However, apart from these omissions of deserving subject-matters which may be rectified in a future edition, this book of readings would really be useful to the students and teachers of Industrial Sociology, Industrial Relations and human aspects of industrializations.

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Quantitative Techniques for Managerial Decision Making, U. K. Srivastava, G. V. Shenoy and S. C. Sharma, Wiley Eastern, 1983, pp. 923, Rs. 63.50.

A fair amount of quantitative techniques is included in any management curriculum. Very few authentic and well written text books have appeared in the market keeping Indian environment in mind. The present book has made an effort in this direction. However, in an attempt to include too much material in one volume the authors have lost a sense of priority and at the same time are unable to devote sufficient space to motivate the students properly. The style of presentation varies considerably as the reader passes from one chapter to another. This is perhaps due to the presence of three authors instead of one. A few chapters have been written lucidly while there is lack of conceptual clarity in certain other places.

Chapter 1 : This chapter starts with a fairly authentic history of the management education in India. A brief introduction to statistical methods and operations research is also included here. While a substantial amount of space is devoted to describe the collection of data, the basic nature of statistical methodology, its ability to deal with situations which have an inherent variability is not properly highlighted. From section 1.3 which discusses statistical methodology the authors have introduced operations research techniques in section 1.4 without showing the proper linkage. A history of development of Operations Research after the Second World War would have been a welcome addition to this chapter.

Chapters 2, 3 : Chapter 2 deals with the presentation of statistical data. It includes a large number of illustrations (presumably from live situations) of bar diagrams. It also contains illustrations of pictogram and Pie diagrams. A very important concept namely continuity of two adjacent classes in a frequency distribution has been omitted both in chapter 2 and chapter 3. In Table 3.1 page 45, for example the class boundaries after the introduction of continuity should be 2.05—2.65, 2.65—3.25 and so on considering the fact that time is a continuous variable. In fact, the basic distinction between discrete and continuous variable—a fundamental concept in statistics is not projected properly in these chapters. Simple algebraic properties of the arithmetic mean have not been included. Chapter 3, however, covers various measures of central tendency with examples illustrating their calculations.

Chapter 4 : This chapter covers various measures of dispersion, skewness and kurtosis. The sudden appearance of Chebyshev's theorem and normal distribution in page 77 is confusing. The computation of variance and higher moments as shown in Table 4.9 in page 93 should include a check column. The fact that variance or standard deviation depends only on a change in scale but not on change of location has been stated without

pointing out its importance. Without introducing continuous variables properly or even without defining probability the authors have introduced density function of continuous variables and computed momcuts using integration towards the end of this chapter. It is a highly confusing and poorly written chapter.

Chapter 5 : Probability. It is a pity the way a subject like probability has been introduced and covered in this chapter. There is hardly any discussion on basic concepts like sample space nor there are illustrations through which the students can grasp the concept. The fact that events are subsets on the sample space have nowhere been stated. Topics such as addition and multiplication of probability, conditional probability, independence which require a good deal of motivation, understanding and reasoning have been covered at a very fast pace. The chapter is also conspicuous due to absence of sufficient number of examples. None of the interesting classical examples such as birthday problem, matching problem or occupancy problem have been even stated. The examples and exercises provided in the chapter are very elementary in nature and lack variety. The students are unlikely to develop sufficient skill in probability computation through these examples.

As an illustration of the lack of the sense of priority, while about 90 pages have been devoted to topics such as representation of data, frequency distribution, measures of location, dispersion, skewness and kurtosis less than 20 pages have been allotted to the basic concepts of probability.

Chapter 6 : This chapter attempts to cover random variables and probability distribution. This is a fairly readable chapter. The authors have however made a mistake by not separating out discrete and continuous variables and treating them under different sections. The fact that it is only meaningful to assign probabilities to a continuous variable in an interval should have been illustrated properly. Likewise the illustration of a bivariate distribution from a problem of probability would have strengthened the relevant section. While discussing bivariate distribution in so much detail it is not understood why an important measure such as correlation coefficient is not introduced in this chapter.

Chapter 7 : The purpose of this chapter is to cover important theoretical probability distributions. It starts with Binomial distribution but logically it should start with Hypergeometric distribution which has not been even mentioned. There is no major criticism against the coverage of Binomial distribution excepting a wrong statement in P. 153. Binomial Probability distribution is applicable to finite population if the sampling is with replacement.

