It is predicated on the likelihood of something occurring. The rationale underlying probability is the foundation of theoretical probability. If a coin is tossed, the theoretical probability of obtaining a head is 12(Sjetne et al. 2019).

You don't truly run an experiment of an experiment. The experimental probability may be estimated by dividing the total number of trials by the number of potential outcomes. For example, if a coin is tossed ten times and heads is recorded six times, the experimental probability of heads is 6/10, or 3/5(Seidenfeld 2015).

Experimental probability, also known as Empirical probability, is based on real experiments and proper documentation of occurrences as they occur. A set of real tests are carried out to determine the presence of any event. Random experiments are those that do not have a predetermined outcome. The results of such tests are unpredictable. To estimate the likelihood of a random experiment, it is performed several times. An experiment is performed a set number of times, with each repetition referred to as a trial. The experimental probability formula is expressed mathematically as(Seidenfeld 2015).

Probability of an Event P(E) = Number of times an event occurs / Total number of trials.

Axiomatic Probability

A collection of principles or axioms that apply to all kinds is established in axiomatic probability. Kolmogorov established these axioms, which are known as Kolmogorov's three axioms. The axiomatic approach to probability quantifies the possibilities of events occurring or not occurring. This topic is covered in full in the axiomatic probability lesson, which includes Kolmogorov's three rules (axioms) as well as several examples. The possibility of an event or outcome occurring dependent on the occurrence of a preceding event or outcome is known as conditional probability(Savage, Scholtes, and Zweidler 2009)(Batanero, Henry, and Parzysz 2005).

III. Basic Solutions

1) **There are 6 pillows in a bed, 3 are red, 2 are yellow and 1 is blue. What is the probability of picking a yellow pillow?**

Ans: The likelihood is equal to the number of yellow pillows in the bed divided by the total number of pillows, i.e., 2/6 = 1/3(Savage et al. 2009).

2) **There is a container full of coloured bottles, red, blue, green and orange. Some of the bottles are picked out and displaced. Sumit did this 1000 times and got the following results:**

- **No. of blue bottles picked out: 300**
- **No. of red bottles: 200**
- **No. of green bottles: 450**
- **No. of orange bottles: 50**

a) **What is the probability that Sumit will pick a green bottle?**

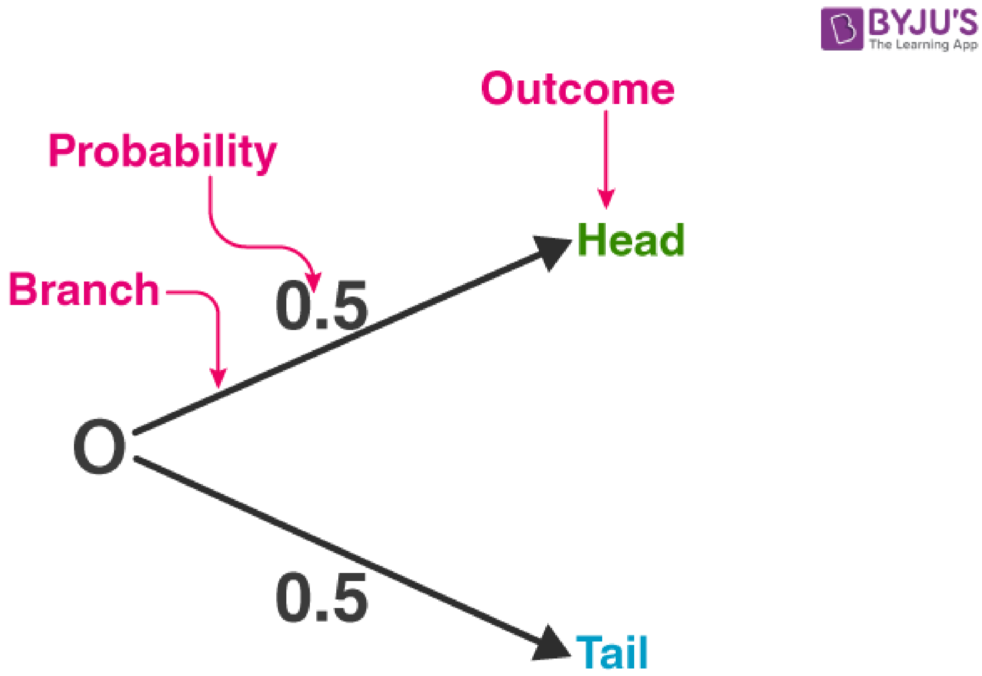
Ans: For every 1000 bottles picked out, 450 are green.Therefore, P(green) = 450/1000 = 0.45

b) **If there are 100 bottles in the container, how many of them are likely to be green?**

Ans: The experiment implies that 450 out of 1000 bottles are green.Therefore, out of 100 bottles, 45 are green(Savage et al. 2009).

