1. **Use the following information from a normal population with mean μ = 52 and variance σ2 = 22.5 to calculate the following questions.**
2. find P (X >55 )
3. find P $(50\leq X\leq 60)$
4. find P $(X\leq 55)$
5. **A random sample from a population with mean and standard deviation produced the following sample information:**

 **n =110 x = 699 s = 20.4**

1. Find a 95% confidence interval for the mean μ. Interpret this interval.
2. Find a 99% confidence interval for the mean μ. Interpret this interval.
3. **Consider the following hypothesis test.**

 **Ho: µ = 17**

 **Ha: µ ≠ 17**

**A sample of 25 gives a sample mean of 14.2 and sample variance of 25.**

* 1. At α = 0.05, what is the rejection rule?
	2. Compute the value of the test statistic
	3. What is the p-value?
	4. What is your conclusion?
1. **Consider the following hypothesis test.**

 **Ho: μ = 15**

 **Ha: μ ≠ 15**

 **A sample of 50 gives a sample mean of 14.2 and sample standard deviation of 5.**

1. At α = 0.02, what is the rejection rule?
2. Compute the value of the test statistic z.
3. What is the p-value?
4. What is your conclusion?

1. **Consider the following hypothesis test**

**Ho: µ ≥ 10**

**Ha: µ < 10**

 **A sample of 50 provides a sample mean of 9.46 and sample variance of 4.**

1. At α = 0.05, what is the rejection rule?
2. Compute the value of the test statistic
3. What is the p-value?
4. What is your conclusion?
5. **Fill in the table and find the following answers:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Months on job (x)** | **Monthly sales (y) thousands of dollars** | $$X^{2}$$ | $$Y^{2}$$ | **XY** | $$(Y-\overbar{Y})$$ | $$(Y-\overbar{Y})^{2}$$ | $$\hat{Y}$$ | $$Y-\hat{Y}$$ | $$(Y-\hat{Y})^{2}$$ |
|  | **1** | **0.8** |  |  |  |  |  |  |  |  |
|  | **2** | **2.4** |  |  |  |  |  |  |  |  |
|  | **4** | **7** |  |  |  |  |  |  |  |  |
|  | **5** | **3.7** |  |  |  |  |  |  |  |  |
|  | **8** | **11.3** |  |  |  |  |  |  |  |  |
|  | **9** | **12** |  |  |  |  |  |  |  |  |
|  | **12** | **15** |  |  |  |  |  |  |  |  |
| **Total** |  |  |  |  |  |  |  |  |  |  |

1. Find $b\_{1}$.
2. Find $b\_{0}$.
3. Write the estimated regression equation.
4. Interpret the estimated regression equation.
5. Calculate the coefficient of determination (R2).
6. Interpret the coefficient of determination (R2).
7. Calculate the adjusted coefficient of determination (Adjusted R2).
8. **A regression model relating x, number of sales persons at a branch office, to y, annual sales at the office ($1000s), has been developed. The computer output from a regression analysis of the data follows.**

 **The regression equation is**

 ***= 80.0 + 50.0X***

 **Predictor Coef Stdev t-ratio**

 **Constant 80.0 11.333 7.06**

 **X 50.0 5.482 9.12**

 **Analysis of Variance**

 **SOURCE DF SS MS**

 **Regression 1 6828.6 6828.6**

 **Error 28 2298.8 82.1**

 **Total 29 9127.4**

1. Write the estimated regression equation.
2. How many branch offices were involved in the study?
3. Compute the F statistic and test the significance of the relationship at a .05 level of significance.
4. Predict the annual sales at the Memphis branch office. This branch has 12 sales persons.
5. **The following regression equation was obtained using the five independent variables.**

|  |
| --- |
| The regression equation issales = - 19.7 - 0.00063 outlets + 1.74 cars + 0.410 income + 2.04 age - 0.034 bossesPredictor Coef SE Coef T PConstant -19.672 5.422 -3.63 0.022outlets -0.000629 0.002638 -0.24 0.823cars 1.7399 0.5530 3.15 0.035income 0.40994 0.04385 9.35 0.001age 2.0357 0.8779 2.32 0.081bosses -0.0344 0.1880 -0.18 0.864S = 1.507 R-Sq = 99.4% R-Sq(adj) = 98.7%Analysis of VarianceSource DF SS MS F PRegression 5 1593.81 318.76 140.36 0.000Residual Error 4 9.08 2.27Total 9 1602.89(Minitab Software) |

1. What percent of the variation is explained by the regression equation?
2. What is the standard error of regression?
3. What is the critical value of the *F-statistic*?
4. What sample size is used in the print out?
5. What is the variance of the slope coefficient of income?
6. Conduct a global test of hypothesis to determine if any of the regression coefficients are not zero.
7. Conduct a test of hypothesis on each of the independent variables. Would you consider eliminating outlets and bosses?
8. **Computer output:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Coefficients** | **Std. Error** | **t-Stat** | **P-value** |
| **Intercept** | **729.8665** | **169.25751** | **4.3121659** | **0.0010099** |
| **Price** | **-10.887** | **3.4952397** | **-3.1148078** | **0.0089406** |
| **Advertising** | **0.0465** | **0.0176228** | **2.6386297** | **0.0216284** |

**ANOVA**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **df** | **SS** | **MS** | **F** | **Significance F** |
| **Regression** | **2** | **12442.8** | **6221.4** | **37.56127994** | **0.00000683** |
| **Residual** | **12** | **1987.6** | **165.63333** |  |  |
| **Total** | **14** | **14430.4** |  |  |  |

**Se =12.86986 R-sq = 0.862263 R-sq(adj) = 0.8393068**

1. Write and interpret the multiple regression equation.
2. Does the model with Price and Advertising contribute to the prediction of Y? Use a 0.05 significance level.
3. Which independent variable appears to be the best predictor of sales? Explain.
4. What is the number of observations used in this study?
5. Assuming that the coefficient on Advertising has Ha: B1 > 0, what statistical decision should be made at 5% level.
6. What is the standard error of estimate? Can you use this statistic to assess the model’s fit? If so, how?
7. What is the coefficient of determination, and what does it tell you about the regression model?
8. What is the coefficient of determination, adjusted for degrees of freedom? Explain how this statistic and the statistic referred to in part (f) help you to determine how well the model fits the data.
9. Test the overall utility of the model. What does the p-value of the test statistic tell you?
10. **For the following ANOVA table are the results from treating 4 cultures with 6 observations for each culture. The enzymes are contained in test tubes with differing levels of enzymes applied.**
11. Please fill in the blank.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source of Variation** | **df** | **SS** | **MS** | **F** |
| **Treatment** |  | **180** |  |  |
| **Error** |  | **60** |  |  |
| **Total** |  |  |  |  |

1. What are the null and alternate hypotheses?
2. What is your decision rule, Use $α=0.05$
3. Indicate your statistical decision.
4. Is there a difference among the means?
5. **A metropolitan bus system sampler’s rider counts on one of its express commuter routes for a week. Use the following data to establish whether the rider ship is evenly balanced by day of the week. Let** $α=0.05$

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Day** | Monday | Tuesday | Wednesday | Thursday | Friday |
| **Rider Count** | 10 | 34 | 21 | 57 | 44 |

1. Is the χ2 value significant at 5% level of significance?
2. Write the conclusion for this question.