + \frac{(20-15.6)^2}{15.6}$$

$$\chi^2 = 1.429$$



Do not reject the null hypothesis. There is not enough evidence to support the claim that the proportions are different.

10.

H_0: The distribution of truck colors is white, 31%; black, 19%; silver, 11%; red, 17%; gray, 10%; blue, 8%, and other, 10%.

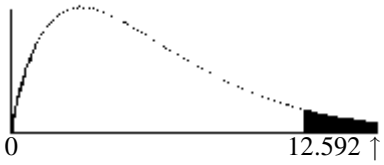
H_1: The distribution is not the same as stated in the null hypothesis. (claim)

O	E
45	0.31(180) = 55.8
32	0.19(180) = 34.2
30	0.11(180) = 19.8
30	0.11(180) = 19.8
22	0.10(180) = 18
15	0.08(180) = 14.4
6	0.10(180) = 18

C. V. = 12.592 $\alpha = 0.05$ d. f. = 6

$$\chi^2 = \frac{(45-55.8)^2}{55.8} + \frac{(32-34.2)^2}{34.2} + \frac{(30-19.8)^2}{19.8} + \frac{(30-19.8)^2}{19.8} + \frac{(22-18)^2}{18} + \frac{(15-14.4)^2}{14.4} + \frac{(6-18)^2}{18}$$

$\chi^2 = 21.655$



Reject the null hypothesis. There is enough evidence to support the claim that the distribution is different from the one stated in the null hypothesis.

11.

H_0: Employee absences are equally distributed over the five-day workweek.

H_1: Employee absences are not equally distributed over the five-day workweek. (claim)

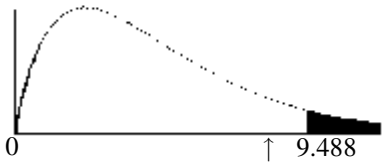
$E = \frac{85}{5} = 17$

C. V. = 9.488 d. f. = 4 $\alpha = 0.05$

11. continued

$$\chi^2 = \frac{(13-17)^2}{17} + \frac{(10-17)^2}{17} + \frac{(16-17)^2}{17} + \frac{(22-17)^2}{17} + \frac{(24-17)^2}{17}$$

$\chi^2 = 8.235$



Do not reject the null hypothesis. There is not enough evidence to say that the absences are not equally distributed during the week.

12.

H_0: The distribution for participating children is 4% five-year olds, 52% four-year olds, 34% three-year olds, and 10% under 3 years of age.

H_1: The distribution is not the same as stated in the null hypothesis. (claim)

O	E
20	0.04(200) = 8
120	0.52(200) = 104
40	0.34(200) = 68
20	0.1(200) = 20

$$\chi^2 = \frac{(20-8)^2}{8} + \frac{(120-104)^2}{104} + \frac{(40-68)^2}{68} + \frac{(20-20)^2}{20}$$

$\chi^2 = 31.991$

P-value: 0.00 < 0.05

(TI: P-value = 0.00000053)

Reject the null hypothesis. There is enough evidence to conclude that the proportions are not the same as stated.

13.

H_0: 10% of deaths were ages 0 - 19, 50% were ages 20 - 44, and 40% were ages 45 and older.

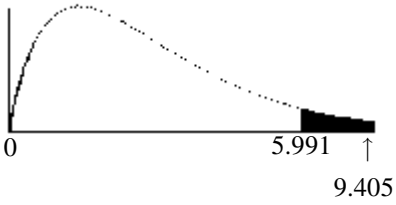
H_1: The distribution is not the same as stated in the null hypothesis. (claim)

O	E
13	0.10(100) = 10
62	0.50(100) = 50
25	0.40(100) = 40

C. V. $= 5.991$ d. f. $= 2$ $\alpha = 0.05$

$$\chi^2 = \frac{(13-10)^2}{10} + \frac{(62-50)^2}{50} + \frac{(25-40)^2}{40}$$

$$\chi^2 = 9.405$$



Reject the null hypothesis. There is enough evidence to support the claim that the proportions are different from those stated by the National Safety Council.

14.

H_0: The distribution of degree recipients is as follows: associates degrees, 23.3%; bachelor degrees, 51.1%; professional degrees, 3%; master degrees, 20.6%; and doctoral degrees, 2%.

H_1: The distribution is not the same as stated in the null hypothesis. (claim)

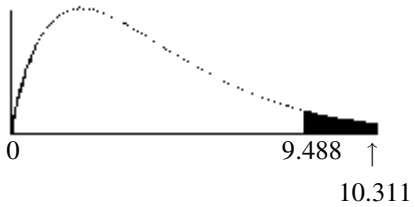
O	E
155	0.233(800) = 186.4
450	0.511(800) = 408.8
20	0.03(800) = 24
160	0.206(800) = 164.8
15	0.02(800) = 16

C. V. $= 9.488$ d. f. $= 4$ $\alpha = 0.05$

$$\chi^2 = \frac{(155-186.4)^2}{186.4} + \frac{(450-408.8)^2}{408.8} + \frac{(20-24)^2}{24} + \frac{(160-164.8)^2}{164.8} + \frac{(15-16)^2}{16}$$

14. continued

$\chi^2 = 10.311$



Reject the null hypothesis. There is enough evidence to support the claim that the distribution is not as stated in the null hypothesis.

15.

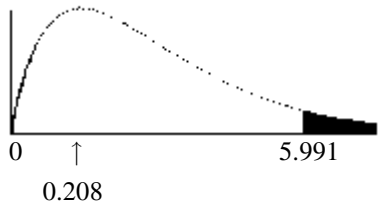
H_0: The proportion of Internet users is the same for all groups.

H_1: The proportion of Internet users is not the same for all groups. (claim)

$$E = \frac{125}{3} = 41.67$$

C. V. $= 5.991$ d. f. $= 2$ $\alpha = 0.05$

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(44-41.67)^2}{41.67} + \frac{(41-41.67)^2}{41.67} + \frac{(40-41.67)^2}{41.67} = 0.208$$



Do not reject the null hypothesis. There is not enough evidence to support the claim that the proportions differ.

16.

H_0: The sales of retail automobiles were 16.0% luxury, 4.6% large, 39.8% midsize, and 39.6% small.

H_1: The proportions differ from those stated in the null hypothesis. (claim)

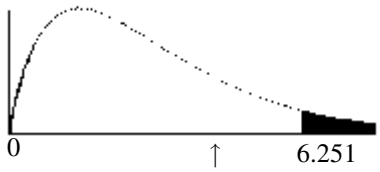
16. continued

C. V. = 6.251 d. f. = 3 $\alpha = 0.10$

O	E
25	0.16(150) = 24
12	0.046(150) = 6.9
60	0.398(150) = 59.7
53	0.396(150) = 59.4

$$\chi^2 = \frac{(25-24)^2}{24} + \frac{(12-6.9)^2}{6.9} + \frac{(60-59.7)^2}{59.7} + \frac{(53-59.4)^2}{59.4}$$

$\chi^2 = 4.502$



Do not reject the null hypothesis. There is not enough evidence to support the claim that the proportions are different from those given in the report.

17.

H_0: The distribution of the ways people pay for their prescriptions is as follows: 60% used personal funds, 25% used insurance, and 15% used Medicare. (claim)

H_1: The distribution is not the same as stated in the null hypothesis.

$\alpha = 0.05$ d. f. = 2

P-value > 0.05

(TI: P-value = 0.7164)

O	E
32	0.6(50) = 30
10	0.25(50) = 12.5
8	0.15(50) = 7.5

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(32-30)^2}{30} + \frac{(10-12.5)^2}{12.5} + \frac{(8-7.5)^2}{7.5} = 0.667$$

Do not reject the null hypothesis since P-value > 0.05.

