11.15: Solutions

1.

mean = 25 and standard deviation = 7.0711

3.

when the number of degrees of freedom is greater than 90

5.

$df = 2$

7.

a goodness-of-fit test

9.

3

11.

2.04

13.

We decline to reject the null hypothesis. There is not enough evidence to suggest that the observed test scores are significantly different from the expected test scores.

15.

H_0: the distribution of COVID-19 cases follows the ethnicities of the general population of Santa Clara County.

17.

right-tailed

19.

2016.136

21.

Graph: Answers may vary.

Decision: Reject the null hypothesis.

Reason for the Decision: p-value < alpha

Conclusion (write out in complete sentences): The make-up of COVID-19 cases does not fit the ethnicities of the general population of Santa Clara County.

23.

a test of independence

25.

a test of independence

27.

8

29.

6.6

31.

0.0435

33.

Smoking Level Per Day	Black	Native Hawaiian	Hispanic/Latino	Japanese	White	Totals
1-10	9,886	2,745	12,831	8,378	7,650	41,490
11-20	6,514	3,062	4,932	10,680	9,877	35,065
21-30	1,671	1,419	1,406	4,715	6,062	15,273
31+	759	788	800	2,305	3,970	8,622
Totals	18,830	8,014	19,969	26,078	27,559	10,0450

Table 11.60

35.

Smoking Level Per Day	Black	Native Hawaiian	Hispanic/Latino	Japanese	White
1-10	7777.57	3310.11	8248.02	10771.29	11383.01
11-20	6573.16	2797.52	6970.76	9103.29	9620.27
21-30	2863.02	1218.49	3036.20	3965.05	4190.23
31+	1616.25	687.87	1714.01	2238.37	2365.49

Table 11.61

37.

10,301.8

39.

right

41.

1. Reject the null hypothesis.
2. p-value < alpha

3. There is sufficient evidence to conclude that smoking level is dependent on ethnic group.

43.

test for homogeneity

45.

test for homogeneity

47.

All values in the table must be greater than or equal to five.

49.

3

51.

0.00005

53.

a goodness-of-fit test

55.

a test for independence

57.

Answers will vary. Sample answer: Tests of independence and tests for homogeneity both calculate the test statistic the same way ∑(ij)(O-E)2E∑(ij)(O-E)2E" role="presentation" style="position: relative;">$\sum_{(ij)} \frac{(O-E)^2}{E} \sum_{(ij)} \frac{(O-E)^2}{E}$. In addition, all values must be greater than or equal to five.

59.

a test of a single variance

61.

a left-tailed test

63.

H_0: $\sigma^2 = 0.81^2$;

H_a: $\sigma^2 > 0.81^2$

65.

a test of a single variance

67.

0.0542

69.

true

71.

false

73.

Marital Status	Percent	Expected Frequency
never married	31.3	125.2
married	56.1	224.4
widowed	2.5	10
divorced/separated	10.1	40.4

Table 11.62

1. The data fits the distribution.
2. The data does not fit the distribution.
3. 3
4. chi-square distribution with $df = 3$
5. 19.27
6. 0.0002
7. Check student's solution.
8. 1. Alpha = 0.05
   2. Decision: Reject null
   3. Reason for decision: p-value < alpha
   4. Conclusion: Data does not fit the distribution.

75.

1. H_0: The local results follow the distribution of the percentage of students who use mass transit to get to school
2. H_a: The local results do not follow the distribution of the percentage of students who use mass transit to get to school
3. $df = 5$
4. chi-square distribution with $df = 5$
5. chi-square test statistic = 13.4
6. p-value = 0.0199
7. Answers may vary.
8. 1. Alpha = 0.05
   2. Decision: Reject null when $a = 0.05$
   3. Reason for Decision: p-value < alpha
   4. Conclusion: Local data do not fit the mass transit Distribution.

5. Decision: Do not reject null when $a = 0.01$
6. Conclusion: There is insufficient evidence to conclude that local data do not follow the distribution of the of students who use mass transit.

77.

1. H_0: The actual college majors of graduating women fit the distribution of their expected majors
2. H_a: The actual college majors of graduating women do not fit the distribution of their expected majors
3. $df = 10$
4. chi-square distribution with $df = 10$
5. test statistic = 11.48
6. p-value = 0.3211
7. Answers may vary.
8. 1. Alpha = 0.05
   2. Decision: Do not reject null when $a = 0.05$ and $a = 0.01$
   3. Reason for decision: p-value > alpha
   4. Conclusion: There is insufficient evidence to conclude that the distribution of actual college majors of graduating women do not fit the distribution of their expected majors.

