JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Use of Probability Theory in Various Domains of Business

Ishpreet kaur[1]

[1]Assistant Professor, Department of Mathematics,
Guru Hargobind Sahib Khalsa Girls College, Karhali Sahib

Abstract

This article emphasis on the use of probability theory in different domains of business. Probability theory is a multifaceted discipline of which every business activity revolves around it. This paper starts by explaining basic definition of probability. Then it highlights the application of different laws and theorems of probability in different circumstances with suitable example for each.

Keywords: *Probability theory, addition law of probability, law of total probability, Bayes' theorem, independent events.*

1. Introduction

Probability measures the chances of occurrence of an event with value between 0 and 1. Its value can also be 0 if there is no scope of occurrence of that event and can be 1 if occurrence of that has 100 % chances. It can be calculated by dividing number of favorable cases by total cases. By estimating the future, the probability can play a vital role in decision making, risk management, strategic planning and optimization.

2. Use of probability in business

- To organize the business properly, business firms have to look after different aspects of business for which the services of a number of persons are always required. Every organization either for-profit or not-for- profit requires management to run their activities in a better way. Probability plays an important role in manpower planning for proper utilization of human resources which we can understand with the help of an example.

Example : - A firm has 3 members in raw material department , 4 in production department and 2 in packaging department and 3 in sales department. Firm has to make a quality assurance cell of 4 members. What is the probability that the cell consists of member from each department?

Solution: - Total members in all departments = 3 + 4 + 2 + 3 = 12

favourable cases for the cell to consists member from each department

$= {}^{3}C_{1} \times {}^{4}C_{1} \times {}^{2}C_{1} \times {}^{3}C_{1} \qquad = 3 \times 4 \times 2 \times 3 = 72$

Total cases for the cell to consists 4 members = ${}^{12}C_{4} = \frac{12!}{4!\,8!} = 495$

P (cell consists member from each department) = $\frac{favourable\ cases}{total\ cases} = \frac{72}{495} = 0.145$

- Addition law of probability is also applicable in various businesses. If there are multiple events, the addition theorem of probability is helpful in measuring chances of occurrence of at least one of the events. It is also applicable to measure chances of occurrence of none of them. We will consider suitable examples.

Example:- If the probability that an insured car will met an accident is 0.29 ; the probability that it will get stolen is 0.12 and the probability that it will get stolen and also will met an accident is 0.07. What is the probability that car will met an accident or will get stolen?

Solution:- Let G and H be events that insured car will met an accident and will get stolen respectively.

$P(G) = 0.29, \quad P(H) = 0.12 \quad \text{and} \quad P(G \cap H) = 0.07$

$P(G \cup H) = P(G) + P(H) - P(G \cap H) = 0.29 + 0.12 - 0.07 = 0.34$

Hence the probability that insured car will either met an accident or will get stolen is 0.34.

Example: - If probability of left tyre of car not working properly is 0.3, of right tyre not working properly is 0.2 and of both tyres not working properly simultaneously is 0.05. Assuming both tyres must operate to enable the car to run properly. What is the probability that car will run properly?

Solution: - Let M and N be two events of left and right tyre not working properly respectively.

$P(M) = 0.3, \qquad P(N) = 0.2, \qquad P(M \cap N) = 0.05$

$P(M \cup N) = P(M) + P(N) - P(M \cap N) = 0.3 + 0.2 - 0.05 = 0.45$

P (car will run properly) = P (neither M nor N) = $1 - P(A \cup B) = 1 - 0.45 = 0.55$

- In business, some events like increase in prices of raw materials and increase in wage rate of labors do not depend on each other. But simultaneous occurrence of both can affect the cost of product. With the help of probability, we can measure the chances of occurrence of such independent events simultaneously.

Example: - If a company makes advertisement of his product from two different sources of social media. The chances that customer will get information about product from 1st source are $\frac{1}{7}$ and from 2nd source are $\frac{1}{5}$. What is the probability that customer (i) will get information from both the sources and (ii) will get information from only one source?

Solution: - Let U and V be events of getting information about product from 1st and 2nd source respectively.

