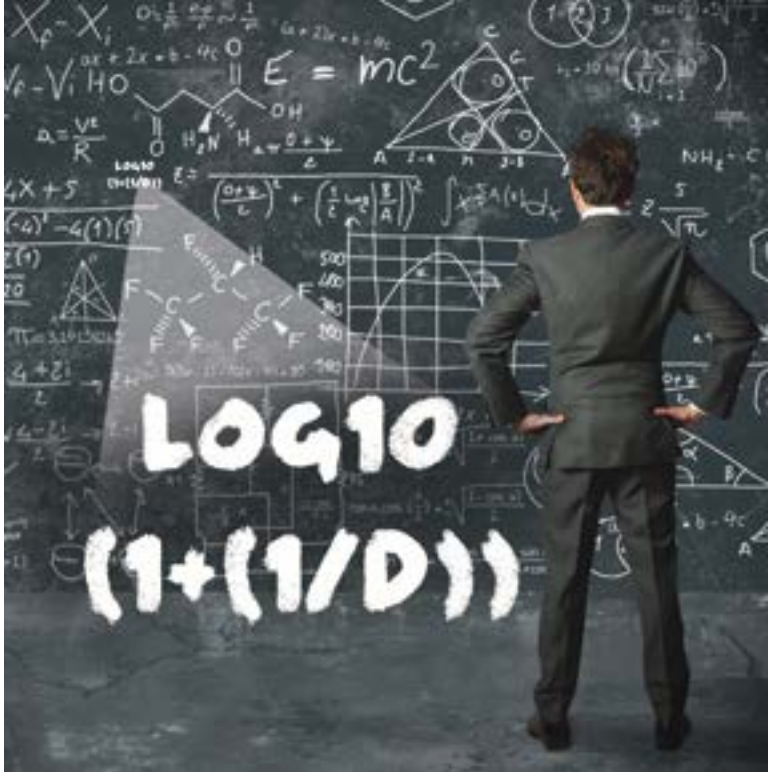
A LAW FOR RANDOM THINKERS

Benford's law has had mathematicians scratching their heads for decades. How does this statistical oddity stack up?



SHUTTERSTOCK

Randomness is a topic that has cropped up in a number of conversations I've had within the past few days. How random was that? No, that's not a rhetorical question. Seriously, how random was that?

In life, random events tend to clump together, of course. Your mother told you this when she said, "Bad luck comes in threes."

But there is one element of randomness that seems hardly to be random at all. In 1881, an American astronomer called Simon Newcomb noticed that the first pages of books of logarithms were much more well thumbed than the middle or back pages. It appeared, he noted, that people were doing more calculations with numbers beginning with the digit '1' than with the digit '9'. He even worked out a mathematical formula that described how often a number beginning with each particular digit was consulted (where D is the digit in question):

$\text{Log}_{10}(1+(1/D))$

So people were looking up numbers beginning with a '1' about 30.1% of the time, numbers beginning with a '2' around 17.6% of the time, up to those beginning with a '9' just 4.6% of the time.

No one could figure out why this was, and so everyone forgot about it.

Almost 60 years later, a US physicist called Frank Benford made the same discovery. But he delved into it in more detail and found out that this mathematical weirdness of digital 'clumping' occurs much, much more frequently than we might think and applies to phenomena beyond that of how well thumbed a book of logarithms happens to be.

The law – which would soon be known as Benford's law and not, sadly, Newcomb's law – actually occurs a great deal in nature and applies to almost any naturally occurring phenomenon that has no artificial upper or lower limits. So, for example, it applies to the drainage area of the world's rivers measured in acres; it applies to the population of US counties; it even applies to the numbers that appear in magazine articles. It doesn't apply to the price of a litre of diesel at UK petrol stations. But it does also apply to the drainage area of the world's rivers if measured in *hectares*.

There's even a variation of the law that applies to the second digit in any number. The consequence of this is that numbers beginning with '10' are much more common than those beginning with '99'.

Of special interest to treasurers is the fact that the law applies to share prices, financial transactions and bank balances. The law has been used by auditors to look for improper expense claims or fraudulent deals: people usually either submit claims such that they are just below a limit that attracts attention or they go excessively random. Either way, they fall foul of Benford's law and get caught out.

There's a wealth of academic literature that scrutinises the mathematics, examining things like probability distributions of probability distributions (yes, you read that correctly; no, you're not seeing double). But in truth, no one seems any the wiser as to exactly *why* Benford's law works.

Maybe it's just one of those random laws of nature.

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IN THIS ISSUE:

The highlights of the June 2017 issue of *The Treasurer* include: Grosvenor Group treasurer Karen Toh talks about her organisation's treasury-transformation project, on page 24. Treasurers share the ways in which they accurately forecast cash visibility, on page 30. The situations that will prompt a board to request information on cash and liquidity, on page 40. What does a corporate financial risk manager do? Find out on page 42