

Several Attempts on Probability Theory Courses Under Trinity Mode

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Abstract. Guiding forward to "Trinity Model" of education, to mould value, to foster ability and to transfer knowledge, for Tsinghua students, a few attempts have been tried on an important series of probability theory course including Probability Theory, Mathematical Statistics and Random Processes. These attempts are that the value shape and vitality stimulate learning interest; accurate concepts promote the level of imparting knowledge and cognizing knowledge; closing to practical problems leads to important probability distribution and enhances ability to solve practical problems; inserting some problems being researched to extend the ability to solve practical problems and to innovate in approaching scientific research; some strengthening links to further enhance and develop such ability

Introduction

The great rejuvenation of Chinese nation brings Tsinghua Univ. new opportunities and new challenges to become top universities in the world. Guiding forward to "Trinity Model" of education, to mould value, to foster ability and to transfer knowledge, a full range of learning and development environment and a profound reform of education and teaching are becoming up in Qing Hua Yuan.

As a basis for an important series course of undergraduate and graduate students of Tsinghua University, probability theory (probability theory, mathematical statistics and random processes) education should be given in-depth thought and change.

On one hand, 60 Years ago as a rigorous discipline since its inception, probability theory in the world range by leaps and bounds, showed tremendous energy and vitality; the ideas and methods of probability theory, created many new subjects and new directions. The other hand, study of probability theory needs both the Calculus as its important tool and special theoretical system and methods. And their further researches need solid and exact theory knowledge, for example, measure theory. So, some students regard it as a dangerous road to take. How to arouse student's interest and cultivate creativity, honesty is important.

Research Group made several attempts and persisted for years, and consequently, has a good reflection that are proved by size continuously increasing of the teaching class.

Course Value Shape and Vitality Stimulate Learning Interest

The series course includes "Probability theory and mathematical statistics" (48 class hours for science and engineering undergraduates and 64 class hours for liberal arts) and "Random Processes" (64 hours for graduate students).

"Shit happens, and it is the unforeseen", so randomness is everywhere. Therefore, since the last century 40 years probability of axiomatic systems established by founder Kolmogorov, probability theory as a rigorous discipline subject has been developed by leaps and bounds in the world, and showed tremendous energy and vitality; the ideas and methods of probability theory, as like as the Midas touch, hasten parturition and gave birth to many new subjects and new research directions.

So Probability Theory has provided, provides and shall provide a huge fancy space and enormous thrust.

Course value shape and vitality stimulate students learning interest of Probability theory.

However, we met with special problem in teaching and perplexity for course named by University Mathematics IV, in fact, consisting of probability theory and Statistics because of the students being both two parts of Arts and Sciences. How to tell a good probability?

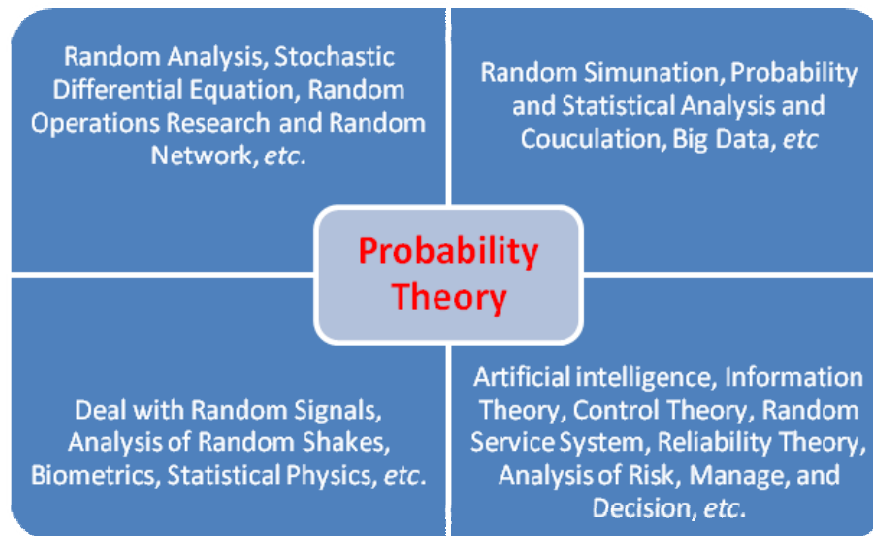


Figure 1. Probability theory is a midas touch.