17. continued

There is not enough evidence to reject the claim that the distribution is the same as stated in the null hypothesis. An implication of the results is that the majority of people are using their own money to pay for medications. A less expensive medication could help people financially.

18.

H_0: The number of people who do not have health insurance is equally distributed over the three educational categories.

H_1: The number of people who do not have health insurance is not equally distributed over the three categories. (claim)

$\alpha = 0.05$ d. f. = 2

0.01 < P-value < 0.025

(TI: P-value = 0.01742)

$$E = \frac{60}{3} = 20$$

$$\chi^2 = \frac{(29-20)^2}{20} + \frac{(20-20)^2}{20} + \frac{(11-20)^2}{20}$$

$\chi^2 = 8.1$

Reject the null hypothesis since 0.01 < P-value < 0.025. (TI: 0.01742) There is enough evidence to support the claim that the number of people who don't have health insurance is not equally distributed over the three educational categories. Perhaps those with more education have better jobs that provide employee health insurance.

19.

H_0: The coins are balanced and randomly tossed. (claim)

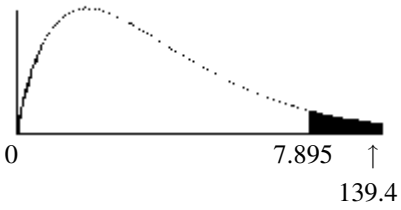
H_1: The distribution is not the same as stated in the null hypothesis.

C. V. = 7.815 d. f. = 3

19. continued

E(0) = 0.125(72) = 9
E(1) = 0.375(72) = 27
E(2) = 0.375(72) = 27
E(3) = 0.125(72) = 9
(use the binomial distribution with n = 3 and p = 0.05)

$$\chi^2 = \frac{(3-9)^2}{9} + \frac{(10-27)^2}{27} + \frac{(17-27)^2}{27} + \frac{(42-9)^2}{9} = 139.4$$



Reject the null hypothesis. There is enough evidence to reject the claim that the coins are balanced and randomly tossed.

20.
Answers will vary.

EXERCISE SET 11-2

1.
The independence test and the goodness of fit test both use the same formula for computing the test-value; however, the independence test uses a contingency table whereas the goodness of fit test does not.

2.
d. f. = (rows − 1)(columns − 1)

3.
H_0: The variables are independent or not related.
H_1: The variables are dependent or related.

4.
Contingency table.

5.
The expected values are computed as (row total · column total) ÷ grand total.

6.
H_0: $p_1 = p_2 = p_3 = \cdots = p_n$
H_1: At least one proportion is different from the others.

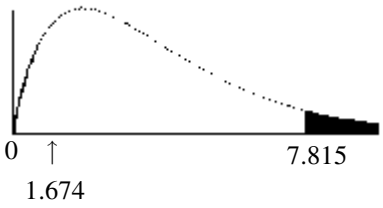
7.
H_0: The living arrangement of a person is independent of the gender of the person.
H_1: The living arrangement of a person is dependent upon the gender of the person. (claim)

C. V. = 7.815 d. f. = 3 $\alpha = 0.05$

	Spouse	Relative	Nonrelative	Alone
Men	57(55)	8(6.5)	25(26.5)	10(12)
Women	53(55)	5(6.5)	28(26.5)	14(12)

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(57-55)^2}{55} + \frac{(8-6.5)^2}{6.5} + \frac{(25-26.5)^2}{26.5} + \frac{(10-12)^2}{12} + \frac{(53-55)^2}{55} + \frac{(5-6.5)^2}{6.5} + \frac{(28-26.5)^2}{26.5} + \frac{(14-12)^2}{12}$$

$\chi^2 = 1.674$



Do not reject the null hypothesis. There is not enough evidence to support the claim that the living arrangement of a person is dependent on the gender of the individual.

8.

H_0: Movie attendance by year is independent of the ethnicity of the movie goers.

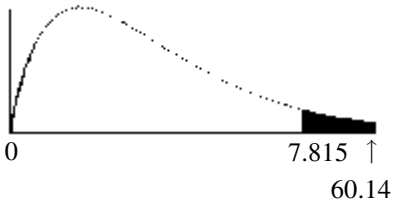
H_1: Movie attendance by year is dependent upon the ethnicity of the movie goers. (claim)

C. V. = 7.815 d. f. = 3 $\alpha = 0.05$

	Cauc.	Hisp.	Af. Am.	Other
2013	724(639.04)	335(366.25)	174(190.43)	107(144.28)
2014	370(454.96)	292(260.75)	152(135.57)	140(102.72)

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(724-639.04)^2}{639.04} + \frac{(335-366.25)^2}{366.25} + \frac{(174-190.43)^2}{190.43} + \frac{(107-144.28)^2}{144.28} + \frac{(370-454.96)^2}{454.96} + \frac{(292-260.75)^2}{260.75} + \frac{(152-135.57)^2}{135.57} + \frac{(140-102.72)^2}{102.72}$$

$\chi^2 = 60.14$



Reject the null hypothesis. There is sufficient evidence to support the claim that movie attendance by year is dependent upon the ethnicity of movie goers.

9.

H_0: Pet ownership is independent of the number of persons living in the household.

H_1: Pet ownership is dependent on the number of persons living in the household. (claim)

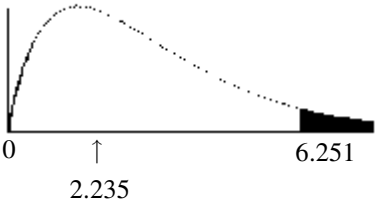
C. V. = 6.251 d. f. = 3 $\alpha = 0.10$

	1 person	2 people	3 people	4 or more people
Dog	7(8)	16(15)	11(13.5)	16(13.5)
Cat	9(8)	14(15)	16(13.5)	11(13.5)

9. continued

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(7-8)^2}{8} + \frac{(16-15)^2}{15} + \frac{(11-13.5)^2}{13.5} + \frac{(16-13.5)^2}{13.5} + \frac{(9-8)^2}{8} + \frac{(14-15)^2}{15} + \frac{(16-13.5)^2}{13.5} + \frac{(11-13.5)^2}{13.5}$$

$\chi^2 = 2.235$



Do not reject the null hypothesis. There is not enough evidence to support the claim that pet ownership is dependent on the number of persons living in the household.

10.

H_0: The rank of women personnel is independent of the military branch of service.

H_1: The rank of women personnel is dependent upon the military branch of service. (claim)

C. V. = 7.815 d. f. = 3 $\alpha = 0.05$

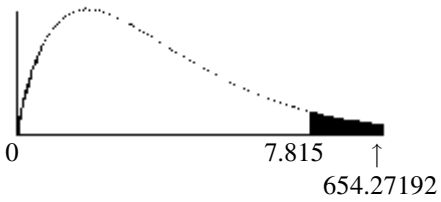
Rank

Branch	Officers	Enlisted
Army	10,791(11,463.0612)	62,491(61,818.9388)
Navy	7816(7909.7344)	42,750(42,656.2656)
Marine Corps	932(1635.7254)	9525(8821.2746)
Air Force	11,819(10,349.4790)	54,344(55,813.5210)

$$\chi^2 = \frac{(10791-11463.0612)^2}{11463.0612} + \frac{(62491-61818.9388)^2}{61818/9388} + \frac{(7816-7909.7344)^2}{7909.7344} + \frac{(42750-42656.2656)^2}{42656.2656} + \frac{(932-1635.7254)^2}{1635.7254} + \frac{(9525-8821.2746)^2}{8821.2746} + \frac{(11819-10349.4790)^2}{10349.4790} + \frac{(54344-55813.5210)^2}{55813.5210}$$

10. continued

$\chi^2 = 654.272$



Reject the null hypothesis. There is enough evidence to support the claim that rank is dependent upon the military branch of service.

