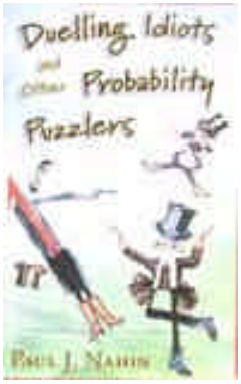

Duelling Idiots and Other Probability Puzzlers. Paul J. Nahin. Princeton University Press. 2002. 280 pp. Price: US$ 19.95.

Paul J. Nahin, the author of this book succeeds entirely in conveying the insight of the great Polish mathematician, Stanislaw Ulam: *In a sufficiently complicated problem, actual sampling is better than an examination of all the chains of possibilities*. One of the contributing factors to this is the mix of examples: humorous, mundane, intriguing, practical; yet every problem is challenging and yields startling results.

In the introduction, the following illustration really brings home the importance and utility of solving problems in probability. The Pentagon claimed that Patriot missiles had 80% success in shooting down Scuds in the Gulf War. This is shown to be false, by a simple calculation of probability starting from a set of sample observations, thanks to Postol, a physicist from MIT.

The reader's interest is captured right away in the very first problem *How to ask an Embarrassing Question*, by its challenge and the ingenuity of the solution. The next problem posed around an amusing situation *When Idiots Duel* establishes the method of listing the sample space and its simulation by a computer program, with the results drawing quite a few exclamations from the reader. Just when one has patted oneself on the back for having digested what has been served, the author dishes out a modification to complicate the problem (apparently) just a little. This technique is consistently maintained throughout the book, which keeps the reader on his/her toes and his/her intellect in awe of the puzzles in the realm of probability.

The logic-circuit problem *Will the Light Bulb Glow?* is a beautiful introduction to Markov chains. The author further captivates us with interesting events and situations in the life of the great mathematician Markov, who first worked out this area of probability theory. There are similar references to great persona in other places in the book too, which help the reader gain the perception of how a variety of unpredictable circumstances are involved in the progress of the pure sciences. Problems from science such as *The Random Radio* are brilliant examples of the practical application of the *Monte Carlo* method.

Who Pays for the Coffee? is a problem from a well-known situation; *The Curious Case of the Snowy Birthdays* an intriguing one, and *The Blind Spider and the Fly* lets us relax as *It is the Spider's Problem*. The last problem *When all fails there is always the Computer*, is a superb introduction to CPM and PERT, required for the management of complex projects, and of interest even to non-academics who are only interested in 'getting things done'.

The problem statements occupy 66 pages and the solutions 121 pages; the solutions are presented with clarity and in a compact form, achieved through diagrams and graphs. Those who do not wish to grapple with the puzzlers can treat themselves to each solution straight after reading the puzzle. However, understanding the processing algorithms of the accompanying computer programs (listed in an appendix), which generate the sample space of chains of possibilities for the various puzzles, is necessary for digesting the approach to solving such probability problems.

The closing chapter on Random Number Generators puts an important aspect in perspective. The quote from von Neumann *There is no such thing as a random number* says it all. Add to that the author's exposition of the fact that a computer is a predictable machine which is used to produce a copious supply of random numbers rapidly, to be used by the programs which implement the methods of solution of probability problems expounded in the book. Finally, the story *Some Things Just Have to be Done by Hand* on God throwing dice (borrowed from the *Analog Yearbook 1984* and modified by the author) makes hilarious reading.

One further aspect, which the author has not discussed, relates to the physical world and is worthy of note. Probability theory, as applied to the physical world, rests on the assumption that the laws of physics are deterministic. We illustrate through an example. The statement that a given coin is 'fair' for tossing is based on our accepted model of the world and the laws of physics. If these laws are deterministic, as in classical physics, the statement is a definite one, and we can use fair coins in a probability puzzler. If these laws are probabilistic, as in quantum physics, the coin is fair only with a probability, and it may be 'not-fair' to varying degrees with various probabilities at various times. All these probabilities must be known to use the coin in a probability puzzler with tossing of the coin. How does one verify these probabilities of varying degrees of fairness, as the verification itself depends on the tossing experiment? The reviewer feels that perhaps, the community of mathematicians and physicists working in the area of foundations of quantum theory have addressed and resolved this question; perhaps, they have not.

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Measuring Biological Diversity. Anne E. Magurran. Blackwell Publishing, Massachusetts, USA. 2003. 256 pp. Price US$ 57.95.

For its size and population, India has a despairingly small number of ecologists studying the patterns and processes of biodiversity distribution. Fortunately, awareness that such studies are lacking but urgently needed, is on the rise. Along with professional ecologists, an increasing number of students still in their Bachelor and Masters degree programmes have started documenting biodiversity and studying seasonal community and species dynamcis[1–4]. For such students and other newcomers to the field in India, the problem is always finding the right resource that will acquaint them or bring them up-to-date with the field of diversity measurement. There is good news for them.

