Chapter 1 : Paul L. Meyer (Author of Introductory Probability and Statistical Applications)

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Thus we have two ways of computing the conditional probability P B I A: This is as it should be, for saying that S has occurred is only saying that the experiment has been performed. Suppose that an office has calculating machines. And some of the machines are new N while others are used U. What is the probability that it is electric? In terms of the notation introduced we wish to compute P E I N. Simply considering the reduced sample space N e. This is sometimes known as the multiplication theorem of probability. We may apply this theorem to compute the probability of the simultaneous occurrence of two events A and B. If we choose two items at random, without replacement, what is the probability that both items are defective? As before, we define the events A and B as follows: The above multiplication theorem 3. P[Ai n A2 n. We shall consider four cases, which are illustrated by the Venn diagrams in Fig. P A I B , and in the fourth case, we cannot make any comparison at all. Above, we used the concept of conditional probability in order to evaluate the probability of the simultaneous occurrence of two events. We can apply this concept in another way to compute the probability of a single event A. We need the following definition. We say that the events Bi. Let A be some event with respect to S and let B 1, B 2,. The Venn diagram in Fig. The important point is that all the events A n Bi. Hence we may apply the addition property for mutually exclusive events Eq. This result represents an extremely useful relationship. For often when P A is required, it may be difficult to compute it directly. However, with the additional information that Bi has occurred, we may be able to evaluate P A I Bi and then use the above formula. Using some of the calculations performed in Example 3. This result may be a bit startling, particularly if the reader recalls that at the beginning of Section 3. A certain item is manufactured by three factories, say 1, 2, and 3. It is known that 1 turns out twice as many items as 2, and that 2 and 3 turn out the same number of items during a specified production period. It is also known that 2 percent of the items produced by 1 and by 2 are defective, while 4 percent of those manufactured by 3 are defective. All the items produced are put into one 3. What is the probability that this item is defective? Let us introduce the following events: The following analogy to the theorem on total probability has been observed in chemistry: Suppose that we have k beakers containing different solutions of the same salt, totaling, say one liter. If we combine all the solutions into one beaker and let P A denote the concentration of the resulting solution, we obtain, 3. Suppose that one item is chosen from the stockpile and is found to be defective. What is the probability that it was produced in factory l? Using the notation introduced previously, we require P B 1 I A. We can evaluate this probability as a consequence of the following discussion. It is also called the formula for the probability of "causes.

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Similarly, if f represents the joint pdf of X 1,. Suppose that the following table represents the joint probability distribution of the discrete random variable X, Y. Let X be the number of aces obtained and let Y be the number of queens obtained. Let X1 and X2 be two independent determinations of the above random variable X. That is, suppose that we are testing the life length of two such devices. Obtain the probability distribution of the random variables V and W introduced on p. Suppose that P is a variable point. That is, X is a continuous random variable uniformly distributed over 3, 5. Find the pdf of the random variable H. First find the pdf of D2 and then apply the results of this chapter. Determine the pdf of the random variable Wand sketch its graph. We recognize this as a linear relationship between x and y. The constants a and b are the parameters of this relationship in the sense that for any particular choice of a and b we obtain a specific linear function. In other cases one or more parameters may characterize the relationship under consideration. Not only is a particular relationship characterized by parameters but, conversely, from a certain relationship we may define various pertinent parameters. With each probability distribution we may associate certain parameters which yield valuable information about the distribution just as the slope of a line yields valuable information about the linear relationship it represents. This distribution is called an exponential distribution, which we shall study in greater detail later. It is a particularly useful distribution for representing the life length, say X, of certain types of equipment or components. The interpretation of k, in this context, will also be discussed subsequently. Assume that items are produced indefinitely on an assembly line. The probability of an item being defective is p, and this value is the same for all items. Let the random variable X be the number of items inspected until the first defective item is found. Thus a typical outcome of the Further Characterizations of Random Variables 7. To check that this is a legitimate probability distribution we note that "" L: Suppose that a random variable and its probability distribution is specified. Is there some way of characterizing this distribution in terms of a few pertinent numerical parameters? A wire cutting machine cuts wire to a specified length. The specified length is 12 inches.

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