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**Кафедра И7**

**«Кафедра математической статистики и прикладной математики»**

**«Математическая статистика»**

Лабораторная работа № 1

«Методы описательной статистики в пакете STATGRAPHICS»

Вариант 18

**Выполнил:**

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**One-Variable Analysis - Material (Material)**

Data variable: Material

Selection variable: Material

40 values ranging from 30,0 to 55,0

***The StatAdvisor***

*This procedure is designed to summarize a single sample of data. It will calculate various statistics and graphs. Also included in the procedure are confidence intervals and hypothesis tests. Use the Tabular Options and Graphical Options buttons on the analysis toolbar to access these different procedures.*

**Summary Statistics for Material**

|  |  |
| --- | --- |
| Count | 40 |
| Average | 43,75 |
| Median | 43,5 |
| Mode | 41,0 |
| Geometric mean | 43,3918 |
| Variance | 30,7564 |
| Standard deviation | 5,54585 |
| Coeff. of variation | 12,6762% |
| Standard error | 0,876875 |
| Minimum | 30,0 |
| Maximum | 55,0 |
| Range | 25,0 |
| Lower quartile | 41,0 |
| Upper quartile | 48,0 |
| Interquartile range | 7,0 |
| Skewness | -0,293965 |
| Stnd. skewness | -0,759014 |
| Kurtosis | 0,0827157 |
| Stnd. kurtosis | 0,106785 |
| Sum | 1750,0 |

***The StatAdvisor***

*This table shows summary statistics for Material. It includes measures of central tendency, measures of variability, and measures of shape. Of particular interest here are the standardized skewness and standardized kurtosis, which can be used to determine whether the sample comes from a normal distribution. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate any statistical test regarding the standard deviation. In this case, the standardized skewness value is within the range expected for data from a normal distribution. The standardized kurtosis value is within the range expected for data from a normal distribution.*

**Frequency Tabulation for Material**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Lower* | *Upper* |  |  | *Relative* | *Cumulative* | *Cum. Rel.* |
| *Class* | *Limit* | *Limit* | *Midpoint* | *Frequency* | *Frequency* | *Frequency* | *Frequency* |
|  | at or below | 28,0 |  | 0 | 0,0000 | 0 | 0,0000 |
| 1 | 28,0 | 32,2857 | 30,1429 | 1 | 0,0250 | 1 | 0,0250 |
| 2 | 32,2857 | 36,5714 | 34,4286 | 4 | 0,1000 | 5 | 0,1250 |
| 3 | 36,5714 | 40,8571 | 38,7143 | 3 | 0,0750 | 8 | 0,2000 |
| 4 | 40,8571 | 45,1429 | 43,0 | 17 | 0,4250 | 25 | 0,6250 |
| 5 | 45,1429 | 49,4286 | 47,2857 | 9 | 0,2250 | 34 | 0,8500 |
| 6 | 49,4286 | 53,7143 | 51,5714 | 5 | 0,1250 | 39 | 0,9750 |
| 7 | 53,7143 | 58,0 | 55,8571 | 1 | 0,0250 | 40 | 1,0000 |
|  | above | 58,0 |  | 0 | 0,0000 | 40 | 1,0000 |

Mean = 43,75 Standard deviation = 5,54585

***The StatAdvisor***

*This option performs a frequency tabulation by dividing the range of Material into equal width intervals and counting the number of data values in each interval. The frequencies show the number of data values in each interval, while the relative frequencies show the proportions in each interval. You can change the definition of the intervals by pressing the alternate mouse button and selecting Pane Options. You can see the results of the tabulation graphically by selecting Frequency Histogram from the list of Graphical Options.*

**Percentiles for Material**

|  |  |
| --- | --- |
|  | *Percentiles* |
| 1,0% | 30,0 |
| 5,0% | 34,0 |
| 10,0% | 35,0 |
| 25,0% | 41,0 |
| 50,0% | 43,5 |
| 75,0% | 48,0 |
| 90,0% | 51,0 |
| 95,0% | 52,5 |
| 99,0% | 55,0 |

***The StatAdvisor***

*This pane shows sample percentiles for Material. The percentiles are values below which specific percentages of the data are found. You can see the percentiles graphically by selecting Quantile Plot from the list of Graphical Options.*