And $\bar{U}$ and $\bar{V}$ be events of not getting information about product from 1st and 2nd source respectively.

$$P(U) = \frac{1}{7}, \qquad P(\bar{U}) = 1 - \frac{1}{7} = \frac{6}{7}$$

$$P(V) = \frac{1}{5}, \qquad P(\bar{V}) = 1 - \frac{1}{5} = \frac{4}{5}$$

(i) P (getting information from both sources) = $P(U \cap V) = P(U).\,P(V)$ {Because U and V are independent}

$$= \frac{1}{7}.\frac{1}{5} = \frac{1}{35}$$

(ii) P (getting information from only one source) = $P(U)\,P(\bar{V}) + P(\bar{U})\,P(V)$

$$= \frac{1}{7}.\frac{4}{5} + \frac{6}{7}.\frac{1}{5} = \frac{4}{35} + \frac{6}{35} = \frac{10}{35} = \frac{2}{7}$$

- Modern era is the era of competition. For every outcome numerous factors are responsible. The law of total probability helps us to find the possibility of occurrence of an event under various scenarios. For this we will consider following example.

Example: - A production company gets a order and order fulfillment depends on receiving of raw material on time. The probability that company will receive raw material on time is 0.65. The probability that company will fulfill the order if it receives raw material on time is 0.80 and probability of fulfilling the order if it does not receive the raw material on time is 0.32. Find the probability that the order will be fulfilled.

Solution: - Let Q and R be events of fulfillment of order and of receiving raw material on time respectively.

$$P(R) = 0.65, \qquad P(\bar{R}) = 1 - 0.65 = 0.35.$$

$$P(Q/R) = 0.80, \qquad P(Q/\bar{R}) = 0.32$$

$$P(Q) = P(R)\,P(Q/R) + P(\bar{R})\,P(Q/\bar{R})$$

$$= (0.65)(0.80) + (0.35)(0.32) = 0.52 + 0.112 = 0.632$$

Hence, the probability that the order will be fulfilled is 0.632.

- In business many factors, which cannot occur at same time and form a full group, can be responsible for happening of an event. Using Bayes' Theorem, we can get conditional probability that event has happened due to a particular factor. Which can be of extreme help for businessman or for management to take strategic decisions for the future? We will consider an example.

Example: - In an A.C. company, an expert surveys the causes of A.C.'s defectiveness. The chances of compressor's problem are 75 % and of gas leakage are 25 %. According to his report, chances that A.C. gets defective due to compressor are 30 % and due to gas leakage are 95 %. If one A.C. gets defective, what is the most probable cause of defectiveness?

Solution:- We will define following events :

P_1: Problem of compressor,

P_2: Problem of gas leakage,

Q: A.C got defective

$P(P_1) = 0.75$, $P(P_2) = 0.25$, $P(Q/P_1) = 0.3$, $P(Q/P_2) = 0.95$

$$P(P_1/Q) = \frac{P(Q/P1)\,P(P1)}{P(Q/P1)\,P(P1) + P(Q/P2)\,P(P2)} = \frac{(0.3)(0.75)}{(0.3)(0.75) + (0.95)(0.25)} = \frac{0.225}{0.225+0.2375} = \frac{0.225}{0.4625} = 0.486$$

$$P(P_2/Q) = \frac{P(Q/P2)\,P(P2)}{P(Q/P1)\,P(P1) + P(Q/P2)\,P(P2)} = \frac{(0.95)(0.25)}{(0.3)(0.75) + (0.95)(0.25)} = \frac{0.2375}{0.225+0.2375} = \frac{0.2375}{0.4625} = 0.514$$

Or $P(P_2/Q) = 1 - P(P_1/Q) = 1 - 0.486 = 0.514$

Since $P(P_1/Q) < P(P_2/Q)$

So, most probable cause of defectiveness is gas leakage.

3. Conclusion

The applications of probability in business are extremely important. In the context of business analytics, probability in collaboration of data and statistics offers a framework for decision making, risk management, strategic planning and optimization.

References

1. Yuldashev Sanjarbek Arslon o 'g 'li. (2023). The Solution of Economic Tasks with the Help of Probability Theory. Texas Journal of Engineering and Technology, 26, 26-29.
2. Yuldashev Sanjarbek Arslon o 'g 'li. (2023). Application Of Theory Of Probability In Solving Economic Problems. Galaxy International Interdisciplinary Research Journal, 11(10), 358-362. Retrieved from https://internationaljournals.co.in/index.php/giirj/article/view/4491
3. Murodov Sardor. (2024). The Role of Probability Theory in Risk Management. International Conference on Advance Research in Humanities, Sciences and Education, 156-159. Retrieved from https://confrencea.org
4. Frank Owusu, Dennis Offei Kwakye, Rhoda Afutu, Isaac Assan-Donkoh. (2022). Asian Journal of Probability and Statistics, 1-6.