Poisson probability distribution can be introduced at an elementary level to describe (a) rare events (b) a Binomial random variable when the number of trials is very large and the probability of success is small and (c) certain type data related with waiting time problems. Instead the authors have tried to introduce the idea of Poisson process making the concept unnecessarily difficult for the readers.

The use of Normal Tables will also be highly confusing to the readers. In Table 5 (page 887) the Probabilities A (b) = P ($0 \leqslant Z \leqslant b$) have been tabulated (Z is a standard normal variable). The value of A (b) for b = .66 is .2454 which is actually available in the Table. In working out Illustration 4 in page 161, it is not clear why it

has been obtained as 0.5—.2546. The wide applicability of the normal distribution in practical situations have not been fully appreciated by the authors as only one illustration of normal distribution has been included in the chapter.

Some significant omissions in the chapter are compound distributions and uniform distribution.

Chapter 8 : This chapter deals with sampling methodology and introduce the concept of sampling distribution. The part covering the description of various sampling methods is fairly well written.

Surprisingly, there is nothing on random numbers in this chapter and no operational procedure of selecting sample. This has been postponed until chapter 23 covering simulation. In fact, it should have been the other way round. The important concept of finite and infinite population and the term such as "finite population correction" have not been included in this chapter.

The transition from sampling to sampling distribution is very hasty and it is doubtful whether an average reader will get anything out of it. There is also a good deal of confusion over the exact and approximate sampling distribution. It is not clearly stated that t and F distribution under the assumption of normality of the parent distribution are exact distributions while the goodness of fit test as presented in the chapter is a large sample test. Central limit theorem on which many important applications of statistics depend should have received a better treatment.

Chapter 9 : Hypothesis testing : This chapter introduces the concepts of hypothesis testing and covers 1. Testing of mean of a normal population with known and unknown standard deviation. 2. Test on proportions. 3. Test on equality of means on normal distribution with independent and paired observations. 4. Testing difference between proportions. 5. Testing equality of variances in normal populations. 6. Testing goodness of fit and test in a contigency table using Chi-square statistic. 7. Analysis of variance and 8. Non-parametric tests such as : sign test, Mann Whitney test, run test, Kolmogrov-Smirnov test. 9. Confidence Interval.

The space devoted to the chapter is about 40 pages. The conclusion is obvious. The treatment can only be of commercial note book type. There is no scope for developing any concept. Even then, a good deal of confusion prevails. To mention a few : No distinction has been made between hypothesis of the form Ho : $\mu \leqslant \mu_0$ and Ho : $\mu = \mu_0$. In illustration 8, one should use large sample normal test with fewer assumptions as both n_1 and n_2 are large. Why different estimates of proportions have been used in illustration 11 and illustration 12 ? Why the method of computing confidence interval given in page 218 is called "general" when it is true only for normal distribution ? The chapter also omitted the hypothesis Ho ($\sigma^2 = \sigma_0^2$) in a normal distribution. It covers confidence interval to some extent but mentions nothing about point estimation. Elementary concepts such as an unbiased estimate and a consistent estimate have no mention in the book.

Chapter 10 : This chapter deals with the various concepts of decision theory and their applications. The material is pretty standard covered in a routine manner. There is hardly any comment to make. One only wonders the usefulness of including such material unless it is linked up with reality to some extent. Illustration : 1 solves a problem using the terminology "State of Nature" while no

discussion has been made what a state of nature could be under Indian conditions.

Chapter 11 : This chapter deals with the correlation, regression and multivariate analysis. This is undoubtedly one of the well written chapters of the book. It is well motivated through several examples, computations have been carried out properly followed by appropriate tests of significance. A few points of criticism still remains. In page 286 it is stated that sample correlation coefficient is an estimate of the population correlation co-efficient but the topic of point estimation has neither been introduced properly nor its property has been discussed earlier showing a lack of co-ordination between the writers of various chapters. This chapter also covers too many advanced topics such as auto-correlation, multicollinearity, factor analysis, method of principal components and discriminant analysis, considering the class of students for which the book is written. Once again, it shows a lack of sense of priority. While so many specialised topics have been included, a basic estimation technique such as maximum likelihood method has been omitted.

