1. When testing for independence in a contingency table with 3 rows and 4 columns, there are ________ degrees of freedom

   a. 6
   b. 5
   c. 7
   d. 12
   e. 9

$$d.f = (c-1)(r-1) = 2(3) = 6$$

2. In testing a hypothesis using the χ^2 test, the theoretical frequencies are based on the

   a. null hypothesis.
   b. alternative hypothesis.
   c. normal distribution.
   d. t-student distribution.
   e. χ^2 distribution

   We calculate the test statistic based on H_0 is true.

3. It is believed that the percentage of health insurance firms and casualty insurance firms who did public relations in-house are different. To test that, a random sample of 86 health insurance firms, 61 did public relations in-house, as did 55 of an independent random sample of 86 casualty insurance firms. The pooled estimate for the overall proportion equal to:

   a. 0.674
   b. 0.709
   c. 0.639
   d. 0.5
   e. 0.902

$$\hat{p} = \frac{x_1 + x_1}{n_1 + n_2} = \frac{61 + 55}{86 + 86} = \frac{29}{43} = 0.6744$$

Two candidates for mayor participated in televised debate. A political pollster recorded the preferences of 500 registered voters in a random sample prior to and after the debate:

	Preference after debate		
Preference prior to the debate	Candidate P	Candidate Q	Total
Candidate P	269	21	290
Candidate Q	36	174	210
Total	305	195	500

At 1% level of significance, is there evidence of difference in the proportion of voters who favor candidate P prior to and after the debate?

Based on this information, answer the next four questions

4. The alternative hypothesis is

   a. There is a difference between the proportion of voters.
   b. There is no difference in the proportion of voters.
   c. Sometime there is a difference between the proportion of voters, sometime no.
   d. The proportion of the difference between voters is 50%.
   e. We cannot tell.

$H_0: \pi_1 = \pi_2 \;\; or \;\; there\ is\ a\ difference\ between\ the\ two\ proportions$

5. What is the value of the test statistic?

   a. – 1.99
   b. 292.74
   c. 1.99
   d. – 292.74
   e. 0.005

$$Z_0 = \frac{b-c}{\sqrt{b+c}} = \frac{21-36}{\sqrt{21+36}} = -1.9867$$

6. The observed level of significance of the test is equal to

   a. 0.0466
   b. 0.0233
   c. 0
   d. 0.9767
   e. 0.4835

$p-value = 2P(Z > |Z_0|) = 2P(Z > |-1.99|) = 2P(Z < -1.99) = 2(0.0233) = 0.0466$

7. What should be your conclusion.

   a. There is no evidence for a difference in the proportion of voters who favor candidate P prior to and after the debate.
   b. There is evidence for a difference in the proportion of voters who favor candidate P prior to and after the debate.
   c. There is evidence that the proportion of voters who will favor candidate P is the same as the proportion who will favor candidate Q after the debate.
   d. Sometime there is a difference in the proportion of voters, and sometime no.
   e. We cannot tell what our decision will be from the information given.

   Since the $p-value = 0.0466 > 0.01$, don't reject H_0 no evidence for a difference in the proportions voters who favor candidate P prior to and after the debate.

A survey investigated the public's attitude toward the federal deficit. Each sampled citizen was classified as to whether he or she felt the government should reduce the deficit or increase the deficit or if the individual had no opinion. The sample results of the study by gender are reported below.

Gender	Reduce the Deficit	Increase the Deficit	No opinion	Total
Female	100 (e=108)	60 (e=60)	50 (e=42)	210
Male	80 (e=72)	40 (e=40)	20 (e=28)	140
Total	180	100	70	350

At the 5% significance level, is it reasonable to conclude that gender is independent of a person's position on the deficit?

Based on this information, answer the next three questions

8. For testing if the gender is independent of a person's position on the deficit, what is the critical value of test?

   a. 5.9915
   b. 7.3778
   c. 1.95
   d. 2.3534
   e. 2.9200

$$\chi^2_{0.05,(c-1)(r-1)} = \chi^2_{0.05,(3-1)(2-1)} = \chi^2_{0.05,2} = 5.9915$$

9. For testing if the gender is independent of a person's position on the deficit, what is the value of test statistic?

   a. 5.291
   b. 2.285
   c. 3.174
   d. 0.058
   e. 2.116

$$\chi^2_0 = \frac{(100-108)^2}{108} + 0 + \frac{(50-42)^2}{42} + \frac{(80-72)^2}{72} + 0 + \frac{(20-28)^2}{28} = \frac{16}{27} + 0 + \frac{32}{21} + \frac{8}{9} + 0 + \frac{16}{7} = \frac{1000}{189} = 5.291$$

10. Which of the following statements is true?

   a. Since we don't reject H_0, Gender and attitude toward the deficit are not related.
   b. Since we don't reject H_0, Gender and attitude toward the deficit are related.
   c. Since we reject H_0, Gender and attitude toward the deficit are related.
   d. Since we reject H_0, Gender and attitude toward the deficit are not related.
   e. We cannot tell what our decision will be from the information given.