11.

H_0: The types of violent crimes committed are independent of the cities where they are committed.

H_1: The The types of violent crimes committed are dependent upon the cities where they are committed. (claim)

C. V. $= 12.592$ d. f. $= 6$ $\alpha = 0.05$

$$E = \frac{\text{(row sum)(column sum)}}{\text{grand total}}$$

$$E_{1,1} = \frac{(119)(85)}{502} = 20.1494$$

$$E_{1,2} = \frac{(119)(141)}{502} = 33.4243$$

$$E_{1,3} = \frac{(119)(276)}{502} = 65.4263$$

$$E_{2,1} = \frac{(119)(85)}{502} = 20.1494$$

$$E_{2,2} = \frac{(119)(141)}{502} = 33.4243$$

$$E_{2,3} = \frac{(119)(276)}{502} = 65.4263$$

$$E_{3,1} = \frac{(128)(85)}{502} = 21.6733$$

$$E_{3,2} = \frac{(128)(141)}{502} = 35.9522$$

$$E_{3,3} = \frac{(128)(276)}{502} = 70.3745$$

$$E_{4,1} = \frac{(136)(85)}{502} = 23.0279$$

$$E_{4,2} = \frac{(136)(141)}{502} = 38.1992$$

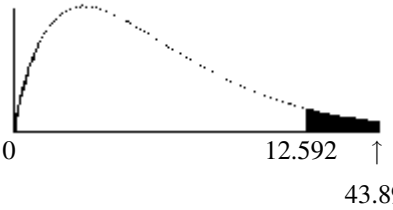
11. continued

$$E_{4,3} = \frac{(136)(276)}{502} = 74.7729$$

City	Rape	Robbery	Assault
Cary, NC	14(20.1494)	35(33.4243)	70(65.4263)
Amherst, NY	10(20.1494)	33(33.4243)	76(65.4263)
Simi Valley, CA	14(21.6733)	37(35.9522)	77(70.3745)
Norman, OK	47(23.0279)	36(38.1992)	53(74.7729)

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(14-20.1494)^2}{20.1494} + \frac{(35-33.4243)^2}{33.4243} + \frac{(70-65.4263)^2}{65.4263} + \frac{(10-20.1494)^2}{20.1494} + \frac{(33-33.4243)^2}{33.4243} + \frac{(76-65.4263)^2}{65.4263} + \frac{(14-21.6733)^2}{21.6733} + \frac{(37-35.9522)^2}{35.9522} + \frac{(77-70.3745)^2}{70.3745} + \frac{(47-23.0279)^2}{23.0279} + \frac{(36-38.1992)^2}{38.1992} + \frac{(53-74.7729)^2}{74.7729}$$

$\chi^2 = 43.890$



Reject the null hypothesis. There is enough evidence to support the claim that the types of violent crimes are dependent upon the cities where they are committed.

12.

H_0: The size of the population (by age) is independent of the state.

H_1: The size of the population (by age) is dependent upon the state. (claim)

C. V. $= 11.071$ d. f. $= 5$ $\alpha = 0.05$

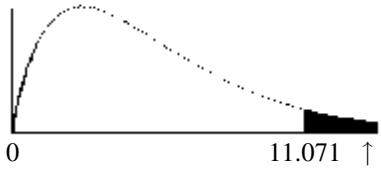
State	Under 5	5 - 17	18 - 24
PA	721(753.9308)	2140(2190.0631)	1025(1078.5184)
OH	740(707.0692)	2104(2053.9369)	1065(1011.4816)

12. continued

State	25 - 44	45 - 64	65 +
PA	3515(3547.2417)	2702(2677.7185)	1899(1754.5275)
OH	3359(3326.7583)	2487(2511.2815)	1501(1645.4725)

$$\chi^2 = \frac{(721-753.9308)^2}{753.9308} + \frac{(2140-2190.0631)^2}{2190.0631} + \frac{(1025-1078.5184)^2}{1078.5184} + \frac{(3515-3547.2417)^2}{3547.2417} + \frac{(2702-2677.7185)^2}{2677.7185} + \frac{(1899-1754.5275)^2}{1754.5275} + \frac{(740-707.0692)^2}{707.0692} + \frac{(2104-2053.9369)^2}{2053.9369} + \frac{(1065-1011.4816)^2}{1011.4816} + \frac{(3359-3326.7583)^2}{3326.7583} + \frac{(2487-2511.2815)^2}{2511.2815} + \frac{(1501-1645.4725)^2}{1645.4725}$$

$\chi^2 = 36.466$



36.466

Reject the null hypothesis. There is enough evidence to support the claim that the size of the population (by age) is dependent upon the state.

13.

H_0: The length of unemployment time is independent of the type of industry where the worker is employed.

H_1: The length of unemployment time is dependent upon the type of industry where the worker is employed. (claim)

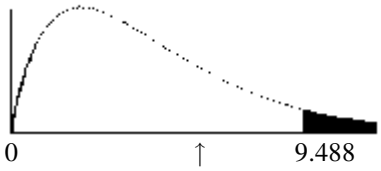
C. V. = 9.488 d. f. = 4 $\alpha = 0.05$

	< 5 wks	5 - 14 wks	15 - 26 wks
Trans./Util.	85(81.0368)	110(104.2974)	80(89.6658)
Information	48(44.2019)	57(56.8895)	45(48.9086)
Financial	83(90.7613)	111(116.8131)	114(100.4256)

13. continued

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(85-81.0368)^2}{81.0368} + \frac{(110-104.2974)^2}{104.2974} + \frac{(80-89.6658)^2}{89.6658} + \frac{(48-44.2019)^2}{44.2019} + \frac{(57-56.8895)^2}{56.8895} + \frac{(45-48.9086)^2}{48.9086} + \frac{(83-90.7613)^2}{90.7613} + \frac{(111-116.8131)^2}{116.8131} + \frac{(114-100.4256)^2}{100.4256}$$

$\chi^2 = 4.974$



4.974

Do not reject the null hypothesis. There is not enough evidence to support the claim that the length of unemployment time is dependent upon the type of industry where the worker is employed.

14.

H_0: The political party affiliation of congressional representatives is independent of the state of the representative.

H_1: The political party affiliation of the congressional representatives is dependent on the state of the representative. (claim)

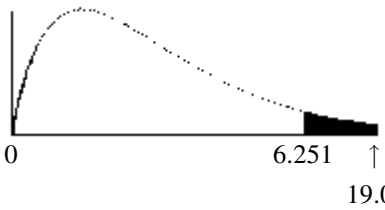
C. V. = 6.251 d. f. = 3 $\alpha = 0.10$

	California	Florida	Illinois	Texas
Democrat	39(27.6866)	10(14.1044)	10(9.4030)	11(18.8060)
Republican	14(25.3134)	17(12.8955)	8(8.5970)	25(17.1940)

$$\chi^2 = \frac{(39-27.6866)^2}{27.6866} + \frac{(10-14.1044)^2}{14.1044} + \frac{(10-9.4030)^2}{9.4030} + \frac{(11-18.8060)^2}{18.8060} + \frac{(14-25.3134)^2}{25.3134} + \frac{(17-12.8955)^2}{12.8955} + \frac{(8-8.5970)^2}{8.5970} + \frac{(25-17.1940)^2}{17.1940}$$

$\chi^2 = 19.043$

14. continued



Reject the null hypothesis. There is enough evidence to support the claim that the political party affiliation of the representative is dependent on the state of the representative.