Chapter 12 : This chapter discusses the concept and application of time series analysis. It is certainly one of the better written chapters of the book. There is no major criticism except that an example in long term forecasting using auxiliary variables would have been helpful.

Chapter 13 : The chapter introduces the idea of index numbers. The methods of computation of various types of index numbers with numerical examples have been presented here. It is a useful chapter written in a compact form.

Chapter 14 ; 15 : Operations research starts with this chapter. There is however no overview on the various topics to be covered in this subject. The presentation and treatment of an important topic like linear programming have left much room for criticism. In page 433 while solving a problem with two variables graphically the term "feasible solution" will be confusing to the readers who are exposed to the concept for the first time. The concept has not been introduced previously in the general framework. Again, in the same page it is claimed that one of the corner points or extreme points will be the solution of the problem without stating any pertinent result. Illustration 1 (pages 423-424) and Illustration 2 (pages 424-425) should be simplified before solution dividing both sides of the constraints by 5. Likewise Illustration 8 (pages 431-432) should be simplified dividing both sides of the constraints by 2. In page 436, equation (14.10) it is unnecessary to introduce slack variables. The readers are likely to comprehend the subject matter better if the equations are taken as $Ax=b$ at that stage. The simplex procedure has been treated very mechanically without giving any insight about the principles. In page 450 the duality theorem has been incompletely stated. The complementary —slackness theorem has not even been mentioned. The MODI (Modified Distribution Method) algorithm for solving transportation problem is discussed without pointing out its connection with the principles of duality.

Although these chapters are very deficient from conceptual point of view it must be pointed out that a large number of exercises have been given at the end of the text for the benefit of the students.

Chapter 16 : The chapter deals with the game theoretic formulation of competitive strategies and their solution using linear

programming technique. The material covered is fairly standard in nature and no comment is really called for.

Chapter 17 : This chapter intends to cover network analysis. It is one of the most poorly written chapters of the book. It is not clear why probabilistic approach has been introduced before the deterministic approach. The statement made in page 553 "PERT and CPM are nowadays used synonymously" is incorrect. There is no mention about resource levelling and fund flow monitoring—two of the most important objectives of network analysis of the project. The link between network technique and linear programming has not been indicated.

Chapter 18 : In this chapter the various simple waiting line models have been introduced with illustrations. This is a fairly readable chapter. Equation (18.2) in page 570 is, however, valid for $n \geqslant 1$. There is, however, no result when the population size is finite which is of practical interest.

Chapter 19 : Inventory Control Models : While discussing the economic order quantity (EOQ) in inventory control problem it is not understandable why so many pages have been devoted to so called three approaches i.e. tabular, graphical and calculus when they are essentially the same thing. The calculation of reorder level and replenishment level involve two statistical variables which have not been properly focussed. Certain simple but useful results such as EOQ in presence of side constraints or the sensitivity of EOQ formula have not been included. The introductory part which discusses the various costs involved with inventory control model is fairly well written.

Chapter 20 : Replacement decisions : The material included in this chapter is fairly standard in nature. Illustration 4 in page 642 is copied from the book Sasieni, Yaspan, Friedman : Operations Research. Incidentally, it is not necessary to assume that $n_0 = 1000$ to solve the problem. Likewise Illustration 5 page 646 (some staffing problems) is also copied from the same book. One only wonders why three authors together could not construct some original numerical examples. There is also nothing in this chapter on preventative maintenance.

Chapters 21, 22, 23 : These chapters include sequencing, integer, dynamic, goal programming and simulation. The presentation is brief but to the point. The chapter on simulation, however, should have included some discussion on random number generation in a computer and Pseudorandom numbers. The book has totally omitted the topic "Reliability" which is emerging as a very important technique in certain types of problems of operations research.

Summarizing, it has been rather unwise for the authors to bring out such a huge book with so many diverse topics. It has resulted in (a) Non uniform style of presentation (b) Wrong decision regarding the space to be devoted to various topics (c) Occasional lack of co-ordination in various chapters (d) Sometimes note book type of approach without any motivation. In addition, there are conceptual mistakes, as well as confusion in presenting and illustrating some techniques as indicated earlier in chapter by chapter review. At least in one chapter there is straightforward copying of illustrations from another book.

It is difficult to see how this book can be useful to the students of any reputed management institute apart from the few chapters indicated before.

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