can be regarded as the cosine of the angle θ between the lines joining (τ_1, τ_2, τ_3) and (t_1, t_2, t_3) respectively to the centre of the above-mentioned circle.

The relationships between the τ_i's given by (5) make it necessary for one value of the τ_i's to occur in each of the three non-overlapping intervals $-\sqrt{2}$ to $-\frac{1}{\sqrt{2}}$; $-\frac{1}{\sqrt{2}}$ to $\frac{1}{\sqrt{2}}$ and $\frac{1}{\sqrt{2}}$ to $\sqrt{2}$. Exactly the same conditions hold for the t_i's.[2]

The 6 permutations of τ_1, τ_2, τ_3 in these three intervals correspond to a subdivision of the circle on which the point (τ_1, τ_2, τ_3) lies into 6 equal arcs of 60° each. Every point on any one of these arcs can be shown to correspond, one to one, to the position of τ_i in any one of the intervals; also proceeding along the circle, points on three alternate arcs correspond to the positions of τ_i as it takes on values from the highest to the lowest in this interval and points on the other three correspond to the positions of τ_i as it moves from the lowest to the highest value.

It is clear that when adjacent arcs are combined in pairs dividing the circle into 3 equal arcs of 120°, the probability density function of (τ_1, τ_2, τ_3) is the same on the 3 arcs and is symmetric on each. At any three points on the circle which divide it into three arcs of 120°, the probability density function of (τ_1, τ_2, τ_3) is therefore the same. The same conditions hold for (t_1, t_2, t_3).

It therefore follows that

$$
\begin{aligned}
P\left(-\frac{\pi}{3} < \theta \le \frac{\pi}{3}\right) &= P\left(-\frac{2\pi}{3} < \theta \le -\frac{\pi}{3} \text{ or } \frac{\pi}{3} < \theta \le \frac{2\pi}{3}\right) \\
&= P\left(-\pi < \theta \le -\frac{2\pi}{3} \text{ or } \frac{2\pi}{3} < \theta \le \pi\right).
\end{aligned} \tag{8}
$$

CORRECTION TO "THE DISTRIBUTION OF EXTREME VALUES IN SAMPLES WHOSE MEMBERS ARE SUBJECT TO A MARKOFF CHAIN CONDITION"

BY BENJAMIN EPSTEIN

Wayne University

In the paper mentioned in the title (*Annals of Math. Stat.*, Vol. 20 (1949), pp. 590–594) I claim to have proved a number of results dealing with the distribution of extreme values in samples of size n drawn at equally spaced intervals from a stationary Markoff process. As Professor W. Feller has kindly pointed

[2] This property has been utilised by the author and S. C. Bhoumik to obtain distributions of the correlation coefficient for samples of three, under varying assumptions regarding the distributions of independent variables x and y. The distribution of τ_i or t_i is also of help in working out the distribution of Fisher's g_1 for samples of three. For the distribution of g_1 for samples of three from continuous rectangular distribution, refer to C. Chandra Sekar in *Current Science*, Vol. 13 (1944), pp. 10–11.

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out to me in personal correspondence, this is actually not the case. However, the theorems and their proofs remain completely valid in their present form if the observations are drawn from a stochastic process satisfying condition (5) of the paper. This chain condition states that the process be such that
Prob $(X_n \leq x \mid X_1 \leq x, X_2 \leq x, \cdots, X_{n-1} \leq x) = $ Prob $(X_n \leq x \mid X_{n-1} \leq x)$
is satisfied for all x and for all positive integers n.

ABSTRACTS OF PAPERS

(Abstracts of papers presented at the Chicago meeting of the Institute, December 27–29, 1950)

1. Cost Functions for Sample Surveys. (Preliminary Report). GARNET E. MCCREARY, University of Manitoba and Iowa State College.

Assume: (1) one travels in a rectangular (grid) fashion rather than straight line (airline) path, (2) n random points have a uniform distribution over the region or stratum. Moderate changes in shape of regions have a minor effect on expected distance. Mean airline distance can be prediced from mean grid distance fairly accurately. The following formulas are derived: (1) expected minimum grid distance for $n = 3$ in a square, (2) an upper bound to expected minimum grid distance for all n, (3) expected grid distance for a stratified and unstratified sample, if the path among the points does not reverse a certain direction, (4) expected distance of a random point from (a) the center of the arc of the circle, semicircle or quadrant, (b) any fixed point, inside or outside the rectangular region, (5) mean square distance between any pair of points adjacent in a clockwise direction (6.7 to 9.5 per cent biased upwards over corresponding mean airline distance). Certain conclusions are drawn regarding the most efficient design with respect to total distance. Detailed mileage records of three Iowa farm surveys were compared with theoretical estimates. If the cost is balanced against the losses resulting from errors in estimate, for a particular design, the problem of determining sample size is broached by using Wald's minimax principle.

2. On a Preliminary Test for Pooling Mean Squares in the Analysis of Variance. A. E. PAULL, Abitibi Power and Paper Company, Limited, Toronto, Canada.

The consequences of performing a preliminary F-test in the analysis of variance is described. The use of the 5% or 25% significance level for the preliminary test results in disturbances that are frequently large enough to lead to incorrect inferences in the final test. A more stable procedure is recommended for performing the preliminary test, in which the two mean squares are pooled only if their ratio is less than twice the 50% point.

3. Estimation for Sub-Sampling Designs Employing the County as a Primary Sampling Unit. EMIL H. JEBE, Iowa State College and North Carolina State College.

This paper summarizes a study of the application of various two-stage designs including the estimation procedures for providing state estimates of agricultural items in North Carolina. Among the principal objectives of the investigation were (1) the comparison of the efficiency of selection of the primary units with equal and with unequal probabilities, and (2) assessment of the relative contributions of the between primary sampling unit and within primary sampling unit error components to the total sampling error. Examination of several linear and ratio estimates indicates a number of advantages for a particular ratio estimate.