15.

H_0: The program of study of a student is independent of the type of institution.

H_1: The program of study of a student is dependent upon the type of institution. (claim)

C. V. $= 7.815$ d. f. $= 3$ $\alpha = 0.05$

$$E_{1,1} = \frac{(88)(302)}{707} = 37.5898$$

$$E_{1,2} = \frac{(88)(405)}{707} = 50.4102$$

$$E_{2,1} = \frac{(441)(302)}{707} = 188.3762$$

$$E_{2,2} = \frac{(441)(405)}{707} = 252.6238$$

$$E_{3,1} = \frac{(87)(302)}{707} = 37.1627$$

$$E_{3,2} = \frac{(87)(405)}{707} = 49.8373$$

$$E_{4,1} = \frac{(91)(302)}{707} = 38.8713$$

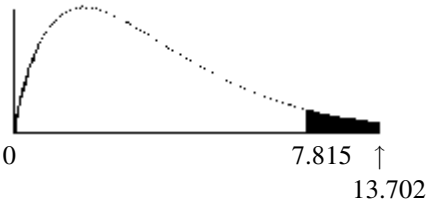
$$E_{4,2} = \frac{(91)(405)}{707} = 52.1287$$

	Two-year	Four-year
Agriculture	36(37.5898)	52(50.4102)
Criminal Justice	210(188.3762)	231(252.6238)
Lang/Lit	28(37.1627)	59(49.8373)
Math/Stat	28(38.8713)	63(52.1287)

15. continued

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(36-37.5898)^2}{37.5898} + \frac{(52-50.4102)^2}{50.4102} + \frac{(210-188.3762)^2}{188.3762} + \frac{(231-252.6238)^2}{252.6238} + \frac{(28-37.1627)^2}{37.1627} + \frac{(59-49.8373)^2}{49.8373} + \frac{(28-38.8713)^2}{38.8713} + \frac{(63-52.1287)^2}{52.1287}$$

$\chi^2 = 13.702$



Reject the null hypothesis. There is enough evidence to conclude that the type of program is dependent on the type of institution.

16.

H_0: The type of transplant is independent of the year in which the transplant was received.

H_1: The type of transplant is dependent upon the year it was received. (claim)

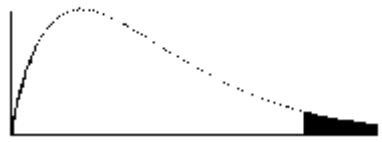
C. V. $= 13.277$ d. f. $= 4$ $\alpha = 0.01$

	Heart	Kidney/Pancreas
2003	2056(1986.2749)	870(850.0705)
2004	2016(2014.9969)	880(862.3628)
2005	2127(2197.7282)	903(940.5667)

	Lung
2003	1085(1174.6546)
2004	1173(1191.6404)
2005	1408(1299.7051)

$$\chi^2 = \frac{(2056-1986.2749)^2}{1986.2749} + \frac{(870-850.0705)^2}{850.0705} + \frac{(2016-2014.9969)^2}{2014.9969} + \frac{(880-862.3628)^2}{862.3628} + \frac{(2127-2197.7282)^2}{2197.7282} + \frac{(903-940.5667)^2}{940.5667} + \frac{(1085-1174.6546)^2}{1174.6546} + \frac{(1173-1191.6404)^2}{1191.6404} + \frac{(1408-1299.7051)^2}{1299.7051} = 23.211$$

16. continued



Reject the null hypothesis. There is enough evidence to support the claim that there is a relationship between the year and type of transplant.

17.

H_0: The type of automobile owned by a person is independent of the gender of the individual.

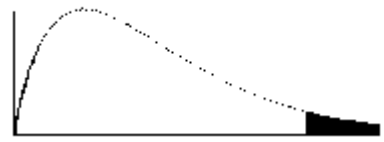
H_1: The type of automobile owned by a person is dependent on the gender of the individual. (claim)

C. V. $= 6.251$ d. f. $= 3$ $\alpha = 0.10$

	Luxury	Large	Midsize	Small
Men	15(12.5654)	9(7.8534)	49(58.1152)	27(21.4660)
Women	9(11.4346)	6(7.1466)	62(52.8848)	14(19.5340)

$$\chi^2 = \frac{(15-12.5654)^2}{12.5654} + \frac{(9-7.8534)^2}{7.8534} + \frac{(49-58.1152)^2}{58.1152} + \frac{(27-21.4660)^2}{21.4660} + \frac{(9-11.4346)^2}{11.4346} + \frac{(6-7.1466)^2}{7.1466} + \frac{(62-52.8848)^2}{52.8848} + \frac{(14-19.5340)^2}{19.5340}$$

$\chi^2 = 7.337$



Reject the null hypothesis. There is enough evidence to support the claim that the type of automobile is related to the gender of the owner.

18.

H_0: The genre of CDs sold is independent of the year in which the sale occurred.

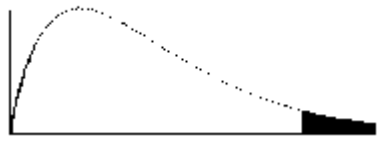
H_1: The genre of CDs sold is dependent upon the year in which the sale occurred. (claim)

C. V. $= 5.991$ d. f. $= 2$ $\alpha = 0.05$

	R&B	Country	Rock
2013	48(45.329)	36(35.616)	93(96.055)
2014	36(38.671)	30(30.384)	85(81.945)

$$\chi^2 = \frac{(48-45.329)^2}{45.329} + \frac{(36-35.616)^2}{35.616} + \frac{(93-96.055)^2}{96.055} + \frac{(36-38.671)^2}{38.671} + \frac{(30-30.384)^2}{30.384} + \frac{(85-81.945)^2}{81.945}$$

$\chi^2 = 0.562$



Do not reject the null hypothesis. There is not sufficient evidence to conclude that the sales by genre are related to the year.

19.

H_0: The type of vitamin pill preferred by an individual is independent on the age of the person taking the pill.

H_1: The type of vitamin pill preferred by the individual is dependent on the age of the individual. (claim)

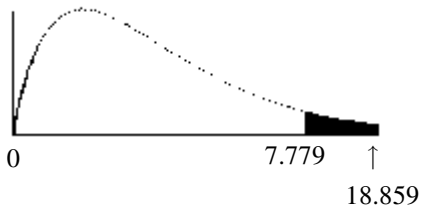
C. V. $= 7.779$ $\alpha = 0.10$ d. f. $= 4$

	Liquid	Tablet	Gummy
20–39	5(8.827)	16(12.202)	6(5.971)
40–59	10(15.365)	25(21.24)	12(10.394)
60–over	19(9.808)	6(13.558)	5(6.635)

19. continued

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(5-8.827)^2}{8.827} + \frac{(16-12.202)^2}{12.202} + \frac{(6-5.971)^2}{5.971} + \frac{(10-15.365)^2}{15.365} + \frac{(25-21.24)^2}{21.24} + \frac{(12-10.394)^2}{10.394} + \frac{(19-9.808)^2}{9.808} + \frac{(6-13.558)^2}{13.558} + \frac{(5-6.635)^2}{6.635}$$

$$\chi^2 = 18.859$$



Reject the null hypothesis. There is enough evidence to support the claim that the type of vitamin pill preferred is dependent upon the age of the individual.

20.

H_0: The drug is not effective.