IV. Probability Tree

The tree diagram aids in organizing and visualizing the various alternative outcomes. The branches and the tree's ends are the two most important places. Each branch's probability is written on the branch, and the ends contain the ultimate conclusion. When determining when to multiply and when to add, tree diagrams are employed. A tree diagram for the coin is shown below(Prasanna 2015):



V. Probability of an Event

Assume that an event E can occur in r of n probable or feasible equally likely ways. The event's likelihood of occurring or success is then represented as(Prasanna 2015);

P(E) = r/n

The likelihood that an event will not occur, often known as its failure, is stated as:

P(E') = (n-r)/n = 1-(r/n)

E' represents that the event will not occur.

Therefore, now we can say(Prasanna 2015);

P(E) + P(E') = 1

This suggests that the sum of all probability in every random test or experiment equals 1.When two occurrences have the same theoretical likelihood of occurring, they are referred to be equally probable occurrences. The outcomes in a sample space are said to be equally likely if they all have the same chance of happening. For example, if you roll a dice, the chance of receiving 1 is 1/6. Similarly, the likelihood of receiving all of the numbers from 2,3,4,5, and 6 at the same time is 1/6. As a result, the following are some instances of equally likely outcomes when rolling a die(Palaniammal 2006):

- **Getting 3 and 5 on throwing a die**

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- **Getting an even number and an odd number on a die**
- **Getting 1, 2 or 3 on rolling a die**

Ar equally likely events, since the probabilities of each event are equal?

Complementary Events

The potential that there will be just two outcomes, stating whether or not an event will occur. Examples of complementing occurrences include a person coming or not coming to your house, receiving a job or not obtaining a job, and so forth. Essentially, the counterpart of an event occurring in the exact opposite likelihood that it will not occur. Here are some more examples(Palaniammal 2006):

- **It will rain or not rain today**
- **The student will pass the exam or not pass.**
- **You win the lottery or you don't.**

VI. Examples

Example 1: Theoretical Probability.

Question 1: What is the theoretical chance of rolling a 4 or a 7 with a pair of dice?

You could do an experiment if this question asked you to estimate the empirical likelihood. You could, for example, roll the dice 100 times, record the outcomes, and state the likelihood. However, because this question asks for theoretical probability, you must apply a formula or create a sample space. Set up a sample space because there is no one formula for estimating die rolling probabilities(Palaniammal 2006).

Solution(Palaniammal 2006):

Step 1: Create a test environment. In other words, list all of the conceivable "events" that may occur. The events in this situation are the numbers that appear after the dice are rolled. The probability for two dice are:

[1][1], [1][2], [1][3], [1][4], [1][5], [1][6],

[2][1], [2][2], [2][3], [2][4],[2][5], [2][6],

[3][1], [3][2], [3][3], [3][4], [3][5], [3][6],

[4][1], [4][2], [4][3], [4][4], [4][5], [4][6],

[5][1], [5][2], [5][3], [5][4], [5][5], [5][6],

[6][1], [6][2], [6][3], [6][4], [6][5], [6][6].

I've bolded the rolls that result in a total of 7.

Step 2: Determine the likelihood. There are 36 potential rolls in the total sample space. Because there are nine rolls that end in a 7, the solution is:

9/36 = .25.

Example 2: Experimental Probability.

Question: What is the flaw in the following statement?(Palaniammal 2006)

When I toss a die, the likelihood of getting a 6 is 16, thus if I throw the die six times, I should expect to get precisely one 6.

In principle, this statement is correct, but in practice, it may not be. Try throwing a dice six times - you won't always get a six.

Question: Kate and Josh each roll the dice 30 times(Palaniammal 2006).

a) How many times do you think Kate will get a 6?

b) How many times do you think Josh will get a 6?

c) What is the total number of sixes you would expect Kate and Josh to get?

Solution

a) Kate should get a 6 on 16 of her throws, in principle. As a result, in principle, Kate should throw a 6 on 5 of her 30 throws.

b) Josh should get a 6 on 5 of his 30 throws.

c) Kate and Josh have tossed the dice 60 times in total. On 10 of those throws, you'd expect them to get a 6. It is quite implausible that either Kate or Josh would have thrown exactly five 6s, or that they would have thrown 10 6s together. However, their combined scores are more likely to have been closer to the projected outcome (ten 6s) than their individual outcomes(Palaniammal 2006).

