ABSTRACTS OF PAPERS

(Abstracts of papers to be presented at the Eastern Regional Meeting, Cambridge, Massachusetts, May 6–7, 1963. Additional abstracts will appear in the June, 1963 issue.)

1. A Generalization on Distribution-Free Tolerance Limits. L. DANZIGER and S. A. DAVIS, International Business Machines Corporation, Poughkeepsie, New York.

Given an ordered random sample $X_1 \leqq X_2 \leqq \cdots \leqq X_n$ from a population with a continuous probability density function $f(x)$, we wish to make distribution-free inferences about a second, finite, random sample $Y_1, Y_2, \cdots Y_N$ from the same population. *The ONE tolerance-limit problem is*: For any integer r, such that $1 \leqq r \leqq n$, and for any integer N_0, such that $0 \leqq N_0 \leqq N$, find the probability that at least N_0 of the Y_i are greater than or equal to X_r. *The TWO tolerance-limit problem can be similarly stated*: For any pair of integers r_1 and r_2, such that $1 \leqq r_1 < r_2 \leqq n$, and for any integer N_0, such that $0 \leqq N_0 \leqq N$, find the probability that at least N_0 of the Y_i are greater than or equal to X_{r_1}, and less than or equal to X_{r_2}. This paper generalizes certain results given by S. S. Wilks (*Ann. Math. Statist.* **12** (1941) 91–96) by proving that the probability of at least N_0 of the Y_i being greater than X_r is equal to the probability of at least N_0 of the Y_i lying betwen X_{r_1} and X_{r_2}, where $r = n + r_1 - r_2 + 1$. Hence, the distribution-free TWO tolerance-limit problem can be reduced to the ONE tolerance-limit problem.

In conjunction with this proof, an extensive set of distribution-free tolerance-limit tables has been computed for many combinations of r, n, and N.

2. On the Power of Rank Tests on the Equality of Two Distribution Functions. JEAN D. GIBBONS, University of Cincinnati.

A comparative study is made of power functions of two-sample rank tests of the hypothesis of equal distributions, $H_0: \; H = G$, including the most powerful rank test, Terry Test, one and two-sided Wilcoxon tests, one and two-sided median tests, and runs. Two new tests are proposed, the Gamma test and Psi test, which are locally most powerful against certain nonparametric alternatives. Numerical results are given for the alternative

$$H_1: \quad H = 1 - (1 - F)^k, \qquad G = F^k,$$

F unspecified, $k = 2, 3, 4$, $m = n \leqq 6$, $\alpha = .01, .05, .10$, using randomized decision rules. If F is symmetric, H amd G are mirror images. Some results for unequal sample sizes are also given. Comparisons are made with power against normal alternatives having the corresponding standardized differences. The Psi test is found to occupy a position intermediate between the Terry and Mann-Whitney-Wilcoxon tests, but the difference between power functions of these and the most powerful rank test is almost negligible. Asymptotic properties of the Psi test are investigated using the results of Chernoff and Savage (*Ann. Math. Statist.* **29** (1958) 972–994).

3. Dependence in Three Dimensions. H. O. LANCASTER, University of Sydney, Sydney, Australia. (By title)

Let a Latin square be described by a triplet of indices $\{x, y, z\}$ each running over the integers $0, 1, 2 \cdots (n - 1)$. Let a three dimensional distribution of $W \equiv \{X, Y, Z\}$ be defined by setting $P\{X = x, Y = y, Z = z\}$ equal to n^{-2} if x, y, z is a triplet occurring in the