BOOK REVIEWS

Amar Sodhi

Rediscovering Mathematics: You Do the Math by Shai Simonson
Classroom Resource Materials, Mathematical Association of America, 2011
ISBN 978-0-88385-770-0, Hardcover, 207 + xxxi pages, US$64.95
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Reviewed by ***Edward Barbeau****, University of Toronto, Toronto, ON*

How can we encourage students to get beyond a mindless approach to mathematics and become active learners who will strive for insight, understanding and creativity? This book, whose author teaches computer science at Stonehill College in Easton, MA, addresses this question explicitly. He directs his book to teachers who he hopes will be able to "reshape the popular perception of mathematics – one child at a time" as well as anyone "looking for a guide to revisit and reconsider mathematics". The background required is arithmetic, basic algebra and some geometry; the reader is assumed to have little experience of mathematics beyond the traditional school classroom.

He begins with advice: don't miss the big picture; don't be passive; slow down; own the mathematics. This is illustrated by an imaginary (and somewhat artificial) exchange between a professional and reader of a mathematical passage. Then the mathematics, a mixed bag of topics, is developed through a sequence of questions, exercises and problems designed to encourage participation. Most of the material will be familiar to readers of this journal: repeating and terminating decimals, averages, mental computation, checking, pythagorean triples, fractions, convergent and divergent series, numerical patterns, rates, variation, percentages, algorithms, Pythagoras' theorem, quadratic equations, probability, three-dimensional solids and area. There are a few snippets of greater interest, such as near misses to Fermat's theorem (e.g. $13^5 + 16^5 = 17^5 + 12$), caroms, the RSA encryption method and solids whose faces are all pentagons and hexagons. Although the treatment is salted with some anecdotes and points of information, it mainly consists of a graded sequence of exercises, each immediately followed by the solution. Although the reader is strongly encouraged to stop and consider the question before looking at the solution, I wonder whether this will in fact occur.

The difficulty with this approach is that a book is a one-way communication from author to reader. Any learning situation requires the teacher and learner to find common ground from which to proceed; each comes with his own worldview. The danger is that, without an opportunity for negotiation, the teacher can proceed to develop a topic without being aware that the reader has hit a stumbling block because of a fundamental difference in outlook. In the present book, I can see this occurring in the discussions on averages and probabilistic expectation. On the other hand, a two-jug liquid pouring problem makes a nice entrée to the Euclidean algorithm. A highly disciplined reader who is willing to struggle with difficulties will gain from this book, but much of the book reads like a regular textbook.

It might have been a better strategy to defer discussion and solutions to the end of the chapter. Sometimes we come to understand gradually or haphazardly, by going ahead, getting stuck and backtracking. Thus, the reader should be discouraged from looking for outside help too soon. Where feasible, students should be helped to construct their own examples. Perhaps the presentation can be punctuated by blanks for the student to fill in or the occasional "why?" inserted into an argument. One author who has done this with greater success is A.D. Gardiner [1, 2].

This book would be suitable for secondary teachers looking for advice and material to encourage more independence among their students, as well as college teachers who have to teach an appreciation course to a general audience.

References

[1] A.D. Gardiner, *Discovering Mathematics: The Art of Investigation*, Oxford, 1987.

[2] A.D. Gardiner, *Mathematical Puzzling*, Oxford,1987.

What's Luck Got to Do with It? The History, Mathematics, and Psychology of the Gambler's Illusion by Joseph Mazur
Princeton University Press, 2011
ISBN: 978-1-40083-445-7, hardcover, 277 + xvii pages, US$29.95
Reviewed by ***Dave Ehrens****, Macalester College, St. Paul, MN, USA*

In addressing the question of why people gamble, or more specifically why people believe they have to win, Joseph Mazur delves into a great deal of history, with enough mathematics and psychology, to make us think that the problem of gambling won't be solved any time soon. The colorful stories from history, mixed with formulas and theories, give us quite a picture of one of our favorite addictions.

Part 1: The History

The book starts with historical and anthropological evidence of games of chance, including a number of histories of words we now use. I was familiar with "knucklebones", but "your lot in life" has a game of chance in its background as well. If the courtier loudly says, "The king has left the building", but you see the king at the next table, then it means that it's legal to gamble. The pendulum swings of the attitudes towards gambling in law through the centuries are displayed in a nice way, full of anecdotes from many time periods. A culture may have laws against gambling because of societal pressure or because the royalty want to keep it to the upper class.