79.

true

81.

true

83.

false

85.

The hypotheses for the goodness-of-fit test are:

1. H_0: Surveyed obese fit the distribution of expected obese
2. H_a: Surveyed obese do not fit the distribution of expected obese

Use a chi-square distribution with $df = 4$ to evaluate the data.

The test statistic is $X^2 = 9.85$

The P-value = 0.0431

At 5% significance level, $\alpha = 0.05$. For this data, $P < \alpha$. Reject the null hypothesis.

At the 5% level of significance, from the data, there is sufficient evidence to conclude that the surveyed obese do not fit the distribution of expected obese.

87.

1. H_0: Car size is independent of family size.
2. H_a: Car size is dependent on family size.
3. $df = 9$
4. chi-square distribution with $df = 9$
5. test statistic = 15.8284
6. p-value = 0.0706
7. Answers may vary.
8. 1. Alpha: 0.05
   2. Decision: Do not reject the null hypothesis.
   3. Reason for decision: p-value > alpha
   4. Conclusion: At the 5% significance level, there is insufficient evidence to conclude that car size and family size are dependent.

89.

1. H_0: Honeymoon locations are independent of bride's age.
2. H_a: Honeymoon locations are dependent on bride's age.
3. $df = 9$
4. chi-square distribution with $df = 9$
5. test statistic = 15.7027
6. p-value = 0.0734
7. Answers may vary.
8. 1. Alpha: 0.05
   2. Decision: Do not reject the null hypothesis.
   3. Reason for decision: p-value > alpha
   4. Conclusion: At the 5% significance level, there is insufficient evidence to conclude that honeymoon location and bride age are dependent.

91.

1. H_0: The types of fries sold are independent of the location.
2. H_a: The types of fries sold are dependent on the location.
3. $df = 6$
4. chi-square distribution with $df = 6$
5. test statistic =18.8369
6. p-value = 0.0044
7. Answers may vary.
8. 1. Alpha: 0.05
   2. Decision: Reject the null hypothesis.
   3. Reason for decision: p-value < alpha
   4. Conclusion: At the 5% significance level, There is sufficient evidence that types of fries and location are dependent.

93.

1. H_0: Salary is independent of level of education.
2. H_a: Salary is dependent on level of education.
3. $df = 12$
4. chi-square distribution with $df = 12$
5. test statistic = 255.7704

6. p-value = 0
7. Answers may vary.
8. Alpha: 0.05

   Decision: Reject the null hypothesis.

   Reason for decision: p-value < alpha

   Conclusion: At the 5% significance level, there is sufficient evidence to conclude that salary and level of education are dependent.

95.

true

97.

true

99.

1. H_0: Age is independent of the youngest online entrepreneurs' net worth.
2. H_a: Age is dependent on the net worth of the youngest online entrepreneurs.
3. df = 2
4. chi-square distribution with df = 2
5. test statistic = 1.76
6. p-value 0.4144
7. Answers may vary.
8. 1. Alpha: 0.05
   2. Decision: Do not reject the null hypothesis.
   3. Reason for decision: p-value > alpha
   4. Conclusion: At the 5% significance level, there is insufficient evidence to conclude that age and net worth for the youngest online entrepreneurs are dependent.

101.

1. H_0: The distribution for personality types is the same for both majors
2. H_a: The distribution for personality types is not the same for both majors
3. df = 4
4. chi-square with df = 4
5. test statistic = 3.01
6. p-value = 0.5568
7. Answers may vary.
8. 1. Alpha: 0.05
   2. Decision: Do not reject the null hypothesis.
   3. Reason for decision: p-value > alpha
   4. Conclusion: There is insufficient evidence to conclude that the distribution of personality types is different for business and social science majors.

103.

1. H_0: The distribution for fish caught is the same in Green Valley Lake and in Echo Lake.
2. H_a: The distribution for fish caught is not the same in Green Valley Lake and in Echo Lake.
3. 3
4. chi-square with df = 3
5. 11.75
6. p-value = 0.0083
7. Answers may vary.
8. 1. Alpha: 0.05
   2. Decision: Reject the null hypothesis.
   3. Reason for decision: p-value < alpha
   4. Conclusion: There is evidence to conclude that the distribution of fish caught is different in Green Valley Lake and in Echo Lake

105.