H_1: The drug is effective. (claim)

$\alpha = 0.10$ d. f. = 1

	Effective	Not effective
Drug	32(25.408)	9(15.592)
Placebo	12(18.592)	18(11.408)

$$\chi^2 = \frac{(32-25.408)^2}{25.408} + \frac{(9-15.592)^2}{15.592} + \frac{(12-18.592)^2}{18.592} + \frac{(18-11.408)^2}{11.408} = 10.643$$

P-value < 0.005 (0.001)

Reject the null hypothesis since P-value < 0.10. There is enough evidence to support the claim that the drug results differ from the placebo.

21.

H_0: $p_1 = p_2 = p_3$ (claim)

H_1: At least one proportion is different.

21. continued

C. V. = 4.605 d. f. = 2

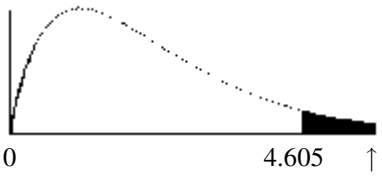
$$E(\text{Cesarean}) = \frac{100(111)}{300} = 37$$

$$E(\text{Non-cesarean}) = \frac{100(189)}{300} = 63$$

	Hosp. A	Hosp. B	Hosp. C
Cesarean	44(37)	28(37)	39(37)
Non-Cesarean	56(63)	72(63)	61(63)

$$\chi^2 = \frac{(44-37)^2}{37} + \frac{(28-37)^2}{37} + \frac{(39-37)^2}{37} + \frac{(56-63)^2}{63} + \frac{(72-63)^2}{63} + \frac{(61-63)^2}{63}$$

$$\chi^2 = 5.749$$



Reject the null hypothesis. There is enough evidence to reject the claim that the proportions are equal.

22.

H_0: $p_1 = p_2 = p_3 = p_4$ (claim)

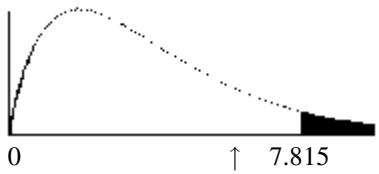
H_1: At least one proportion is different.

C. V. = 7.815 d. f. = 3

	Fr	Soph	Jr	Sr
Yes	10(16.75)	15(16.75)	20(16.75)	22(16.75)
No	40(33.25)	35(33.25)	30(33.25)	28(33.25)

$$\chi^2 = \frac{(10-16.75)^2}{16.75} + \frac{(15-16.75)^2}{16.75} + \frac{(20-16.75)^2}{16.75} + \frac{(22-16.75)^2}{16.75} + \frac{(40-33.25)^2}{33.25} + \frac{(35-33.25)^2}{33.25} + \frac{(30-33.25)^2}{33.25} + \frac{(28-33.25)^2}{33.25} = 7.788$$

22. continued



7.788

Do not reject the null hypothesis. There is not enough evidence to reject the claim that the proportions are equal.

23.

H_0: $p_1 = p_2 = p_3 = p_4$ (claim)

H_1: At least one proportion is different.

C. V. = 7.815 d. f. = 3

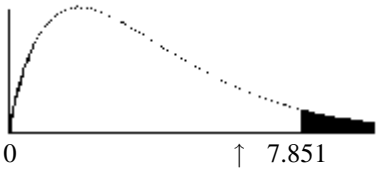
$$E(\text{passed}) = \frac{120(167)}{120} = 41.75$$

$$E(\text{failed}) = \frac{120(313)}{120} = 78.25$$

	Southside	West End	East Hills	Jefferson
Passed	49(41.75)	38(41.75)	46(41.75)	34(41.75)
Failed	71(78.25)	82(78.25)	74(78.25)	86(78.25)

$$\chi^2 = \frac{(49-41.75)^2}{41.75} + \frac{(38-41.75)^2}{41.75} + \frac{(46-41.75)^2}{41.75} + \frac{(34-41.75)^2}{41.75} + \frac{(71-78.25)^2}{78.25} + \frac{(82-78.25)^2}{78.25} + \frac{(74-78.25)^2}{78.25} + \frac{(86-78.25)^2}{78.25}$$

$\chi^2 = 5.317$



5.317

Do not reject the null hypothesis. There is not enough evidence to reject the claim that the proportions are equal.

24.

H_0: $p_1 = p_2 = p_3$ (claim)

H_1: At least one proportion is different.

C. V. = 9.210 d. f. = 2

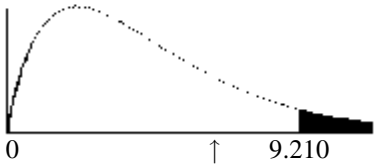
$$E(\text{yes}) = \frac{92(133)}{276} = 44.33$$

$$E(\text{no}) = \frac{92(143)}{276} = 47.67$$

	Mall A	Mall B	Mall C
Yes	52(44.33)	45(44.33)	36(44.33)
No	40(47.67)	47(47.67)	56(47.67)

$$\chi^2 = \frac{(52-44.33)^2}{44.33} + \frac{(45-44.33)^2}{44.33} + \frac{(36-44.33)^2}{44.33} + \frac{(40-47.67)^2}{47.67} + \frac{(47-47.67)^2}{47.67} + \frac{(56-47.67)^2}{47.67}$$

$\chi^2 = 5.602$



5.602

Do not reject the null hypothesis. There is not enough evidence to reject the claim that the proportions are equal.

25.

H_0: $p_1 = p_2 = p_3$ (claim)

H_1: At least one proportion is different from the others.

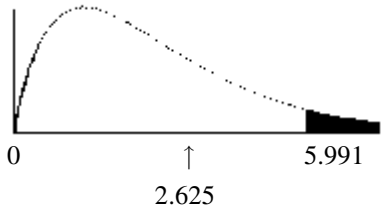
C. V. = 5.991 d. f. = 2

	Pork	Beef	Poultry
Athletes	15(16)	36(32)	9(12)
Nonathletes	17(16)	28(32)	15(12)

$$\chi^2 = \frac{(15-16)^2}{16} + \frac{(36-32)^2}{32} + \frac{(9-12)^2}{12} + \frac{(17-16)^2}{16} + \frac{(28-32)^2}{32} + \frac{(15-12)^2}{12}$$

$\chi^2 = 2.625$

25. continued



Do not reject the null hypothesis. There is not enough evidence to reject the claim that the proportions are equal.

26.

H_0: $p_1 = p_2 = p_3$ (claim)

H_1: At least one proportion is different.

C. V. $= 4.605$ d. f. $= 2$

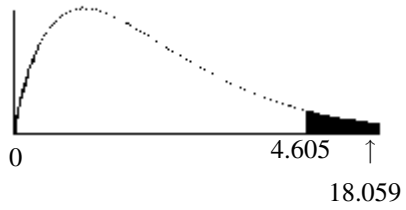
$$E(\text{mother works}) = \frac{60(118)}{180} = 39.33$$

$$E(\text{mother doesn't work}) = \frac{60(62)}{180} = 20.67$$

	Elem.	Middle	High
work	29(39.33)	38(39.33)	51(39.33)
no work	31(20.67)	22(20.67)	9(20.67)

$$\chi^2 = \frac{(29-39.33)^2}{39.33} + \frac{(38-39.33)^2}{39.33} + \frac{(51-39.33)^2}{39.33} + \frac{(31-20.67)^2}{20.67} + \frac{(22-20.67)^2}{20.67} + \frac{(9-20.67)^2}{20.67}$$

$$\chi^2 = 18.059$$



Reject the null hypothesis. There is enough evidence to reject the claim that the proportions are equal.

27.

H_0: $p_1 = p_2 = p_3 = p_4 = p_5$

H_1: At least one proportion is different.