In modern eras, gambling was logically related to the invention of insurance for the large shipping firms. Betting on the markets and betting on dice were shown to be similar to the addicted gambling man. Now, much like a good documentary, the author selects details to show the reader from a vast array of possibilities. He concentrates on certain colorful times and places, showing the similar effects of addiction to gambling.

In this chapter he makes quite clear the fallacy in his subtitle. If a person is successful at a game or investment, he may believe it is because he is good at it, or that the luck he has experienced is part of him instead of random. Positive reinforcement through arbitrary effect may make someone feel invincible. This leads to tremendous losses at the tables and in the markets.

Part 2: The Mathematics

The second part of the book starts with some classics of probability classes, with sampling and spaces and fractions, but all the math is mixed in with anecdotes about teachers and gamblers, making it much more palatable for the lay reader than a typical probability text. A small scene from *Casablanca* is well placed before the discussion switches from coin flipping to the more complex roulette.

The mathematical section is not long and, due to the author's manner of presentation, one could easily move past the formulas if the mathematics wasn't of much interest to the reader. Then again, if the formulas were at the right level for the reader, say a clever middle school student or a person well versed in algebra, then the book is deficient in providing enough to learn the math. It does, however, provide enough vocabulary to lead you to an online or library search.

Part 3: The Analysis

A description of the whole book can be found in just Part 3. The complex ideas of mathematics of psychology are introduced, and the book does not intend to draw scientific conclusions. Instead, it illustrates the steps that one might take to reach the conclusions. This is a fine way to introduce people to the discussion, and perhaps convince them of the mistakes people make when they assume too much about their success in gambling.

Mazur explains some of the reasoning that gamblers use, illustrating differences that are not differences in math, but are differences in the mind. Using a wide variety of anecdotes from Dostoyevsky to *Deal or No Deal*, we see a number of important points. Is it easier to gamble with your own money, or the house's? Does it make a difference whether you think of the money as already won?

A weakness in this section might be found in the lack of psychological vocabulary. In section one there are actual historical faces. In section two we have a nice variety of mathematical formulae and definitions. While the third section has vivid descriptions of places and events, you don't feel like the conclusions are grounded in recent science simply because of the lack of use of technical vocabulary. That said, the terms used are easy to digest by the general public, and the points come across clearly.

Copious appendices at the end of the book contain useful information, but may muddy the message. The index of games provided is useful, as is the glossary of gambling terms. The mathematical formulae provided seem to vary dramatically in their detail. Some take a great deal of time on what could be a simple matter, while other explanations seem to make large leaps to conclusions. Having taught many of the listed ideas, I'm probably not the target audience, but the lack of consistent depth was a bit disturbing. The endnotes were useful but divided into "Notes" and "Callouts". I couldn't tell why one piece of information would get one label or the other, but each one was quite useful and entertaining.

I found "What's Luck got to Do with it?" to be entertaining and engaging. I don't think that it will convince people with gambling problems to change their ways, but the bits of history, with gambling in high class and low, may be a satisfying distraction for them.

Unsolved Crux Problems

In Crux, no problem is ever closed . . . some don't even get opened! Below are two more problems from the vaults that have defied solvers to date. Good luck!

909*. [1984 : 20; 1985 : 94–95] *Proposed by Stan Wagon, Smith College, Northampton, Massachusetts, USA.*

For which positive integers n is it true that, whenever an integer's decimal expansion contains only zeros and ones, with exactly n ones, then the integer is not a perfect square?

1077*. [1985 : 249; 1987 : 93] *Proposed by Jack Garfunkel, Flushing, NY, USA.*

For $i = 1, 2, 3$, let C_i be the centre and r_i the radius of the Malfatti circle nearest A_i in triangle $A_1A_2A_3$. Prove that

$$A_1C_1{\cdot}A_2C_2{\cdot}A_3C_3 \;\geq\; \frac{(r_1+r_2+r_3)^3 - 3r_1r_2r_3}{3}\,.$$

When does equality occur?