**JAIPURIA INSTITUTE OF MANAGEMENT, INDORE**

**PGDM**

**FIRST TRIMESTER (Batch 2019-21)**

**END TERM EXAMINATION, SEPTEMBER-2019**

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| --- | --- | --- | --- |
| Course Name | **Statistics for Management** | Course Code | **OM 101** |
| Max. Time | **2 hours** | Max. Marks | **40** |

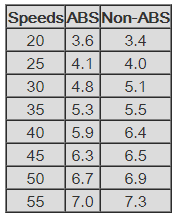
**INSTRUCTIONS:**

Exam instructions, Professor may wish to include.

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**Questions.1 (5 Marks)**

How effective are antilock brakes (ABS)? These brakes pump very rapidly rather than lock, and thus they help to prevent skids. As a test, a car buyer organized an experiment. He hit the brakes and, using a stopwatch, recorded the number of seconds it took to stop an ABS-equipped car and another identical car without ABS. The speeds when the brakes were applied and the number of seconds each took to stop on dry pavement are listed here. Can we infer that ABS is better?

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The results of excel analysis is shown below. Draw your inferences.

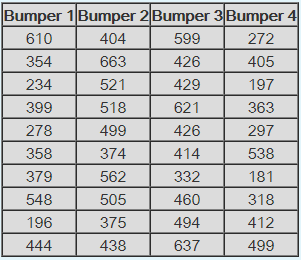
|  |  |  |
| --- | --- | --- |
| t-Test: Paired Two Sample for Means | |  |
|  | ABS | non-ABS |
| Mean | 5.4625 | 5.6375 |
| Variance | 1.51125 | 1.95410714 |
| Observations | 8 | 8 |
| Pearson Correlation | 0.993511614 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 7 |  |
| t Stat | -2.19795039 |  |
| P(T<=t) one-tail | 0.031962061 |  |
| t Critical one-tail | 1.894578605 |  |
| P(T<=t) two-tail | 0.063924123 |  |
| t Critical two-tail | 2.364624252 |  |

**Questions.2 (15 Marks)**

North American automobile manufacturers have become more concerned with quality because of foreign competition. One aspect of quality is the cost of repairing damage caused by accidents. A manufacturer is considering several new types of bumpers. To test how well they react to low-speed collisions, the manufacturer installs 10 bumpers of each of four different types on mid-sized cars, which were then driven into a wall at 5 miles per hour. The cost of repairing the damage in each case was assessed. The data are shown below.

a. Is there sufficient evidence at the 5% significance level to infer that the bumpers differ in their reactions to low-speed collisions?

b. If differences exist, which bumpers differ?



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| --- | --- | --- | --- | --- | --- | --- |
| The results of ANOVA analysis are shown below: | | | | | | |
| ANOVA |  |  |  |  |  |  |
| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
| Between Groups | 150883.875 | 3 | 50294.625 | 4.05630801 | 0.013947 | 2.866266 |
| Within Groups | 446368.1 | 36 | 12399.11389 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 597251.975 | 39 |  |  |  |  |
| Bumper 4 | 10 | 3482 | 348.2 | 14048.6222 |  |  |
|  |  |  |  |  |  |  |
| ANOVA |  |  |  |  |  |  |
| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
| Rows | 77460.3 | 9 | 8606.7 | 0.71527191 | 0.68899 | 2.456281 |
| Columns | 124510.2 | 2 | 62255.1 | 5.17379766 | 0.016781 | 3.554557 |
| Error | 216589.8 | 18 | 12032.76667 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 418560.3 | 29 |  |  |  |  |

**The results of t-test analysis for various two-sample comparison is given below.**

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  | *Bumper 1* | *Bumper 2* |
| Mean | 380 | 485.9 |
| Variance | 16924.22222 | 8197.433333 |
| Observations | 10 | 10 |
| Pooled Variance | 12560.82778 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 18 |  |
| t Stat | -2.112865403 |  |
| P(T<=t) one-tail | 0.024421145 |  |
| t Critical one-tail | 1.734063607 |  |
| P(T<=t) two-tail | 0.048842289 |  |
| t Critical two-tail | 2.10092204 |  |