27. continued

C. V. $= 9.488$ d. f. $= 4$

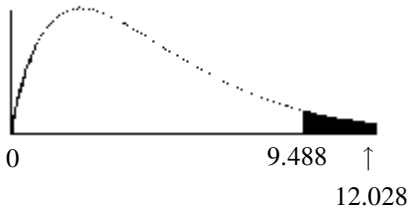
$$E(\text{yes}) = \frac{(104)(75)}{375} = 20.8$$

$$E(\text{no}) = \frac{(271)(75)}{375} = 54.2$$

	18	19	20	21	22
Yes	19(20.8)	18(20.8)	23(20.8)	31(20.8)	13(20.8)
No	56(54.2)	57(54.2)	52(54.2)	44(54.2)	62(54.2)

$$\chi^2 = \frac{(19-20.8)^2}{20.8} + \frac{(18-20.8)^2}{20.8} + \frac{(23-20.8)^2}{20.8} + \frac{(31-20.8)^2}{20.8} + \frac{(13-20.8)^2}{20.8} + \frac{(56-54.2)^2}{54.2} + \frac{(57-54.2)^2}{54.2} + \frac{(52-54.2)^2}{54.2} + \frac{(44-54.2)^2}{54.2} + \frac{(62-54.2)^2}{54.2}$$

$$\chi^2 = 12.028$$



Reject the null hypothesis. There is enough evidence to conclude that the proportions are different.

28.

H_0: $p_1 = p_2 = p_3 = p_4$ (claim)

H_1: At least one proportion is different.

C. V. $= 7.815$ d. f. $= 3$

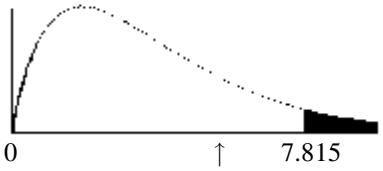
$$E(\text{present}) = \frac{239(75)}{300} = 59.75$$

$$E(\text{not present}) = \frac{61(75)}{300} = 15.25$$

	A	B	C	D
Present	66(59.75)	60(59.75)	57(59.75)	56(59.75)
Not present	9(15.25)	15(15.25)	18(15.25)	19(15.25)

28. continued

$$\chi^2 = \frac{(66-59.75)^2}{59.75} + \frac{(60-59.75)^2}{59.75} + \frac{(57-59.75)^2}{59.75} + \frac{(56-59.75)^2}{59.75} + \frac{(9-15.25)^2}{15.25} + \frac{(15-15.25)^2}{15.25} + \frac{(18-15.25)^2}{15.25} + \frac{(19-15.25)^2}{15.25} = 5.0$$



Do not reject the null hypothesis. There is not enough evidence to reject the claim that the proportions are the same.

29.

H_0: $p_1 = p_2 = p_3 = p_4$ (claim)

H_1: At least one proportion is different.

$\alpha = 0.05$ d. f. $= 3$

$$\text{E(on bars)} = \frac{30(62)}{120} = 15.5$$

$$\text{E(not on bars)} = \frac{30(58)}{120} = 14.5$$

	N	S	E	W
on	15(15.5)	18(15.5)	13(15.5)	16(15.5)
off	15(14.5)	12(14.5)	17(14.5)	14(14.5)

$$\chi^2 = \frac{(15-15.5)^2}{15.5} + \frac{(18-15.5)^2}{15.5} + \frac{(13-15.5)^2}{15.5} + \frac{(16-15.5)^2}{15.5} + \frac{(15-14.5)^2}{14.5} + \frac{(12-14.5)^2}{14.5} + \frac{(17-14.5)^2}{14.5} + \frac{(14-14.5)^2}{14.5} = 1.735$$

P-value > 0.10 (0.629)

(TI: P-value = 0.6291)

Do not reject the null hypothesis since P-value $>$ 0.05. There is not enough evidence to reject the claim that the proportions are the same.

30.

H_0: $p_1 = p_2 = p_3 = p_4$ (claim)

H_1: At least one proportion is different.

$\alpha = 0.10$ d. f. $= 3$

$$\text{E(will travel)} = \frac{125(184)}{500} = 46$$

$$\text{E(will not travel)} = \frac{125(316)}{500} = 79$$

	A	B	C	D
will	37(46)	52(46)	46(46)	49(46)
will not	88(79)	73(79)	79(79)	76(79)

$$\chi^2 = \frac{(37-46)^2}{46} + \frac{(52-46)^2}{46} + \frac{(46-46)^2}{46} + \frac{(49-46)^2}{46} + \frac{(88-79)^2}{79} + \frac{(73-79)^2}{79} + \frac{(79-79)^2}{79} + \frac{(76-79)^2}{79}$$

$\chi^2 = 4.334$

P-value > 0.10 (0.228)

(TI: P-value = 0.22758)

Do not reject the null hypothesis since P-value > 0.10. There is not enough evidence to reject the claim that the proportions are the same.

31.

H_0: $p_1 = p_2 = p_3$ (claim)

H_1: At least one proportion is different from the others.

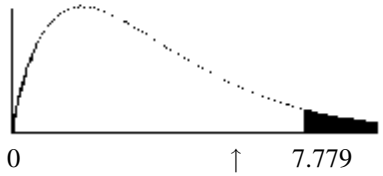
C. V. $= 7.779$ d. f. $= 4$

Age	Inhalants	Hallucinogens	Tranquilizers
12 – 17	16(11.679)	9(13.053)	5(5.267)
18 – 25	22(23.359)	30(26.107)	8(10.534)
26 and older	13(15.962)	18(17.840)	10(7.198)

$$\chi^2 = \frac{(16-11.679)^2}{11.679} + \frac{(9-13.053)^2}{13.053} + \frac{(5-5.267)^2}{5.267} + \frac{(22-23.359)^2}{23.359} + \frac{(30-26.107)^2}{26.107} + \frac{(8-10.534)^2}{10.534} + \frac{(13-15.962)^2}{15.962} + \frac{(18-17.840)^2}{17.840} + \frac{(10-7.198)^2}{7.198}$$

$\chi^2 = 5.782$

31. continued



Do not reject the null hypothesis. There is not enough evidence to reject the claim that the proportions are equal.

32.

			Total
	12(9.61)	15(17.39)	27
	9(11.39)	23(20.61)	32
Total	21	38	59

$$\chi^2 = \frac{(12-9.61)^2}{9.61} + \frac{(15-17.39)^2}{17.39} + \frac{(9-11.39)^2}{11.39} + \frac{(23-20.61)^2}{20.61} = 1.70$$

$$\chi^2 = \frac{59(12\cdot 23 - 15\cdot 9)^2}{(12+15)(12+9)(9+23)(15+23)}$$

$$= \frac{1172979}{689472} = 1.70$$

Alternate Method:

$$\chi^2 = \frac{n(ad-bc)^2}{(a+b)(a+c)(c+d)(b+d)}$$

$$\chi^2 = \frac{59(12\cdot 23 - 15\cdot 9)^2}{(12+15)(12+9)(9+23)(15+23)} = 1.70$$

Both answers are the same.

33.

$$\chi^2 = \frac{(|O-E|-0.5)^2}{E} = \frac{(|12-9.61|-0.5)^2}{9.61} + \frac{(|15-17.39|-0.5)^2}{17.39} + \frac{(|9-11.39|-0.5)^2}{11.39} + \frac{(|23-20.61|-0.5)^2}{20.61}$$

$$= \frac{3.5721}{9.61} + \frac{3.5721}{17.39} + \frac{3.5721}{11.39} + \frac{3.5721}{20.61}$$

$$= 1.064$$

34.

