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**«Математическая статистика»**

Лабораторная работа № 6

«Критерии согласия в статическом пакете STATGRAPHIC»

Вариант 13

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**Задание 1.**

Смоделировать выборку объемом 50 элементов согласно гипотетическому нормальному распределению с параметрами m = 9 и σ = 20. Проверить с помощью критериев согласия соответствие статистического и гипотетического распределений с уровнем значимости α = 0.1.

**Решение в пакете Statgraphics**

Смоделированная выборка:

**Probability Distributions**

Distribution: Normal

|  |  |  |
| --- | --- | --- |
| *Parameters:* | *Mean* | *Std. Dev.* |
| Dist. 1 | 9 | 20 |
| Dist. 2 |  |  |
| Dist. 3 |  |  |
| Dist. 4 |  |  |
| Dist. 5 |  |  |

**The StatAdvisor**

*This procedure allows you to analyze any of 45 probability distributions. Currently, the Normal distribution has been selected. You can create various plots, compute tail areas and critical values, and generate random numbers from the selected distribution. Up to five sets of parameters can be specified by pressing the alternate mouse button and selecting Analysis Options.*

**Cumulative Distribution**

Distribution: Normal

Lower Tail Area (<)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Variable* | *Dist. 1* | *Dist. 2* | *Dist. 3* | *Dist. 4* | *Dist. 5* |
| 0 | 0,326354 |  |  |  |  |

Probability Density

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Variable* | *Dist. 1* | *Dist. 2* | *Dist. 3* | *Dist. 4* | *Dist. 5* |
| 0 | 0,0180263 |  |  |  |  |

Upper Tail Area (>)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Variable* | *Dist. 1* | *Dist. 2* | *Dist. 3* | *Dist. 4* | *Dist. 5* |
| 0 | 0,673646 |  |  |  |  |

**The StatAdvisor**

*This pane evaluates the cumulative Normal. It will calculate the tail areas for up to 5 critical values of the distribution. It will also calculate the probability density or mass function. For example, the output indicates that, for the first distribution specified, the probability of obtaining a value less than 0,0 is 0,326354. Also, the probability of obtaining a value greater than 0,0 is 0,673646. The height of the probability density function at 0,0 is 0,0180263.*

**Inverse CDF**

Distribution: Normal

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *CDF* | *Dist. 1* | *Dist. 2* | *Dist. 3* | *Dist. 4* | *Dist. 5* |
| 0,01 | -37,527 |  |  |  |  |
| 0,1 | -16,6311 |  |  |  |  |
| 0,5 | 9 |  |  |  |  |
| 0,9 | 34,6311 |  |  |  |  |
| 0,99 | 55,527 |  |  |  |  |

**The StatAdvisor**

*This pane finds critical values for the Normal. You may specify up to 5 five tail areas. The critical value is defined as the largest value for the Normal such that the probability of not exceeding that value does not exceed the area specified. For example, the output indicates that, for the first distribution specified, -37,527 is the largest value such that the probability of not exceeding -37,527 is less than or equal to 0,01.*

**Random Numbers**

To generate random numbers from the selected distribution, use the save button on the analysis toolbar.

Random numbers to be generated: 50

**The StatAdvisor**

*This pane allows you to specify the number of observations desired in a random sample from the Normal. You set the number of observations by pressing the alternate mouse button and selecting Pane Options. After setting the size, press the Save Results button on the analysis toolbar. This allows you to save random samples from the specified distribution in columns of the current data file. Every time you select Save Results, a new random sample will be generated.*

**





Проверка соответствия:

**Uncensored Data - NORM2**

Data variable: NORM2 (Random Numbers for Dist. 1)

50 values ranging from -35,4356 to 50,6299

Fitted Distributions

|  |
| --- |
| *Normal* |
| mean = 8,83457 |
| standard deviation = 20,9745 |

**The StatAdvisor**

*This analysis shows the results of fitting a normal distribution to the data on NORM2. The estimated parameters of the fitted distribution are shown above. You can test whether the normal distribution fits the data adequately by selecting Goodness-of-Fit Tests from the list of Tabular Options. You can also assess visually how well the normal distribution fits by selecting Frequency Histogram from the list of Graphical Options. Other options within the procedure allow you to compute and display tail areas and critical values for the distribution. To select a different distribution, press the alternate mouse button and select Analysis Options.*