Example 3:

Question: There are four candidates in a presidential election. A, B, C, and D are their initials. According to our polling data, A has a 2020 percent probability of winning the election, whereas B has a 4040 percent probability of winning. What is the likelihood that A or B will win the election?(Maity 2018)

Solution:

In summary, if A1A1 and A2A2 are disjoint events, then P(A1A2) =P(A1) +P(A2) P(A1A2) =P(A1) +P(A2) P(A1A2) =P(A1) +P(A2) P(A1A2) =P(A1) +P(A2) (A2). The same logic applies when there are n discontinuous events A1, A2, AnA1, A2, An:

P(A1A2A3An) =P(A1) +P(A2) ++P(An), if A1, A2, and An are disjoint(A1A2A3An) =P(A1) +P(A2) ++P(An), if A1, A2, and An are disjoint(A1A2A3An) =P(A1) +P(A2) ++P(An)(Maity 2018).

The third axiom goes even farther, stating that the same is true even for a countably infinite number of disconnected occurrences. Soon, we'll see additional instances of how to apply the third axiom(Maity 2018).

Example 4

Question: Determine the likelihood of ‘getting 3 on a dice roll(Maity 2018).

Solution:

Sample Space = {1, 2, 3, 4, 5, 6}

Number of favourable event = 1

i.e. {3}

Total number of outcomes = 6

Thus, Probability, P = 1/6

Example 5

Question: Draw a card at random from a deck of cards. What is the likelihood that the card drawn will be a face card?(Maity 2018)

Solution:

A standard deck has 52 cards.

The total number of possible outcomes is 52.

The number of favorable events is equal to 4 x 3 = 12. (Considered Jack, Queen and King only)

P = Number of Favourable Outcomes/Total Number of Outcomes = 12/52= 3/13.

Example 6

Question: A jar includes four blue balls, five red balls, and eleven white balls. What is the likelihood that the first ball pulled from the vessel is red, the second ball is blue, and the third ball is white?(Maity 2018)

Solution: The chance of getting the first red ball or the first event is 5/20.

Given that we have drawn a ball for the first event, the number of choices for the second event is 20 – 1 = 19.

As a result, the chances of receiving the second ball as blue or the second event are 4/19.

With the first and second events occurring, the number of possible outcomes for the third event is 19 – 1 = 18.

And the likelihood of the third ball being white or the third event occurring is 11/18.

As a result, the chance is calculated as 5/20 x 4/19 x 11/18 = 44/1368 = 0.032.

P = 3.2 percent is another way to say it(Maity 2018).

Example 7

Question: **If two dice are thrown, what is the likelihood that the total will be(Galavotti 2015):**

1. **equal to 1**
2. **equal to 4**
3. **less than 13**

Solution:

1) To calculate the probability that the total is equal to one, we must first compute the sample space S of two dice, as illustrated below.

S = { (1,1),(1,2),(1,3),(1,4),(1,5),(1,6)

(2,1),(2,2),(2,3),(2,4),(2,5),(2,6)

(3,1),(3,2),(3,3),(3,4),(3,5),(3,6)

(4,1),(4,2),(4,3),(4,4),(4,5),(4,6)

(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)

(6,1),(6,2),(6,3),(6,4),(6,5),(6,6) }

1) Let E represent the event "sum equal to 1." Because there are no outcomes where the total is equal to one, P(E) = n(E) / n(S) = 0 / 36 = 0.

2) Three alternative results result in a total of four, and they are as follows:

E = (1,3), (2,2), and (3,1) As a result, P(E) = n(E) / n(S) = 3 / 36 = 1 / 12

3) We can observe all potential outcomes for the event E from the sample space, which result in a total smaller than 13. For example, (1,1) or (1,6) or (2,6) or (6,6).

As you can see, the maximum probability of an event occurring is when both dies have the number 6, i.e. (6,6).

As a result, P(E) = n(E) / n(S) = 36 / 36 = 1(Galavotti 2015)

VII. Conclusion

VIII. In conclusion I would say that Probability and chances are used in a variety of scenarios, including deciding what sort of weather to prepare for, whether or not to buy a stock, and how much to risk while gambling. Probability enables individuals to determine which options are safe and which are dangerous. Of course, having a solid understanding of probability makes this process much easier. We may learn about the possibility of future events and plan accordingly by knowing about probability. Probability theory is defined as a bridge between qualitative reasoning and quantitative computations. formalized and included other early research from the domains of mathematics, information theory, and physics, such that probability theory became a framework that permits consistent conclusions to be reached in conditions of insufficient information and reasonable decisions to be made in uncertain situations. The method makes use of the ability to directly convert qualitative information into accurate quantitative values, allowing for additional computations. The concepts of 'probability theory as logic' encourage one to analyze all relevant information in a certain decision-making process methodically and consistently. Furthermore, upgrading data by incorporating new information into an existing framework allows for much latitude to reflect on potential changes and diverse perspectives–both qualitative and quantitative.

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