SHEWHART ON ECONOMIC CONTROL

Economic Control of Quality of Manufactured Product. By Walter A. Shewhart. New York, Van Nostrand, 1931. xiv+501 pp.

This important book, written by a recognized authority in the fast developing field of mathematical statistics, comes as a welcome addition to the all too sparse collection of expository books. Those who have wished in their statistical courses for practical problems to illustrate sampling theory, the correlation surface, frequency distribution of parameters such as the mean and standard deviation, and the use of Chi Square, will be enthusiastic about the splendid collection of practical problems most of which have their origin in the telephone business.

It has been known for some time (at least since the time of Gauss) that the distribution of the average $\overline{X}$ of a sample taken from a normal universe is normal with a standard deviation $\sigma/\sqrt{n}$. Student, Karl Pearson, and R. A. Fisher have studied the distribution of the standard deviation, and Fisher has given the theoretical formula. For non-normal universes we do not know the distribution of so simple a statistic as the arithmetic mean. Therefore, for non-normal universes appeal must, at present, be made to experimental data. Dr. Shewhart presents observed distributions of average of 1,000 samples of four taken from (1) a rectangular universe and (2) a triangular universe. These distributions appear to approach normality as the number of samples increases and as a result it seems safe to say that in almost all cases in practice we may establish sampling limits for averages of samples of four or more upon the basis of normal law theory. Shewhart gives also the results of experiments to obtain the distribution of the standard deviation when the universe is not normal. The summary of available information in respect to some of the more important statistics, which is given on page 212, should be of challenging interest to mathematicians.

After briefly indicating in a general way in Chapters 1, 2, 3, and 4 how it is possible to use modern statistical theory to control quality of the manufactured product, Dr. Shewhart digresses to give a practical presentation of statistical theory, especially the modern theory of sampling. Some elementary but important problems of presenting data by tables and graphs are considered in Chapters 5 and 6. Such statistical concepts as arithmetic mean, median, mode, standard deviation, skewness, kurtosis, correlation coefficient, and correlation ratio are defined and their calculation is illustrated in Chapter 7. A discussion of the relative usefulness of these statistics and a development of Tchebycheff's theorem are given in Chapter 8. A study of correlation and relationship is presented in Chapter 9. Laws basic to the control of quality, that is, the law of large numbers, the point binomial, and the meaning of statistical laws are described in Chapter 10. The development of statistical concepts will be found to be sufficiently complete for those who do not require the details of difficult proofs. Those who wish to investigate proofs will find ample references to periodical literature. An excellent bibliography is given as Appendix III.

Chapters 11 to 21 can best be described by presenting outlines of some of the problems of control.