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Probability & Applied Stats

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Chapter 2

This paper is going to be explaining every topic we learned about in chapter 2. Chapter 2 starts off diving into probability. It explains probability as the “measure of one’s belief in the occurrence of a future event.”. Probability plays a big role in our very lives it helps us establish certain inferences we can make from the results we get. As we dive deeper into chapter 2 it starts to discuss set notation. Where it also gives us examples like if there was a sample space S where sets A, and B are both subsets the union would be both sets A and B combined. Which can be denoted as . The intersection of two sets is only what they have in common. Which can be denoted as . It also goes into detail about the compliment of a set which is all the elements that are not in that set. An example would be if you had a sample of number from one to ten and in set A you had the numbers five, four, and two. The compliment would be all the numbers in the sample space besides the ones that are in set A. A compliment of a set could also be denoted as .

In 2.4 this section of the chapter dives into the probabilistic model for an experiment. An experiment is a process by which an observation can be inferred or made by the results. A sample space is associated with an experiment of all the possible same points. Diving into the next topic it discusses is the sample point method. In this method there are five steps to follow to complete this process. Step 1 is to define the experiment and clearly determine how to describe one simple event. Step 2 is to list the simple events associated with the experiment and test each to make certain that it cannot be decomposed. Step 3 is to assign reasonable probabilities to the sample point in S. Step 4 is to define the event of interest. Step 5 would be to find the probability of A by summing the probabilities of the sample points in A.

The next topic that is introduced to us is the combinations formula. This formula takes in two values n and r. The definition of combinations is “The number of combinations of n objects taken r at a time is the number of subsets, each of size r, that can be formed from the n objects.”. To get the total amount of combinations you need to take the factorial of n divide it by r factorial times n minus r factorial. Once you simplify everything then you have achieved the total amount of combinations in problem. This is great for in certain cases when you are trying to figure out certain instances of a problem. An example if you want to test the probability of pulling an ace in the first five cards drawn. You would need to calculate the probably of pulling an ace over the total combination of drawing five cards. This helps us mathematically calculate these specific events to get us answers that we are looking for. Another type of probability is called permutation. Permutation is the ordered arrangement of r objects. This probability is written out as . Both of these probability formulas are very useful for solving problems. The one catch I remember when I am solving problems that involve these formulas is if order matters use permutations. If it doesn’t matter then you should use combinations to figure the total probability.

The next type of probability that chapter 2 discusses is the conditional probability. This is finding the probability of an event occurring if some other event already happened. To solve for this, you would need the intersection of events A and B and divide it by the probability of B. This would give you the answer of the probability of A if event B already happened. The conditional probability can be denoted as . You can also find the probability of B given A. This can be written as . Notice how similar these equations are the only difference is whatever value you are looking for. If you are looking for then you just divide the intersection of A, B by the probability B. Then all you are changing is for finding is dividing by intersection of A, B by the probability A.

In probability there are two laws that can be applied to certain events these laws are the multiplicative and additive law. The multiplicative law is the probably of the intersection of two events. This can be written out as . It is also equal to and . But if the events are independent then it will just be equal to . The Additive law which is the probability of the union of to events. This can be written out as . To get the union of two events you must do . But if the events are mutually exclusive then and . Also, a side note if you ever wanted to get the compliment of a probability. This can be known as the probability of an event not happening or shown as or .

Progressing through the chapter we get to 2.10 which introduces Bayes’ Rule. Bayes’ Rules is the probability of an event occurring based on prior knowledge of certain conditions that are related to the event. The equation can be written out as . The proof proves it directly follows the definition of conditional probability and law of total probability . One of the last topics in chapter 2 talks about numerical events and random variables. A numerical event is an event that is majorly interested by scientist, engineers, or business personal in which the events can be identified as numbers. A random variable is a real valued function for which the domain is a sample space. The very last topic in this chapter is random sampling. Usually in a statistical experiment it involves making observation of a sample from a large body of data. That is referred to a population. Once you start making observations this can be viewed as a one or more than one random variable. Doing so can help make inference about the characteristics in said population. Definition 2.13 on page 78 gives a more detailed definition for random sampling “Let N and n represent the numbers of elements in the population and sample, respectively. If the sampling is conducted in such a way that each of the samples has an equal probability of being selected, the sampling is said to be random, and the result is said to be a random sample.” This definition sates that N is the total amount of elements in the population and n is the number of elements in the sample if it has a equal probability then it is stated as a random sample. Chapter 2 is a very important chapter that goes over the basic foundation of what you need when conducting complex probability problems. Without having these formulas under your belt you will have a tough time later in the book.