For Question 8:

$\chi^2 = 13.222$

$n = 936 + 240 + 195 + 101 + 909 + 297 + 150 + 115 = 2943$

$$C = \sqrt{\frac{\chi^2}{\chi^2+n}} = \sqrt{\frac{13.222}{13.222 + 2943}} = 0.0669$$

For Question 20:

$\chi^2 = 10.643$

$n = 32 + 9 + 12 + 18 = 71$

$$C = \sqrt{\frac{10.643}{10.643 + 71}} = 0.361$$

REVIEW EXERCISES - CHAPTER 11

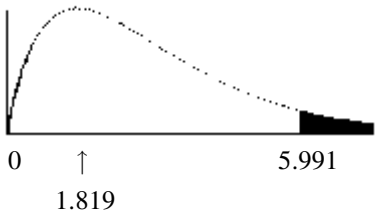
1.

H_0: The distribution of trafic fatalities were as follows: used seat belt, 31.58%; did not use seat belt, 59.83%; status unknown, 8.59%.

H_1: The distribution is not as stated in the null hypothesis. (claim)

C. V. $= 5.991$ d. f. $= 2$ $\alpha = 0.05$

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(35-37.896)^2}{37.896} + \frac{(78-71.796)^2}{71.796} + \frac{(7-10.308)^2}{10.308} = 1.819$$



Do not reject the null hypothesis. There is not enough evidence to support the claim that the distribution differs from the one stated in the null hypothesis.

2.

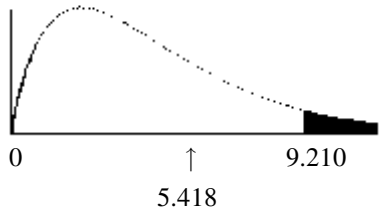
H_0: The distribution of the reasons why workers were displaced is as follows: plant closed or moved, 44.8%; insufficient work, 25.2%; and position eliminated, 30%.

H_1: The distribution of reasons why workers were displaced is not the same as stated in the null hypothesis. (claim)

C. V. $= 9.210$ d. f. $= 2$ $\alpha = 0.01$

$$\chi^2 = \frac{(40-54)^2}{54} + \frac{(53-45.36)^2}{45.36} + \frac{(87-80.64)^2}{80.64}$$

$$\chi^2 = 5.418$$



Do not reject the null hypothesis. There is not enough evidence to support the claim that the distribution is different from that stated in the null hypothesis.

3.

H_0: The distribution of denials for gun permits is as follows: criminal history - 75%, domestic violence - 11%, and other - 14%. (claim)

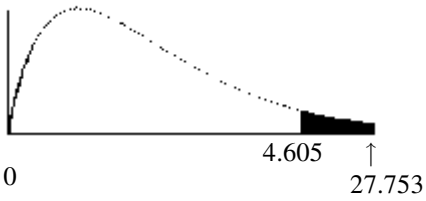
H_1: The distribution is not the same as stated in the null hypothesis.

C. V. $= 4.605$ d. f. $= 2$

Criminal History	Domestic Violence	Other
120(150)	42(22)	38(28)

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(120-150)^2}{150} + \frac{(42-22)^2}{22} + \frac{(38-28)^2}{28} = 27.753$$

3. continued



Reject the null hypothesis. There is enough evidence to reject the claim that the distribution is as stated in the null hypothesis. The distribution may vary in different geographic locations.

4.

H_0: The employees show no preference in the type of music played.

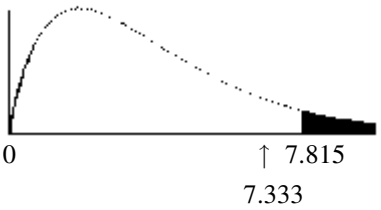
H_1: The employees show a preference for the type of music played. (claim)

C. V. $= 7.815$ d. f. $= 3$

$$E = \frac{60}{4} = 15$$

Type	Classical	Country	Pop	Rock
Number	9(15)	18(15)	22(15)	11(15)

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(9-15)^2}{15} + \frac{(18-15)^2}{15} + \frac{(22-15)^2}{15} + \frac{(11-15)^2}{15} = 7.333$$



Do not reject the null hypothesis. There is not enough evidence to support the claim that there is a preference for the type of music played.

5.

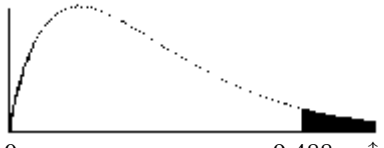
H_0: The type of investment is independent of the age of the investor.

H_1: The type of investment is dependent upon the age of the investor. (claim)

C. V. $= 9.488$ d. f. $= 4$

Age	Large	Small	Inter.	CD	Bond
45	20(28.18)	10(15.45)	10(15.45)	15(9.55)	45(31.36)
65	42(33.82)	24(18.55)	24(18.55)	6(11.45)	24(37.64)

$$\chi^2 = \frac{(20-28.18)^2}{28.18} + \frac{(10-15.45)^2}{15.45} + \frac{(10-15.45)^2}{15.45} + \frac{(15-9.55)^2}{9.55} + \frac{(45-31.36)^2}{31.36} + \frac{(42-33.82)^2}{33.82} + \frac{(24-18.55)^2}{18.55} + \frac{(24-18.55)^2}{18.55} + \frac{(6-11.45)^2}{11.45} + \frac{(24-37.64)^2}{37.64} = 27.998$$



Reject the null hypothesis. There is enough evidence to support the claim that the type of investment is dependent on age.

6.

H_0: The month in which tornadoes occurred is independent of the year in which they occurred.

H_1: The month in which tornadoes occurred is dependent upon the year in which they occurred. (claim)

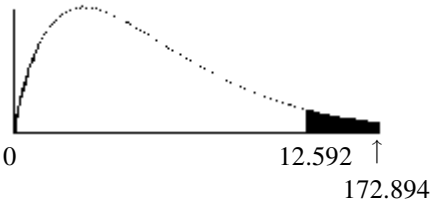
C. V. $= 12.592$ d. f. $= 6$ $\alpha = 0.05$

	2015	2014	2013	2012
January	26(13.561)	4(23.153)	87(49.944)	97(127.342)
February	2(9.632)	41(16.445)	46(35.474)	63(90.448)
March	13(17.807)	25(30.402)	18(65.581)	225(167.210)

6. continued

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(26-13.561)^2}{13.561} + \frac{(4-23.153)^2}{23.153} + \frac{(87-49.944)^2}{49.944} + \frac{(97-127.342)^2}{127.342} + \frac{(2-9.632)^2}{9.632} + \frac{(41-16.445)^2}{16.445} + \frac{(46-35.474)^2}{35.474} + \frac{(63-90.448)^2}{90.448} + \frac{(13-17.807)^2}{17.807} + \frac{(25-30.402)^2}{30.402} + \frac{(18-65.581)^2}{65.581} + \frac{(225-167.210)^2}{167.210}$$

$\chi^2 = 172.894$



Reject the null hypothesis. There is sufficient evidence to conclude that a relationship exists between the month and the year in which the tornadoes occurred.

7.

H_0: $p_1 = p_2 = p_3$ (claim)

H_1: At least one proportion is different.

$\alpha = 0.01$ d. f. $= 2$

$$\text{E(work)} = \frac{80(114)}{240} = 38$$

$$\text{E(don't work)} = \frac{80(126)}{240} = 42$$

	16	17	18
work	45(38)	31(38)	38(38)
don't work	35(42)	49(42)	42(42)

$$\chi^2 = \frac{(45-38)^2}{38} + \frac{(31-38)^2}{38} + \frac{(38-38)^2}{38} + \frac{(35-42)^2}{42} + \frac{(49-42)^2}{42} + \frac{(42-42)^2}{42}$$

$\chi^2 = 4.912$

$0.05 <$ P-value < 0.10 (0.086)

7. continued

Do not reject the null hypothesis since P-value > 0.01. There is not enough evidence to reject the claim that the proportions are the same.

