ON NEW PROPERTIES OF APPLIED STATISTIC DISTRIBUTIONS

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Basic statistical distributions such as Gaussian, Student, Snedecor-Fisher and chi-square are considered. Their properties are studied in order to construct effective calculating schemes for them.

1. Introduction

Let $S_n(x)$, $\chi_n^2(x)$, $F_{n_1,n_2}(x)$ be Student, chi-square and Snedecor-Fisher distribution functions respectively. Via τ_n, χ_n^2, η_{n_1,n_2} we will denote random variables corresponding to $S_n(x)$, $\chi_n^2(x)$ and $F_{n_1,n_2}(x)$.

$$\tau_n \overset{d}{=} \frac{\xi_0}{\sqrt{(\xi_1^2 + ... + \xi_n^2)/n}}, \qquad (1)$$

$$\chi_n^2 \overset{d}{=} \xi_1^2 + ... + \xi_n^2, \qquad (2)$$

$$\eta_{n_1,n_2} \overset{d}{=} \frac{(\xi_1^2 + ... + \xi_{n_1}^2)/n_1}{(\xi_{n_1+1}^2 + ... + \xi_{n_1+n_2}^2)/n_2}, \qquad (3)$$

where $\xi_0, \xi_1, \xi_2, ..., \xi_{n_1+n_2}$ are independent random variables distributed in accordance with the Gaussian law with the distribution function $\Phi(x) = \dfrac{1}{\sqrt{2\pi}} \displaystyle\int_{-\infty}^{x} e^{-t^2/2} dt$.

Based on (1) - (3) it may be presupposed that for $S_n(x)$, $\chi_n^2(x)$, $F_{n_1,n_2}(x)$ there are exact formulae in which the functions are presented in terms of elementary functions and $\Phi(x)$. In sections 2, 3 of the proposed presentation this hypothesis is completely verified. In addition for the calculation of Student, chi-square and Snedecor-Fisher distributions the efficient algorithms are worked out as a consequence of the obtained results.

References

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