Those in the know are familiar with Anne Magurran's 1988 *Ecological Diversity and its Measurement*. This was an excellent reference that students like me went

back to several times, while writing our initial work on biodiversity. Things have changed quite a bit, though, since the late 1980s. Easy-to-use computer software have been developed and they are widely available – for free – on the internet; there are several null and biological models of diversity distribution, and some useful and powerful measures of diversity have been devised. The field of phylogenetics has advanced in bounds, and measures of taxonomic diversity have been improved. A modern reference covering this newly formed territory was therefore in order. Magurran has once again filled this niche with her new book. This is not a formal second edition of her previous book, but rather its evolved version.

The first chapter of the book is a general introduction, but it lists valuable web resources and mostly freely available software that compute various diversity indices and measures that have been developed in the past decade and a half. I would particularly like to draw attention to Robert Colwell's EstimateS (http://viceroy.eeb.uconn.edu/EstimateS). It computes most of the popular indices. It is being increasingly used in biodiversity studies and most people will find it indispensable in their data analysis.

Perhaps the most important part of the book is the second chapter. It introduces readers to the fundamental but some of the most informative methods of representing data and fitting models: rank/abundance plots, species abundance models, and the philosophical difference between statistical and biological models. The former class of models statistically describes species abundance and includes, for example, Fisher's log series, log normal distribution and negative binomial. The latter class of models, on the other hand, theoretically explains biological basis of species abundance patterns, and includes niche apportionment models. The chapter includes a whole section on Tokeshi's excellent biological models, developed mainly in the 1990s.

The third chapter concerns measures of species richness, or estimating the total number of species in an area from a sample. It is a good introduction to species accumulation and rarefaction curves, and the use, and pitfalls, of log normal distribution to estimate species richness. A section discusses at length Ann Chao's useful estimators of total species richness. This set of models has been made user-friendly by implementation in EstimateS.

The most popular components of biodiversity estimates are perhaps, richness and evenness indices. These have been discussed widely both because of their use in a range of systems, as well as because they have been widely misused and their meaning and utility have been repeatedly questioned. Chapter four gives reasonably detailed accounts of the oft-used diversity indices, such as log series alpha, Q-statistics, Shannon index, Simpson's index and Berger–Parker index. The diversity of diversity indices itself is quite overwhelming, and a table on page 120 and its discussion on pages 119–121 would prove useful while choosing appropriate diversity indices. This chapter also briefly discusses measures of underappreciated dimensions of diversity: taxonomic diversity and functional diversity. Under-representation of these measures of diversity is unfortunate. Taxonomic diversity is an important consideration in conservation studies. Functional diversity has important implications for the diversity–stability debate on the one hand and community structures, species packing and stability of communities on the other hand. Perhaps the book will be successful in encouraging ecologists and conservation biologists to pay more attention to these aspects of diversity.

Chapters five and six are important for ecologists who study multiple communities and compare them. Chapter five discusses sampling issues at length. There are sections on various methods, such as species abundance distribution, rarefaction and jackknifing. Chapter six is a good overview of beta diversity, or diversity in space and time, and includes an account of cluster analysis. Although informative, it is too brief an introduction to cluster analysis and users of this book will be better off turning to other good books available on this subject for additional reading.

The last chapter 'No Prospect of an End', is somewhat disappointing. It sums up the field and its possible future directions, but rather than being emphatic and visionary it merely serves to end the text. It fails to be stimulating. The chapter is followed by worked examples of the prominent diversity indices and other methods of measuring diversity. Although this section is useful, the reader is advised to refer to much richer and more diverse resources available on the internet.

Despite some shortcomings mentioned above, this is a crucial reference for budding ecologists, conservation biologists, forest officials and habitat managers. All institutional libraries, major or minor, should have copies of this useful reference. Hopefully, students, more advanced researchers and habitat managers will continue to document, study and conserve India's biodiversity. Of particular interest are quantitative comparisons of species assemblages and monitoring of our biological diversity in relation to management strategies and in the face of threats to biodiversity. Magurran's book has much to offer in these areas, and hopefully we will make good use of it.

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Citation Analysis in Research Evaluation. Henk F. Moed. Springer, Dordrecht, The Netherlands. 2005. 346 pp. Price: US$ 59.95.

Performance evaluation is important in all organizations. In particular, evaluation is important in the field of science and technology as millions of dollars are invested on scientific research and the impact of research is felt in virtually every sector of the economy.

Ever since Gene Garfield came up with the citation index for science in the early 1960s, he has been writing essays on a variety of topics, often using data from *Science Citation Index*. Many of these essays, since brought out in the form of a multi-volume series entitled *Essays of an Information Scientist*, are state-of-the-art examples of citation analysis-based research evaluation. And the Institute for Scientific Information, the publisher of *SCI*, and later the Thomson group, have brought out many tools specifically to