Unit 4: The Mathematics of Chance

Goal: To understand how chance and probability can affect daily life.

Expectations

1. use probabilities to make and justify decisions about risks in everyday life, such as investing in the stock market, taking medication, or selecting car insurance.

   Example:

   In a study, 11% of healthy people ages 65–75 had side effects that required medical attention after receiving a flu shot. If a person had side effects, 9% of those caught the flu. If a person did not have side effects, 3% of those caught the flu. Based on the results of the study, if 1000 people between the ages of ages 65–75 are given a flu shot, on average, how many people would be expected to catch the flu?

2. calculate expected value to analyze fairness and payoff in situations such as lotteries, warranties, and insurance.

   Example:

   You have purchased a new car for $30,000 and need to purchase automobile insurance. What are the different types of insurance coverages that can be purchased? What is the minimum amount of coverages required by Maryland law? If you double the amount of coverage, will your premium double?

   Example:

   You have had a minor accident and estimate that the cost to repair your car would be $500. Should you file a claim with the insurance company?

   Example:

   You are buying a computer. The computer has a 30-day warranty. You are asked at checkout whether you wish to buy an extended warranty. A one-year warranty costs $50, while a two-year warranty costs $80. In the latest consumer magazine, you have read that during the first 1 year, 10% of computers will need repairs at an average cost of $200. During the second year, 20% of computers will need repairing at an average cost of $300. Should you purchase either of the warranty plans?

3. determine conditional probabilities and probabilities of compound events by constructing and analyzing representations, including tree diagrams, Venn diagrams, and contingency tables, to make decisions in problem situations.

   Example:

   A blood test for a rare disease is very expensive, costing $100,000. Ten people have been exposed to this disease. If exposed, there is a 0.1

probability that the person will get the disease. A blood sample has been taken from each person. To save money, a portion of each of the ten samples is combined, and the test is conducted on the combined sample. If the test is negative, then it is assumed that all ten people do not have the disease. If that test is positive, then all ten will be tested individually. Is this procedure cost effective?

Example:

In the World Series, team A has a 60% chance to win each game, while Team B has a 40% chance. The first team to win 4 games wins the World Series. What is the probability that team A will win the series 4 games to none? What is the probability that the World Series will take a maximum of 7 games to decide?

3. solve problems involving large quantities, such as estimating crowd size, counting the number of available phone numbers, license plates, and Social Security numbers.

Example:

It has been claimed that the traditional 10-digit phone number will have to be expanded to more digits in the near future. Analyze the statement. In your analysis include the total number of possible 10-digit phone numbers, what phone numbers are used for, and when this change might be made.

Example:

Using two different strategies, estimate how many people attended this event.