**Stem-and-Leaf Display for Material: unit = 1,0 1|2 represents 12,0**

LO|30,0

1 3|

1 3|

5 3|4455

5 3|

6 3|8

13 4|0011111

20 4|2223333

20 4|44555

15 4|6667

11 4|88889

6 5|00

4 5|223

1 5|5

***The StatAdvisor***

*This display shows a frequency tabulation for Material. The range of the data has been divided into 13 intervals (called stems), each represented by a row of the table. The stems are labeled using one or more leading digits for the data values falling within that interval. On each row, the individual data values are represented by a digit (called a leaf) to the right of the vertical line. This results in a histogram of the data from which you can recover at least two significant digits for each data value. If there are any points lying far away from most of the others (called outside points), they are placed on separate high and low stems. In this case, there is one outside point. Outside points are illustrated graphically on the box-and-whisker plot, which you can access via the list of Graphical Options. The leftmost column of numbers are depths, which give cumulative counts from the top and bottom of the table, stopping at the row which contains the median.*

**Confidence Intervals for Material**

95,0% confidence interval for mean: 43,75 +/- 1,77365 [41,9763; 45,5237]

95,0% confidence interval for standard deviation: [4,54294; 7,12106]

***The StatAdvisor***

*This pane displays 95,0% confidence intervals for the mean and standard deviation of Material. The classical interpretation of these intervals is that, in repeated sampling, these intervals will contain the true mean or standard deviation of the population from which the data come 95,0% of the time. In practical terms, we can state with 95,0% confidence that the true mean Material is somewhere between 41,9763 and 45,5237, while the true standard deviation is somewhere between 4,54294 and 7,12106.*

*Both intervals assume that the population from which the sample comes can be represented by a normal distribution. While the confidence interval for the mean is quite robust and not very sensitive to violations of this assumption, the confidence interval for the standard deviation is quite sensitive. If the data do not come from a normal distribution, the interval for the standard deviation may be incorrect. To check whether the data come from a normal distribution, select Summary Statistics from the list of Tabular Options, or choose Normal Probability Plot from the list of Graphical Options.*

**Hypothesis Tests for Material**

Sample mean = 43,75

Sample median = 43,5

Sample standard deviation = 5,54585

t-test

Null hypothesis: mean = 0,0

Alternative: not equal

Computed t statistic = 49,8931

P-Value = 0,0

Reject the null hypothesis for alpha = 0,05.

sign test

Null hypothesis: median = 0,0

Alternative: not equal

Number of values below hypothesized median: 0

Number of values above hypothesized median: 40

Large sample test statistic = 6,16644 (continuity correction applied)

P-Value = 7,01236E-10

Reject the null hypothesis for alpha = 0,05.

signed rank test

Null hypothesis: median = 0,0

Alternative: not equal

Average rank of values below hypothesized median: 0,0

Average rank of values above hypothesized median: 20,5

Large sample test statistic = 5,50782 (continuity correction applied)

P-Value = 3,64207E-8

Reject the null hypothesis for alpha = 0,05.

chi-squared test

Null hypothesis: sigma = 1,0

Alternative: not equal

Computed chi-squared statistic = 1199,5

P-Value = 0,0

Reject the null hypothesis for alpha = 0,05.

***The StatAdvisor***

*This pane displays the results of tests concerning the population from which the sample of Material comes. The t-test tests the null hypothesis that the mean Material equals 0,0 versus the alternative hypothesis that the mean Material is not equal to 0,0. Since the P-value for this test is less than 0,05, we can reject the null hypothesis at the 95,0% confidence level. The sign test tests the null hypothesis that the median Material equals 0,0 versus the alternative hypothesis that the median Material is not equal to 0,0. It is based on counting the number of values above and below the hypothesized median. Since the P-value for this test is less than 0,05, we can reject the null hypothesis at the 95,0% confidence level. The signed rank test tests the null hypothesis that the median Material equals 0,0 versus the alternative hypothesis that the median Material is not equal to 0,0. It is based on comparing the average ranks of values above and below the hypothesized median. Since the P-value for this test is less than 0,05, we can reject the null hypothesis at the 95,0% confidence level. The sign and signed rank tests are less sensitive to the presence of outliers but are somewhat less powerful than the t-test if the data all come from a single normal distribution.*

*The chi-squared test tests the null hypothesis that the standard deviation of Material equals 1,0 versus the alternative hypothesis that the standard deviation of Material is not equal to 1,0. Since the P-value for this test is less than 0,05, we can reject the null hypothesis at the 95,0% confidence level.*