1. H_0: The distribution of average energy use in the USA is the same as in Europe between Year 1 and Year 6.
2. H_a: The distribution of average energy use in the USA is not the same as in Europe between Year 1 and Year 6.
3. df = 4
4. chi-square with df = 4
5. test statistic = 2.7434
6. p-value = 0.7395
7. Answers may vary.
8. 1. Alpha: 0.05
   2. Decision: Do not reject the null hypothesis.
   3. Reason for decision: p-value > alpha
   4. Conclusion: At the 5% significance level, there is insufficient evidence to conclude that the average energy use values in the US and EU are not derived from different distributions for the period from Year 1 to Year 6.

107.

1. H_0: The distribution for technology use is the same for community college students and university students.
2. H_a: The distribution for technology use is not the same for community college students and university students.
3. 2
4. chi-square with df = 2
5. 7.05
6. p-value = 0.0294
7. Answers may vary.
8. 1. Alpha: 0.05
   2. Decision: Reject the null hypothesis.
   3. Reason for decision: p-value < alpha
   4. Conclusion: There is sufficient evidence to conclude that the distribution of technology use for statistics homework is not the same for statistics students at community colleges and at universities.

110.

225

112.

H_0: $\sigma^2 \leq 150$

114.

36

116.

Answers may vary.

118.

The claim is that the variance is no more than 150 minutes.

120.

a Student's *t*- or normal distribution

122.

1. H_0: $\sigma = 15$
2. H_a: $\sigma > 15$
3. $df = 42$
4. chi-square with $df = 42$
5. test statistic = 26.88
6. *p*-value = 0.9663
7. Answers may vary.
8. 1. Alpha = 0.05
   2. Decision: Do not reject null hypothesis.
   3. Reason for decision: *p*-value > alpha
   4. Conclusion: There is insufficient evidence to conclude that the standard deviation is greater than 15.

124.

1. H_0: $\sigma \leq 3$
2. H_a: $\sigma > 3$
3. $df = 17$
4. chi-square distribution with $df = 17$
5. test statistic = 28.73
6. *p*-value = 0.0371
7. Answers may vary.
8. 1. Alpha: 0.05
   2. Decision: Reject the null hypothesis.
   3. Reason for decision: *p*-value < alpha
   4. Conclusion: There is sufficient evidence to conclude that the standard deviation is greater than three.

126.

1. H_0: $\sigma = 2$
2. H_a: $\sigma \neq 2$
3. $df = 14$
4. chi-square distiribution with $df = 14$
5. chi-square test statistic = 5.2094
6. *p*-value = 0.0346
7. Answers may vary.
8. 1. Alpha = 0.05
   2. Decision: Reject the null hypothesis
   3. Reason for decision: *p*-value < alpha
   4. Conclusion: There is sufficient evidence to conclude that the standard deviation is different than 2.

128.

The sample standard deviation is $34.29.

H_0 : $\sigma^2 = 25^2$
H_a : $\sigma^2 > 25^2$

$df = n - 1 = 7$.

test statistic:

x2= x72= (n–1)s2252= (8–1)(34.29)2252=13.169x2= x72= (n–1)s2252= (8–1)(34.29)2252=13.169" role="presentation" style="position: rela

$x^2 = x_7^2 = \frac{(n-1)s^2}{25^2} = \frac{(8-1)(34.29)^2}{25^2} = 13.169$;

p-value:

P(x72>13.169)=1–P(x72 ≤13.169)=0.0681P(x72>13.169)=1–P(x72 ≤13.169)=0.0681" role="presentation" style="position: relative;">$P\left(x_7^2 > 13.169\right) = 1-$.

$P\left(x_7^2 > 13.169\right) = 1 - P\left(x_7^2 \leq 13.169\right) = 0.0681$

Alpha: 0.05

Decision: Do not reject the null hypothesis.

Reason for decision: *p*-value > alpha

Conclusion: At the 5% level, there is insufficient evidence to conclude that the variance is more than 625.

130.

1. The test statistic is always positive and if the expected and observed values are not close together, the test statistic is large and the null hypothesis will be rejected.
2. Testing to see if the data fits the distribution “too well” or is too perfect.