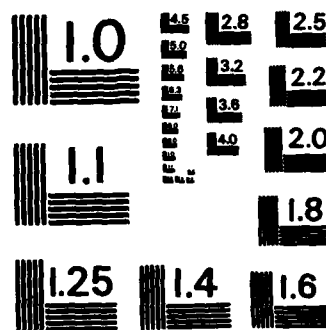


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During 1984-85 two papers were published, two were submitted and three are in process. Work in Reliability, Multivariate Analysis and Information Theory continued. <i>Keywords:</i>			
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Multivariable Problems of
Statistics and Problem Theory



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Report on the Air Force Grant # 830080

for the period of one year ending on April 14, 1985.

This year has been one of the most fruitful years in the career of Professor J.N. Srivastava, the Principal Investigator. (This is so, in spite of the fact that the period from June - Oct., 1985 saw terrifying and unpredictable ups and downs in Srivastava's health, which at that time looked more like a heart problem, but was later found to be more related to complications in the digestion process, and is now essentially under control).

During the first $1\frac{1}{2}$ months, research was continued in the field of Reliability. The results were presented in the International Symposium on Reliability and Quality Control, held in Columbia, Missouri, June 4-8, 1985, where Professor Srivastava was an Invited Speaker. This work was mostly concerned with block-treatment type of comparative experiment on the hazard rate, the basic distribution being exponential.

In mid June 1984, the heart problem began. In spite of this, Professor Srivastava participated in the distinguished Workshop on Efficient Data Collection (sponsored by certain Federal Agencies) at U.C., Berkeley, for one week, during which she also gave a talk as an Invited Speaker. Her topic was Optimal Design theory. The work presented included the new developments made by her during 1983-84 on symmetrical factorial designs of the parallel flats type, when S (the number of levels of a factor) is not a prime number, but a power of a prime number. This leads one into algebra and ring theory. (As of May 1985, some more

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work needs to be done on this topic, before the paper should be written.) The area is probably the most advanced in all of (Discrete) Design Theory in existence at this time. (Its usefulness can not be exaggerated: the use of optimal designs would result in savings of billions of dollars in scientific research.)

Because of her health, Srivastava did not participate in any further conferences. However, in August 1985, she wrote a paper on Structural Richness of designs. This is a new concept, which would give more flexibility to the experimenter in the analysis of his results, if the model originally assumed is found to be faulty (a situation which does occur in most experiments).

In September 1984, Srivastava began looking into the field of Sampling, and since October 1984, important discoveries by her began. Two papers have been written. There is material for writing several more papers. Each of these papers is potentially a breaker of new ground, and would start an important subfield of Sampling.

One of these papers makes a great advance in the interface of Experimental Design and Sampling. If the sample size n is fixed, it is shown that a 4-design can do the job about as well as Simple Random Sampling without Replacement (SRSWOR), in the sense that all the sample moments (up to order four) will be the same under the two cases. But, this gives the 4-design a distinct advantage over SRSWOR (which can also be looked upon, in a sense, as a 4-design), namely, that we can thereby restrict (usually, severely) the sample space, thus gaining in cost and efficiency in multiple ways.

The other paper should turn out to be one of the most important papers in the field of Sampling. Basically, it introduces a very large

Chief, 1985

class of estimators in the field of finite population sampling. It generalises the largest known classes of estimators in three different directions. It also provides expressions for the variance of the estimators. Furthermore, a class of estimators of the variance (of the above estimators) are also given. The paper opens up many many fields.

During the year under consideration, work in reliability, multivariate analysis, and information theory, was continued sporadically. Many basic approaches in problems of experimental design in the reliability field were specially considered with a view to found and develop a new subject, namely, the Design of Experiments for Reliability Assessment. (Whatever work is already available in this field is rather elementary relative to the needs.) Consideration was given to multivariate exponential and Weibull distributions.

During the year under consideration, the following two papers were published:

- (1) (with A. Wijetunga) D-optimal cyclic 2-dimensional block designs, Trab. Estad. Invest. Oper., Vol. 34, 1983 (published in 1985).
- (2) Structural Richness: an important requirement for a statistical experimental design, Jour. Ind. Soc. Agr. Stats., IASRI Silver Jubilee Souvenir Volume.

Also, the following two papers were submitted, and are scheduled to appear:

- (3) (with F. Saleh) On the need of t-designs in finite population sampling; to appear in Utilitas Mathematicas
- (4) On a general theory of sampling using experimental design concepts, I: Estimation; to appear in the Bulletin of International Statistical Institute, Amsterdam Session, 1985.



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