8.

H_0: $p_1 = p_2 = p_3 = p_4$ (claim)

H_1: At least one proportion is different.

C. V. $= 7.815$ d. f. $= 3$

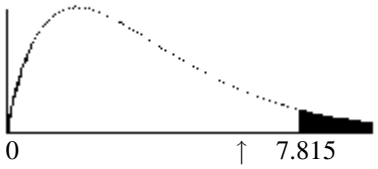
$$E(\text{male}) = \frac{100(219)}{400} = 54.75$$

$$E(\text{female}) = \frac{100(181)}{400} = 45.25$$

	May	June	July	Aug
Male	51(54.75)	47(54.75)	58(54.75)	63(54.75)
Female	49(45.25)	53(45.25)	42(45.25)	37(45.25)

$$\chi^2 = \frac{(51-54.75)^2}{54.75} + \frac{(47-54.75)^2}{54.75} + \frac{(58-54.75)^2}{54.75} + \frac{(63-54.75)^2}{54.75} + \frac{(49-45.25)^2}{45.25} + \frac{(53-45.25)^2}{45.25} + \frac{(42-45.25)^2}{45.25} + \frac{(37-45.25)^2}{45.25}$$

$\chi^2 = 6.166$



Do not reject the null hypothesis. There is not enough evidence to reject the claim that the proportions are the same.

9.

H_0: $p_1 = p_2 = p_3 = p_4$

H_1: At least one proportion is different from the others. (claim)

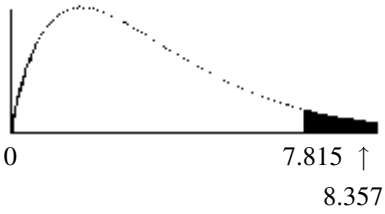
C. V. $= 7.815$ d. f. $= 3$ $\alpha = 0.05$

9. continued

	Parents	Spouse	Non-family	Other
10 years ago	47(52)	38(29)	5(7)	10(12)
Now	57(52)	20(29)	9(7)	14(12)

$$\chi^2 = \frac{(47-52)^2}{52} + \frac{(38-29)^2}{29} + \frac{(5-7)^2}{7} + \frac{(10-12)^2}{12} + \frac{(57-52)^2}{52} + \frac{(20-29)^2}{29} + \frac{(9-7)^2}{7} + \frac{(14-12)^2}{12}$$

$\chi^2 = 8.357$



Reject the null hypothesis. There is enough evidence to support the claim that at least one proportion is different from the others.

10.

H_0: The incidence of the cardiovascular procedure is independent of the gender of the individual.

H_1: The incidence of cardiovascular procedure is dependent on the gender of the individual. (claim)

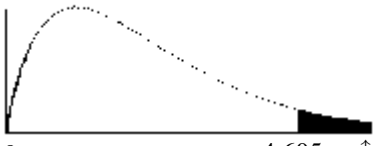
C. V. $= 4.605$ d. f. $= 2$ $\alpha = 0.10$

	Stent	Bypass	Pacemaker
Men	425(406.638)	320(276.289)	198(260.073)
Women	227(245.362)	123(166.711)	219(156.927)

$$\chi^2 = \frac{(425-406.638)^2}{406.638} + \frac{(320-276.289)^2}{276.289} + \frac{(198-260.073)^2}{260.073} + \frac{(227-245.362)^2}{245.362} + \frac{(123-166.711)^2}{166.711} + \frac{(219-156.927)^2}{156.927}$$

$\chi^2 = 59.948$ (TI83 $= 59.949$)

10. continued



Reject the null hypothesis. There is enough evidence to support the claim that the procedure is dependent on the gender of the individual.

CHAPTER 11 QUIZ

1. False, it is one-tailed right.

2. True

3. False, there is little agreement between observed and expected frequencies.

4. c

5. b

6. d

7. 6

8. Independent

9. Right

10. At least 5

11. H_0: The reasons why people lost their jobs are equally distributed. (claim)
H_1: The reasons why people lost their jobs are not equally distributed.

C. V. = 5.991 d. f. = 2 E = 24

$\chi^2 = \sum \frac{(O-E)^2}{E} = 2.333$

11. continued

Do not reject the null hypothesis. There is not enough evidence to reject the claim that the reasons why people lost their jobs are equally distributed. The results could have been different 10 years ago since different factors of the economy existed then.

12. H_0: Takeout food is consumed according to the following distribution: at home - 53%, in the car - 19%, at work -14%, other - 14%. (claim)
H_1: The distribution is different from that stated in the null hypothesis.
C. V. = 11.345 d. f. = 3

$\chi^2 = \sum \frac{(O-E)^2}{E} = 5.271$

Do not reject the null hypothesis. There is not enough evidence to reject the claim that the distribution is as stated. Fast-food restaurants may want to make their advertisements appeal to those who like to take their food home to eat.

13. H_0: College students show the same preference for shopping channels as those surveyed.
H_1: College students show a different preference for shopping channels. (claim) C. V. = 7.815 d. f. = 3
$\chi^2 = 21.789$
Reject the null hypothesis. There is enough evidence to support the claim that college students show a different preference for shopping channels.

14. H_0: The number of commuters is distributed as follows: alone - 76.6%, carpooling - 9.7%, public transportation -4.9%, walking - 2.8%, other - 1.7%, and working at home - 4.3%.

14. continued

H_1: The proportions are different from the null hypothesis. (claim)
C. V. $= 11.071$ d. f. $= 5$
$\chi^2 = 69.224$
Reject the null hypothesis. There is enough evidence to support the claim that the distribution is different from the one stated in the null hypothesis.

15. H_0: Ice cream flavor is independent of the gender of the purchaser. (claim)
H_1: Ice cream flavor is dependent upon the gender of the purchaser.
C. V. $= 7.815$ d. f. $= 3$
$\chi^2 = 7.198$
Do not reject the null hypothesis. There is not enough evidence to reject the claim that ice cream flavor is independent of the gender of the purchaser.

16. H_0: The type of pizza ordered is independent of the age of the purchaser.
H_1: The type of pizza ordered is dependent on the age of the purchaser. (claim)
$\alpha = 0.10$ d. f. $= 9$
$\chi^2 = 107.3$
P-value < 0.005
Reject the null hypothesis since P-value < 0.10. There is enough evidence to support the claim that the type of pizza is related to the age of the purchaser.

17. H_0: The color of the pennant purchased is independent of the gender of the purchaser. (claim)
H_1: The color of the pennant purchased is dependent on the gender of the purchaser.
C. V. $= 4.605$ d. f. $= 2$
$\chi^2 = 5.632$

17. continued

Reject the null hypothesis. There is enough evidence to reject the claim that the color of the pennant purchased is independent of the gender of the purchaser.

18. H_0: The opinion of the children on the use of the tax credit is independent of the gender of the children.
H_1: The opinion of the children on the use of the tax credit is dependent upon the gender of the children. (claim)
C. V. $= 4.605$ d. f. $= 2$
$\chi^2 = 1.534$
Do not reject the null hypothesis. There is not enough evidence to support the claim that the opinion of the children is dependent upon their gender.

19. H_0: $p_1 = p_2 = p_3$ (claim)
H_1: At least one proportion is different from the others.
C. V. $= 4.605$ d. f. $= 2$
$\chi^2 = 6.711$
Reject the null hypothesis. There is enough evidence to reject the claim that the proportions are equal. It seems that more women are undecided about their jobs. Perhaps they want better income or greater chances of advancement.