**Tests for Normality for NORM2**

|  |  |  |
| --- | --- | --- |
| *Test* | *Statistic* | *P-Value* |
| Shapiro-Wilk W | 0,977123 | 0,621388 |

**The StatAdvisor**

*This pane shows the results of several tests run to determine whether NORM2 can be adequately modeled by a normal distribution. The Shapiro-Wilk test is based upon comparing the quantiles of the fitted normal distribution to the quantiles of the data.*

*Since the smallest P-value amongst the tests performed is greater than or equal to 0,05, we can not reject the idea that NORM2 comes from a normal distribution with 95% confidence.*

**Goodness-of-Fit Tests for NORM2**

Kolmogorov-Smirnov Test

|  |  |
| --- | --- |
|  | *Normal* |
| DPLUS | 0,0613832 |
| DMINUS | 0,0421122 |
| DN | 0,0613832 |
| P-Value | 0,991728 |

**The StatAdvisor**

*This pane shows the results of tests run to determine whether NORM2 can be adequately modeled by a normal distribution.*

*Since the smallest P-value amongst the tests performed is greater than or equal to 0,05, we can not reject the idea that NORM2 comes from a normal distribution with 95% confidence.*

**Tail Areas for NORM2**

Normal distribution

|  |  |  |
| --- | --- | --- |
| *X* | *Lower Tail Area (<)* | *Upper Tail Area (>)* |
| 7,06765 | 0,46643 | 0,53357 |
| 7,95111 | 0,483198 | 0,516802 |
| 8,83457 | 0,5 | 0,5 |
| 9,71802 | 0,516802 | 0,483198 |
| 10,6015 | 0,53357 | 0,46643 |

**The StatAdvisor**

*This pane calculates tail areas for the fitted normal distribution. It will calculate the tail areas for up to 5 critical values, which you may specify by pressing the alternate mouse button and selecting Pane Options. For example, the output indicates that the probability of obtaining a value less than or equal to 7,06765 is 0,46643 for the fitted normal distribution.*

**Critical Values for NORM2**

|  |  |
| --- | --- |
| *Lower Tail Area (<=)* | *Normal* |
| 0,01 | -39,9594 |
| 0,1 | -18,0453 |
| 0,5 | 8,83457 |
| 0,9 | 35,7145 |
| 0,99 | 57,6286 |

**The StatAdvisor**

*This pane calculates critical values for the fitted normal distribution. It will calculate the critical values for up to 5 lower tail areas, which you may specify by pressing the alternate mouse button and selecting Pane Options. For example, the output indicates that the value of the fitted normal distribution below which you would find an area equal to 0,01 is -39,9594.*

**Normal Tolerance Limits for NORM2**

Normal distribution

Sample size = 50

Mean = 8,83457

Sigma = 20,9745

95,0% tolerance interval for 99,73% of the population

Xbar +/- 3,64032 sigma

Upper: 85,1883

Lower: -67,5192

**The StatAdvisor**

*Assuming that NORM2 comes from a normal distribution, the tolerance limits state that we can be 95,0% confidence that 99,73% of the distribution lies between -67,5192 and 85,1883. This interval is computed by taking the mean of the data +/-3,64032 times the standard deviation. This interval is only reliable if the data come from a normal distribution, which you can test by selecting Tests for Normality from the list of Tabular Options. If the data do not come from a normal distribution, select Distribution-Free Limits from the list of Tabular Options.*

**Distribution-Free Tolerance Limits for NORM2**

Data summary

Count = 50

Maximum = 50,6299

Median = 7,33305

Minimum = -35,4356

95,0% tolerance interval for 90,8547% of the population

Upper: 50,6299

Lower: -35,4356

(Based on an interval depth = 1)

**The StatAdvisor**

*Without assuming that NORM2 comes from a normal distribution, the tolerance limits state that we can be 95,0% confidence that 90,8547% of the distribution lies between -35,4356 and 50,6299. This interval is computed from the smallest and largest data values.*



