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ABSTRACTS OF PAPERS

(Abstracts of papers presented at the Annual meeting, New York, New York, August 19–22, 1969 Additional abstracts appeared in earlier issues.)

27. Maximum likelihood histograms. EDWARD J. WEGMAN, University of North Carolina.

Conventional histograms are characterized as being measurable with respect to σ-algebras. They enjoy certain maximum likelihood and consistency properties. The conventional histogram is generalized to the case where all intervals need not be equally long. This generalization is maximum likelihood. The number of such histograms is computed. Consistency is shown to depend on the existence of an optimal histogram. Based on this optimal histogram, asymptotically maximum likelihood histograms are defined. Other types of histograms are discussed in several examples. (Received 21 May 1969.)

28. Ladder variables for a continuous time process (preliminary report). N. U. PRABHU AND MICHAEL RUBINOVITCH, Cornell University.

Ladder processes are introduced and studied for a class of stochastic processes with stationary independent increments. This is the class of processes which are representable as the difference between two independent processes on $[0, \infty)$, where one is a compound Poisson process and the other a process with stationary independent increments. The distribution of the ladder process is obtained via a continuous time version of Feller's combinatorial lemma [The Harold Cramér Volume (1959), 75–91]. A limit theorem for the supremum functional of the underlying process is given and is used to investigate the asymptotic behavior of a dam model introduced by Gani and Pyke [*J. Math. Mech.* **9** (1960) 639–652]. (Received 23 May 1969.)

29. A random walk approach to a shutdown queuing system. PAUL R. MILCH AND MARK H. WAGGONER, Naval Postgraduate School.

A queueing system with two service stations is discussed. Service times are independent exponentially distributed random variables with rates λ and μ, respectively. There are initial queues of sizes M and N, respectively, at the two stations. Operations begin simultaneously at both stations. Customers served by one station join the queue (if any) at the other station. Customers served by both stations leave the system. The results are the non-steady state Laplace transforms of the total operation time of the system; idle time of a station and time spent in the system by an individual customer. These results are obtained by a two-dimensional random walk representation of the service operations. The combinatorial methods used are the Reflection Principle and a new device called the Telescope Principle. (Received 23 May 1969.)

30. On some invariant tests concerning covariance matrices of multivariate normal populations. N. GIRI, University of Montreal. (By title)

Let $N(\xi_i, \Sigma_i)$, $i = 1, \cdots k$ be k independent p-variate normal populations with unknown mean ξ_i and unknown covariance matrix Σ_i. For testing hypothesis (A) $H_{10}: \Sigma_1 = \Sigma_0$ against the alternatives $H_{11}: \Sigma_1 \neq \Sigma_0$, where Σ_0 is a specified positive definite matrix; (B) $H_{20}: \Sigma_1 = \Sigma_2$ against the alternatives $H_{21}: \Sigma_1 \neq \Sigma_2$ and (C) $H_{30}: \Sigma_1 = \cdots = \Sigma_k$ against the alternatives