

Ideological and Political Exploration for Probability Formulas

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Abstract: Probability theory is an important component of data science, and probability formulas are a key means of analyzing data, occupying a pivotal position in the era of big data. In the context of domestic curriculum ideological and political education, this paper explores the ideological and political elements contained in several probability formulas, seeks the integration of probability formulas and ideological and political education, and makes analogies between the principles, advantages, and applications of these formulas and some ideological and political contents. It not only visualizes abstract probability formulas, but also helps students establish correct worldviews, life values, and moral values. This paper attempts to improve the teaching quality of the courses related to probability and cultivate students' sense of social responsibility through the ideological and political exploration of these probability formulas.

Keywords: Probability formulas; Ideological and political education; Make analogies

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1. Introduction

Mathematical literacy is an important component of the overall quality of a student. With the increasing quantification and universality of cross-disciplinary integrations of various disciplines, mathematics has become a scientific tool for analyzing and solving problems in most majors, serving as the theoretical foundation for students to learn many professional courses. With the development of the Engineering Education Professional Certification, clear requirements have been put forward for mathematics courses, and there are also quantifiable specific indicators for the courses related to probability. Probability Theory is the main course that educates students to master commonly used probability tools, is an important cornerstone for laying a theoretical foundation for students, and is an effective medium for cultivating their rational thinking. By the applications of the research results in this paper, the paper aims to strengthen students' mastery of these probability formulas and promote their understanding of some correct values.

In August 2019, the General Office of the Communist Party of China Central Committee and the General Office of the State Council issued "Several Opinions on Deepening the Reform and Innovation of Ideological

and Political Courses in Schools in the New Era” that clearly proposed to comprehensively promote the ideological and political construction of school curriculums. In May 2020, the Ministry of Education issued the “Guidelines for the Construction of Curriculum Ideological and Political Education in Colleges and Universities” that comprehensively deployed the construction of curriculum ideological and political education in colleges and universities. In recent years, various colleges and universities in China have actively promoted their curriculum ideological and political education. Many courses have undergone ideological and political reforms in teaching designs, teaching methods, teaching contents, and teaching cases, including courses related to probability such as Probability Theory and Mathematical Statistics ^[1-12], Applied Stochastic Processes ^[13], Information Theory ^[14], and Recommendation Systems ^[15,16]. The courses related to probability keep up with the trend of the era, have a wide range of applications, and are highly welcomed by students. However, so far, there have been few studies on the ideological and political exploration of the courses related to probability. In the context of domestic curriculum ideological and political education, ways to organically integrate ideological and political elements into probability formulas are the focus of this paper. This paper makes analogies between the principles, advantages, and applications of several probability formulas and some ideological and political contents, not only visualizing abstract probability formulas and mastering the principles or ideas of commonly used probability formulas, but also helping students establish correct worldviews, life values, and moral values and cultivating their sense of social responsibility.

2. Formulas of ideological and political education

This section integrates some ideological and political contents related to values into several probability formulas such as independence of events, Pearson correlation coefficient, Spearman correlation coefficient, cosine similarity, total probability formula, Bayesian formula, laws of large numbers, and so on. The principles, advantages, and applications of these probability formulas are analogized to some ideological and political content for cultivating students’ “morality” and “intelligence.”

Let A and B be two events and P() be the probability of a certain event. If $P(AB) = P(A)P(B)$, then the two events A and B are said to be independent of each other. That is to say, if the occurrences of two events A and B do not affect each other, that is, the occurrence of event A will not change the probability of the occurrence of event B, then the two events A and B are said to be independent of each other. When thinking about problems, everyone should try to avoid being influenced by external irrationality and form their value judgments independently. The independence of thought is the foundation of scientific spirit and innovative thinking, which is of great significance for personal growth and social progress. In education, teaching, and academic research, cultivating ideological independence can help students and scholars deeply explore the essence of problems and the laws of things, thereby they may transform nature, improve production, and improve life.

Pearson correlation coefficient is used to measure the linear correlation between two variables or samples, which eliminates the influences of dimensional differences, mean differences, and order of magnitude differences between different variables or samples on the results. It is used to effectively analyze problems in various fields. In the field of sociology, the Pearson correlation coefficient can be used to analyze the degree of intimacy in interpersonal relationships, the efficiency of team cooperation and the stability of social networks. By studying the correlations between people, it can help people better understand the structures and operational mechanisms of society, and promote social harmony and stability. By analyzing the correlations between different social factors, the fundamental sources of social problems and the mechanisms of mutual influences can be revealed.