Mrs. Qin Qing, main member of the Research Group, gave proposal that it should be in accordance with the Trinity (value creation, capacity-building, knowledge transfer) to find the right way, and made your contact details and arrangements an exchange activities. Under the support of Academy of Social Science of our university, President Chen Fu and four Bureau Chiefs of the research institutes took part in an exchange and communication together with our group, and then several times some students of the academy were invited to ours meets. Thus, Academic, students and teachers together discussed the further needs from social, political and economics and some challenge problems and topics that be solved based on random mathematics. Understanding the one of characters of social science of our university is that any analysis and conclude were finished based on the quality change and their relationships. And discoveries of the values in multi-faceted directions and regions enhanced the affinity between students, teachers and course.

Accurate Concepts Promote the Level of Imparting Knowledge And Cognizing Knowledge

Mathematical concept is an important part. General probability courses, excepted for students of Mathematics Department, are not involved Measure Theory, The conception about probability space is also not accurate. In our course, probability space in an axiomatization system and simple measure theory, like as Borel measurability and Stieltjes integral, have been instructed in brief since they are foundation of modern probability and further researches are needed, which made very easy to hold the distribution function type and general expectation of a function of random vector. The student's vision was expended and the enable was enhanced greatly.

An independence each other is another special and very important concept in probability theory. It is not in another subject of mathematics except of probability theory and its related subjects. And it is very different with human real life and political life. Consequently, what is the essence of the independence concept? It is value to discuss the concept in detail.

Based on its definition, one can get a conclusion that under the condition of their probabilities of events being less than 1 and bigger than zero, two both events are not mutually exclusive if their independent each other and they must be not independent if they are essentially exclusive which is very differs from everyday life and political independence in the community. Thus they are impossible to be independent in the left of Fig. 2, and the situation in right hand hits that they are able

to be independent but must be not sure. Furthermore, on can find the essence of independent and derives that both two conceptions of random variables and vents are the same.

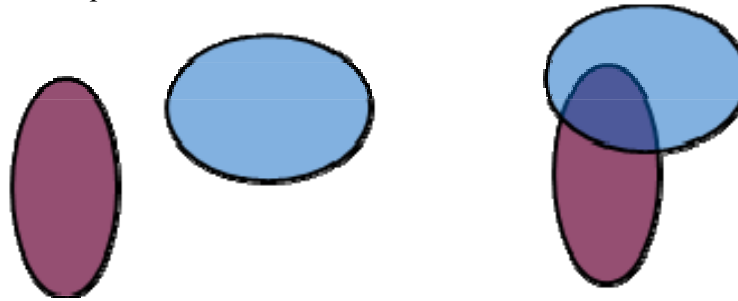


Figure 2. Independent and exclusive.

Closing to Practical Problems and Inserting Some Problems in Researches to Extend the Ability to Solve Practical Problems and to Get Innovative Researches

Three important random experiments, Bernoulli Test, Poisson flow and problem of error, lead to the 8 useful probability distributions, which it is easy to hold the characters of these distributions, including characters of being more difficult distributions, like as Pascal distribution and Gamma distribution. For example, their mathematical expectations are remembered almost immediately.

Inserting some problems being researched to extend the ability to solve practical problems and to innovate in approaching scientific researches.

When learning of Markov processes and a stable processes, we introduced also a useful HMM model (Hidden Markov Model) in acoustic signal processing and pointed out that the stochastic process is not a Markov process based on our research discovery and gave the reason in theory and experiment results although a lot of lively discussion regard as being. Our views has got authority's approval at an famous International Conference on Information Theory.

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