|  |  |  |
| --- | --- | --- |
|  | Bumper 1 | Bumper 3 |
| Mean | 380 | 483.8 |
| Variance | 16924.22222 | 10426.17778 |
| Observations | 10 | 10 |
| Pooled Variance | 13675.2 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 18 |  |
| t Stat | -1.984794338 |  |
| P(T<=t) one-tail | 0.031311612 |  |
| t Critical one-tail | 1.734063607 |  |
| P(T<=t) two-tail | 0.062623223 |  |
| t Critical two-tail | 2.10092204 |  |

|  |  |  |
| --- | --- | --- |
|  | Bumper 1 | Bumper 4 |
| Mean | 380 | 348.2 |
| Variance | 16924.22222 | 14048.62222 |
| Observations | 10 | 10 |
| Pooled Variance | 15486.42222 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 18 |  |
| t Stat | 0.571395182 |  |
| P(T<=t) one-tail | 0.287398955 |  |
| t Critical one-tail | 1.734063607 |  |
| P(T<=t) two-tail | 0.574797909 |  |
| t Critical two-tail | 2.10092204 |  |

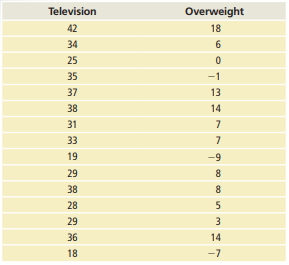
|  |  |  |
| --- | --- | --- |
|  | Bumper 2 | Bumper 3 |
| Mean | 485.9 | 483.8 |
| Variance | 8197.433333 | 10426.17778 |
| Observations | 10 | 10 |
| Pooled Variance | 9311.805556 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 18 |  |
| t Stat | 0.048661708 |  |
| P(T<=t) one-tail | 0.480862388 |  |
| t Critical one-tail | 1.734063607 |  |
| P(T<=t) two-tail | 0.961724775 |  |
| t Critical two-tail | 2.10092204 |  |

|  |  |  |
| --- | --- | --- |
|  | Bumper 2 | Bumper 4 |
| Mean | 485.9 | 348.2 |
| Variance | 8197.433333 | 14048.62222 |
| Observations | 10 | 10 |
| Pooled Variance | 11123.02778 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 18 |  |
| t Stat | 2.919492955 |  |
| P(T<=t) one-tail | 0.0045758 |  |
| t Critical one-tail | 1.734063607 |  |
| P(T<=t) two-tail | 0.0091516 |  |
| t Critical two-tail | 2.10092204 |  |

|  |  |  |
| --- | --- | --- |
|  | Bumper 3 | Bumper 4 |
| Mean | 483.8 | 348.2 |
| Variance | 10426.17778 | 14048.62222 |
| Observations | 10 | 10 |
| Pooled Variance | 12237.4 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 18 |  |
| t Stat | 2.740943692 |  |
| P(T<=t) one-tail | 0.006714615 |  |
| t Critical one-tail | 1.734063607 |  |
| P(T<=t) two-tail | 0.013429229 |  |
| t Critical two-tail | 2.10092204 |  |

**Questions.3 (15 Marks)**

Critics of television often refer to the detrimental effects that all the violence shown on television has on children. However, there may be another problem. It may be that watching television also reduces the amount of physical exercise causing weight gains. A sample of 15 10-year-old children was taken. The number of pounds each child was overweight was recorded (a negative number indicates the child is underweight). In addition, the number of hours of television viewing per week was also recorded. These data are listed here.



a) Draw the scatter diagram.

b) Calculate the sample regression line and describe what the coefficients tell you about the relationship between the two variables.

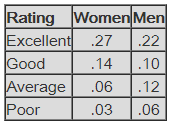
c) Is there evidence of a linear relationship between the number of hours of television viewing and how overweight the child is?

d) Predict with 90% confidence the number of pounds overweight for a child who watches 30 hours of television per week.

**Questions.4 (5 Marks)**

Casino Windsor conducts surveys to determine the opinions of its customers. Among other questions respondents are asked to give their opinion about “Your overall impression of Casino Windsor.” The responses are: Excellent, Good, Average, Poor

Additionally, the gender of the respondent is noted. After analyzing the results the following table of joint probabilities was produced.



a. What proportion of customers rate Casino Windsor as excellent?

b. Determine the probability that a male customer rates Casino Windsor as excellent.

c. Find the probability that a customer who rates Casino Windsor as excellent is a man.

d. Are gender and rating independent? Explain your answer.