For example, studying the correlation between economic growth and environmental pollution can help people better understand the balance between economic development and environmental protection, and promote sustainable social development. By analyzing the correlations between relevant variables before and after the implementations of social policies, the degrees of impact and effectiveness of the policies can be evaluated, which helps governments and decision-makers formulate policies more scientifically and reasonably, optimize resource allocations, improve social management and governance levels, and promote social development.

By the Pearson correlation coefficient can better understand motivations and value orientations behind human behaviors, guide people to establish correct life and moral values, and promote social harmony and stability. Spearman correlation coefficient calculates the linear correlation between the rank statistics of two sets of data for overcoming the influence of outliers on the results. In work and life, people will encounter various abnormal situations and emergencies, which may have negative impacts on their behaviors and decision-making, and even lead to deviating from their original goals. When facing abnormal situations and emergencies, we should remain calm, and rational, and not be affected by temporary interferences, maintaining inner determination and peace, as the Spearman correlation coefficient overcomes the interference of outliers. Students can be educated not to be influenced by external interferences and difficulties, but to steadfastly achieve their goals and pursue their dreams.

Cosine similarity measures the similarity between two data points (vectors) by calculating the cosine value of the angle between two vectors. This formula ignores the 0-0 matchings among all corresponding two-component matchings in two vectors (data points), greatly overcoming the impact of invalid information on similarity measurement. It is widely used in high-dimensional sparse data fields, for example, recommendation systems. When everyone is analyzing problems, it is important to grasp the main contradictions and delve into the core elements. It is important to concentrate energies and resources, focusing on the key points of problems, rather than overly distracting attention. By identifying and understanding the main contradictions, one can quickly and accurately grasp the essence of problems, effectively find solutions, and avoid getting bogged down in trivial details.

The total probability formula decomposes the probability of a complex event into the probabilities of several simple events, and then linearly integrates the probabilities of these simple events to obtain the probability of the complex event. This process of decomposition and integration is not just a simple mathematical operation, but also a way of thinking for solving problems. When facing the challenges of solving complex problems, the study shouldn't be intimidated by the complexities of the problems but should learn to break them down into multiple simple problems, then tackle them one by one, and finally solve the entire complex problem. This divide-and-conquer strategy can not only help to clarify the thread of the problem, but also enhance students' problem-solving ability.

Bayesian formula obtains posterior information by integrating prior information and sample information and then calculates the posterior probability. In essence, the Bayesian formula reflects the transformation from a prior distribution of an unknown parameter to its corresponding posterior distribution. People's understandings of objective things are usually carried out in the process of continuous improvement. As more sample information is being obtained, the prior and posterior distributions are relative, in other words, this posterior distribution can serve as the prior distribution for further understanding the same thing. With frequent updates of information, it is necessary to adjust ideas and plans of work, study, and life in a timely manner to adapt to constantly changing environmental conditions.

The main idea of all laws of large numbers is that the frequency of a random event converges with probability to its probability. In a large number of social practice activities, specific behaviors of an individual can be analogized to the frequency of a random event, and an individual can generate a series of behaviors in

social activities. Social norms and values can be analogized to the probability of a random event, representing behavior patterns recognized and expected by society. They are formed by the long-term development of society, generally recognized by people, and have a guiding and restraining effects on individuals. With the increase of social practice of an individual, that is, with the increase of sample size, behaviors (frequencies) of an individual tend to stable social norms and values (probabilities), which is similar to the laws of large numbers that the frequency of a random event converges with probability to its probability. Ideological and political education emphasizes the consistency between individual behaviors and social norms and encourages individuals to continuously learn and practice to gradually align behaviors with the requirements of socialist core values. In a large number of repeated social practices, people's good behavior habits and correct values can be shaped and solidified. Just as in conducting a large number of coin tossing experiments, the frequency of the coin facing up gradually stabilizes at the probability of the coin facing up, and behaviors of an individual will gradually tend to requirements of socialist core values by continuously learning and practicing.

3. Conclusion

This paper extracts the ideological and political elements from multiple probability formulas, explores the organic integration of these probability formulas and ideological and political education, and makes analogies between the principles, advantages, and applications of these formulas and some ideological and political contents, such as independence of events - cultivating students' scientific spirit and innovative thinking, applications of Pearson correlation coefficient - promoting social harmony and stability, Spearman correlation coefficient - steadfastly pursuing their dreams, cosine similarity - grasping the main contradictions of problems, total probability formula - dividing a complex problem and conquering them, Bayesian formula - dynamically adjusting ideas and plans, laws of large numbers - behaviors of an individual will gradually tend to requirements of socialist core values by continuously learning and practicing. By the ideological and political exploration of probability formulas, not only abstract probability formulas can be visualized, but also students can be helped to establish correct worldviews, life values, and moral values, which helps to improve the teaching quality of the courses related to probability and cultivate students' sense of social responsibility.

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