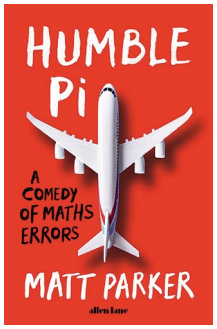
Weapon of maths instruction



Humble Pi: A Comedy of Maths Errors

By Matt Parker

Allen Lane: 2019.
336pp. £20

Think about how often we use mathematics in our daily lives. It could be something as basic as measuring your living room for your new furniture or calculating a tip. At worst, you suffer some embarrassment as you frantically reach for your mobile phone calculator, but can the consequences of making a mistake in mathematics be life-altering? Indeed, the fact that a simple unit error could result in deaths is a sobering thought, yet comedian and mathematician, Matt Parker, tells there are many examples like this in recent memory.

Every day we experience or come into contact with something that is built on maths. *Humble Pi* talks about the ridiculous and in some cases tragic consequences of mathematical errors in different forms, digging through some fantastically researched examples to point out how the finance world, the media and even scientists and engineers can sometimes get it so wrong.

Engineering errors are probably the most obvious examples and often have the most disastrous consequences. Most of us will have heard of the Broughton Suspension Bridge collapse in 1831 that was caused by soldiers marching in perfect step at the bridge's resonant frequency, but many other examples are discussed with terrific insight into how these engineering failures occurred.

The book also highlights the vicious beast that is error in computer code, an issue that is particularly relevant given the extent to which we rely on computers these days. High-frequency trading algorithms, for example, are based on ordinary code that needs to be regularly updated depending on the financial environment. So if an update fails or there's an incorrect line of code, this could result in the loss of hundreds of millions of dollars.

Although one may find it difficult to sympathize with the big bad world of finance, there are also very unfortunate consequences of not updating code correctly, particularly when it is controlling instrumentation. As an example, the author details the Therac-25 medical radiation machine, which treats cancer patients with electrons or X-rays. In the case described here, an error in the code meant that a subroutine was not run, causing the patient to receive a lethal dose of radiation.

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Unless you are a computer engineer, you take the daily seamless operation of your computer for granted, but computers, not unlike humans, can have problems tracking time. So if you have any sort of fear of flying, you will not be comforted by the fact that computers on airplanes are no exception. The example of how 800 aircraft in southern California lost radio contact with the Los Angeles Air Route Traffic Control Center in 2004 is not for the faint-hearted: it happened because of how the air traffic control system kept track of time; the counter hit zero and resulted in a loss of electrical power.

I think all scientists might benefit from reading about the kinds of error that are prevalent in databases. The book talks about how we store data (most commonly with Excel), and discusses how a misunderstanding of data handling by these programs can lead to serious errors in subsequent processing and results by scientists. For example, genes can be a mix of letters and numbers that could be erroneously autocorrected by an Excel sheet. And of course, using these data in scientific publications provides yet another layer of potential problems. All of this is before thinking about those errors that happen as a result of maths formulae or inputting incorrect numerical data, for example.

The book is a very informative look at our relationship with maths, how we use it and how it goes sideways. On the surface this seems obvious; mistakes in maths in any form are bad. Although it's so easy to blame a human, it is very nice how the author explains how a number of smaller errors can often line up just right to make disaster more likely (this is the Swiss cheese model of disasters). I would argue that this is not just a book that highlights how badly we fail as humans. On the contrary, it highlights how normal it is that we do fail and reassures us that's OK, because we are trying to achieve incredible feats, in some cases for the first time. Putting the right measures in place to help filter out smaller mistakes may be a better approach than naively assuming no one makes mistakes, and this is a sentiment that we can all take on board.

After fumbling my way through Parker's examples, I wholeheartedly agree. Maths is not always intuitive, but what's more important is how we decide to learn from those errors. We can choose to make more errors public in order to learn from them, and as the author explains, this argument can be made quite strongly for things like negative results in drug trials. As always, the situation isn't always this clear-cut and competing interests more often than not get in the way.

The reader of this book should feel thoroughly entertained and, I hope, inspired to go out and err as best as humanly possible. ❐

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