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A Review of Ian Stewart's *The Magical Maze*, John Wiley, 1997, 268 pp.

by **Leong Yu Kiang**

This book is an offshoot of the Christmas Lectures which the author gave to the Royal Institution of Great Britain in 1997 and contains much more material than those actually delivered at the Lectures. Although the tradition of these Lectures started way back in 1826, the author is the second mathematician to have given them, the first mathematician to have done so being Christopher Zeeman, who is one of the pioneers and avid proponent of catastrophe theory in the seventies. Two mathematicians within 170 years of scientific exposition - does this say something about mathematicians as expositors or public relations people? Incidentally, Zeeman was Stewart's boss at the Mathematics Institute in Warwick for many years, and Stewart is a well-known and well-established expositor of mathematics since the seventies.

As the caption below the title says, "Seeing the world through mathematical eyes" is what the reader would be rewarded with if he weaves through some of the passages of the "magical maze" laid out in the book. Actually, the word "maze" may convey too much of a mystifying impression of mathematics. What strikes the reader after reading the book is the amazing richness in ideas and applicability of mathematics in everyday life if only one knows where and how to look for them. Not many of us are aware that a toy train set has as much computational abilities as a supercomputer - admittedly in principle, though not in speed. Or that three common ways of tying a shoelace have something to do with an optimizing principle, commonly known as Fermat's principle, governing the path of a light ray.

To the uninitiated, and even to professional mathematicians who are not specialists in probability theory, a 30-page chapter casts some light on some probabilistic paradoxes that appear to be counter-intuitive. If a couple with two children tell you that their eldest child is a girl, what are the chances that the youngest is also a girl? If this is too easy for you, try this well-known "puzzle". A game show contestant chooses one of three doors. There is a car behind one door and goats behind the others. After he has chosen a door, the host of the show, who knows where the car is, opens a door to reveal a goat. He then asks the contestant to reconsider the choice he has just taken. The question is: should the contestant change his choice? In other words, will changing his initial choice improve his chances of getting the car? If you think that it makes no difference, then this chapter will reveal to you some of the subtleties of so-called "conditional probabilities".

There is something about how modular arithmetic makes some common tricks work and more seriously, how it is tied up with calculating days and dates. You will also learn that people at AT&T's Bell Laboratories also do interesting mathematics in addition to maximizing the company's profits, albeit in connection with saving money for the company. A simple chemical experiment known as the Belousov-Zhabotinskii (BZ) reaction, we are told, is related to computer-generated patterns considered by the English logician Alan Turing and the Hungarian-born American mathematician John von Neumann. The geometry of nature is complicated and may be modelled by something called "fractals", which lead to a whole new discipline that studies what is perhaps mistakenly called "chaos". These are some of the main themes delved into with only a minimum of technical mathematics. Some mention is also made of ongoing collaborative research by the author and others on the dynamics of motion of animals.

The contents page of the book may confuse you initially with a picture of a maze and the division of the material into "junctions" and "passages". But soon you will realize that each chapter (represented as a junction) is independent of one another. Whichever way you choose to read the book, you will emerge from the "magical maze" in an entranced and exhilarated state. You would never have thought that there is mathematics in shells, trees, viruses and wallpapers.