Statistics Chapter Review Questions

For full credit, show all work and it must be clear; final answers must be clear as well. For questions that require a hypothesis test, **clearly state H0 , H1**,, your conclusion as a sentence, and the reasoning and computations behind your conclusion.

**Question 3:** Eight samples of a certain grape juice product were taken. The measured sugar (g) in these samples was recorded as:

|  |  |  |  |
| --- | --- | --- | --- |
| 11.48 | 11.45 | 11.50 | 11.46 |
| 11.5 | 11.42 | 11.49 | 11.43 |

An analyst will to use this sample to determine if the mean sugar concentration in this juice is less than 11.5 g. What are the null and alternative hypotheses? What is the analyst’s conclusion if he uses a Type I error of .01? Show all work, clearly state your conclusion and rationale for it.

**Question 7:** Consider a T random variable with 5 degrees of freedom. What is the numerical value of A such that P(2.571 <  < 3.365) = A?

**Question 11:** Two different injection molding machines are used to make plastic parts. Parts are considered defective or non-defective. A sample of 120 parts from Machine 1 contains 20 defectives. A sample of 110 parts from Machine 2 contains 15 defectives.

What are the null and alternative hypotheses? Is it reasonable to assume that both machines produce the same fraction of defective parts? Show all work, clearly state your conclusion and rationale for it.

What is the p-value for this problem?

**Question 16:** The ambient temperature (X1) and number of work days in a month (X2) are thought to affect the amount of electrical power (Y) used at a particular plant. The data are:

|  |  |  |
| --- | --- | --- |
| Y | X1 | X2 |
| 310 | 84 | 31 |
| 296 | 80 | 27 |
| 276 | 60 | 25 |
| 260 | 56 | 20 |

You want to model the power using a multiple linear regression model and the following Excel output results

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ANOVA |  |  |  |  |  |  |  |  |
|  | *df* | *SS* | *MS* | *F* | *Significance F* |  |  |  |
| Regression | 2 | 1450.885914 | 725.4429569 | 6358.73 | 0.008867 |  |  |  |
| Residual | 1 | 0.114086147 | 0.114086147 |  |  |  |  |  |
| Total | 3 | 1451 |   |   |   |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
| Intercept | 165.2712456 | 1.111795037 | 148.6526205 | 0.004283 | 151.1446 | 179.3979 | 151.1446 | 179.3979 |
| X Variable 1 | 0.736030268 | 0.032276152 | 22.80415208 | 0.027899 | 0.325923 | 1.146138 | 0.325923 | 1.146138 |
| X Variable 2 | 2.668218859 | 0.099136991 | 26.91446278 | 0.023643 | 1.408564 | 3.927874 | 1.408564 | 3.927874 |

Using an  = .05, Show (1) the hypotheses tests that are being done on the regressors and (2) the specific model (i.e., with all the relevant  numerical values) that should be used based upon the conclusions you draw from the Excel output.

**Question 19:** The following are recorded times, in hours, until failure of a medical linear accelerator:

|  |  |  |
| --- | --- | --- |
| 953 | 983 | 997 |
| 988 | 915 | 1037 |

What are the null and alternative hypotheses? Can it be concluded that the standard deviation of the time to failure is greater than 40 hrs2? Show all work, clearly state your conclusion and rationale for it. Use Type I error probability of .05.

**Question 23:** Four different gauges can be used to measure the depth of a chemical solution in a vat. To determine if there is a difference between the gauges, depth measurements from a single vat were taken with four each of each type of gauge. The measurements (in.) were as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Gauge 1 | Gauge 2 | Gauge 3 | Gauge 4 |
| 46 | 47 | 52 | 51 |
| 50 | 53 | 47 | 45 |
| 47 | 45 | 49 | 51 |
| 53 | 50 | 45 | 45 |

An analyst used Excel to determine if there was a difference and the following output was obtained:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| ANOVA |  |  |  |  |  |  |
| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
| Rows | 16.66667 | 3 | 5.555556 | 0.402414 | 0.756753 | 4.757063 |
| Columns | 1.166667 | 2 | 0.583333 | 0.042254 | 0.958909 | 5.143253 |
| Error | 82.83333 | 6 | 13.80556 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 100.6667 | 11 |   |   |   |   |

What are the null and alternative hypotheses that the analyst used? Express each as a sentence, no symbols.

Can it be concluded that there is a difference between the gauges? Explain.

**Question 25:** An article in Psychology looked at a certain type of intelligence scores of identical twins to see if there was a difference in intelligence (or not) depending upon whether the twin was born first or second. The following table shows the scores for each set of twins in the study:

|  |  |  |
| --- | --- | --- |
| Twin Set | First born | Second born |
| 1 | 6.48 | 6.43 |
| 2 | 7.99 | 8.76 |
| 3 | 6.32 | 6.32 |
| 4 | 7.60 | 7.62 |
| 5 | 6.03 | 6.59 |

What are the null and alternative hypotheses? Using an  = .05, what is the conclusion*?* Show all work, clearly state your conclusion and rationale for it.