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Robust one-way ANOVA under possibly non-regular conditions. (English. English summary)

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Summary: "Consider the one-way ANOVA problem of comparing the means $m_1, m_2, \cdots, m_c$ of c distributions $F_1, F_2, \cdots, F_c$ given by $F_i(x) = F(x - m_i)$. Solutions based on (i) normal-theory procedures, (ii) linear rank statistics and (iii) M-estimators are available.

"The above model presupposes that $F_1, F_2, \cdots, F_c$ have equal variances (= homoscedasticity). However, practising statisticians contend that homoscedasticity is often violated in practice. Hence a more realistic problem to consider is one in which $F_i(x) = F((x - m_i)/\sigma_i),\ i = 1, 2, \cdots, c$, where F is symmetric about the origin and $\sigma_1, \cdots, \sigma_c$ are unknown and possibly unequal (= heteroscedasticity). Now we have to compare $m_1, m_2, \cdots, m_c$. At present, nonparametric tests for the equality of $m_1, m_2, \cdots, m_c$ are available. However, simultaneous tests for paired comparisons and contrasts do not seem to be available.

"This paper begins by proposing a solution applicable to both the homoscedastic and the heteroscedastic situations, assuming F to be symmetric. Then the assumptions of symmetry and the identical shapes of $F_1, \cdots, F_c$ are progressively relaxed and solutions are proposed for these cases as well. The procedures are all based on either the 15% trimmed means or the sample medians, whose quantiles are estimated by means of the bootstrap. Monte Carlo studies show that these procedures tend to be superior to the Wilcoxon procedure and Dunnett's normal theory procedure. A rigorous justification of the bootstrap is also presented. The methodology is illustrated by a comparison of mean effects of cocaine administration in pregnant female Sprague-Dawley rats, where skewness and heteroscedasticity are known to be present."