Since the $\chi^2_0 = 5.291 < \chi^2_{0.05,2} = 5.9915$,, don't reject H_0 and we conclude that gender and attitude toward the deficit are not related (independent)

In a clothing stores, the manager performed a regression analysis of the relationship between the size of the store in thousands of square feet and its annual sales ($ millions). The data were collected from a sample of 14 stores, he believes that the appropriate model is

$$\hat{y} = -2.11 + 2.14\,\mathrm{X}$$

Some additional results are given: $s_e(\hat{\beta}_1) = 0.4516,\ SSR = 71,\ \ SSE = 38$

Based on this information, answer the next four questions

11. the correlation coefficient between the size of the store of square feet and its annual sales

    a. 0.8071
    b. 0.6513
    c. 0.4249
    d. – 0.8071
    e. – 0.6513

$$r = \sqrt{R^2} = \sqrt{\frac{SSR}{SSR + SSE}} = \sqrt{\frac{71}{71 + 38}} = 0.8071$$

12. To test $H_0\!:\beta_1 = 1\ vs.\ H_1\!:\beta_1 \neq 1$ at 1% level of significant, the test statistic equal to

    a. 2.524
    b. – 2.524
    c. – 4.738
    d. 4.738
    e. – 6.886

$$T_0 = \frac{\hat{\beta}_1 - \beta_{10}}{S_e(\hat{\beta}_1)} = \frac{2.14 - 1}{0.4516} = 2.524$$

13. To test $H_0\!:\beta_1 = 1\ vs.\ H_1\!:\beta_1 \neq 1$ at 1% level of significant, what would be the critical value

    a. 3.0545
    b. 3.0123
    c. 1.7823
    d. 1.7709
    e. 2.1788

$$t_{0.005,12} = 3.0545$$

14. To test $H_0\!:\beta_1 = 1\ \ vs.\ H_1\!:\beta_1 \neq 1$, assume that the test statistic is 2.681, the p – value of the test is

    a. 0.02
    b. 0.05
    c. between 0.035 and 0.05
    d. 0.01
    e. 0.035

$$p - value = 2P(T_{12} > |t_0|) = 2P(T_{12} > |2.681|) = 2P(T_{12} > 2.681) = 2(0.01) = 0.02$$

The marketing manager of a large supermarket chain would like to use shelf space (X) per feet to predict the weekly sales (Y) in dollars. A random sample of 12 equal-sized stores is selected, with the following results. You are given the following information to help you carrying out the analyses:

$$\sum x = 150,\ \sum y = 2850,\ Sxx = 375,\ Syy = 30025,\ Sxy = 2775\ \&\ SSE = 9490$$

Based on this information, answer the six questions

15. on average, for each increase in shelf space of an additional foot, there is an expected

a. increase in weekly sales of an estimated \$7.4
b. increase in weekly sales of an estimated \$125
c. decrease in weekly sales of an estimated \$125
d. decrease in weekly sales of an estimated \$7.4
e. we cannot tell

$$\hat{\beta}_1 = \frac{Sxy}{Sxx} = \frac{2775}{375} = \$7.4$$

16. Predict the weekly sales for all stores with 8 feet of shelf space

a. \$204.2
b. \$150.9
c. \$587.4
d. \$1167.4
e. \$30000

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1\bar{x} = \frac{2850}{12} - 7.4\left(\frac{150}{12}\right) = 145$$
$$\hat{Y}|_{x=8} = \hat{\beta}_0 + \hat{\beta}_1 x = 145 + 7.4(8) = \$204.2$$

17. The percentage of the variation that can explained by the model is

a. 68.39%
b. 82.70%
c. 31.61%
d. 46.21%
e. 50.5%

$$R^2 = \frac{SSR}{SST} = \frac{SST - SSE}{SST} = \frac{Syy - SSE}{Syy} = \frac{30025 - 9490}{30025} = 0.6839$$

18. The estimate of the standard error of the estimate equals

a. 30.81
b. 1.59
c. 949
d. 0.8270
e. 0.1851

$$S_e = \sqrt{\hat{\sigma}^2} = \sqrt{\frac{SSE}{n-2}} = \sqrt{\frac{9490}{10}} = \sqrt{949} = 30.805$$

19. A 95% confidence interval estimate for the slope of the regression line is

a. Between 3.855 and 10.944
b. Between 3.898 and 10.901
c. Between 4.783 and 11.017
d. Between 4.517 and 10.283
e. Between 4.543 and 10.257

$$\hat{\beta}_1 \pm t_{0.025,10} S_e(\hat{\beta}_1)$$
$$7.4 \pm 2.2281 \frac{\sqrt{949}}{\sqrt{375}}$$
$$3.855 \le \beta_1 \le 10.944$$

20. Suppose the managers of the brokerage firm want to obtain a 99% prediction interval of the weekly sales of an individual store that has 8 feet of shelf space. The Standard error of the prediction interval is

a. 32.853
b. 11.416
c. 130.33
d. 1079.33
e. 328.53

$$\sqrt{\hat{\sigma}^2\left(1 + \frac{1}{n} + \frac{(x-\bar{x})^2}{Sxx}\right)} = \sqrt{949\left(1 + \frac{1}{12} + \frac{\left(8 - \frac{150}{12}\right)^2}{375}\right)} = 23.853$$