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Reviews

'Guesstimation'

reviewed by Anna Faherty



Guesstimation: Solving the world's problems on the back of a cocktail napkin

Lawrence Weinstein and John A Adam

We've all been there. You're in a bar with a group of friends. The night draws in. The empties pile up. The conversation turns to sublime speculation and ridiculous argument. How many golf balls would you need to circle the Earth? What's the risk of being killed by a shark? How efficient is wind power? How far does your average Premiership footballer run in a game? How can we put an end to all these questions and go home?

The answer, it seems, is right in front of you. Pick up a cocktail napkin, think like Enrico Fermi and you can "guesstimate" your way through any amount of numerical, political and scientific nonsense. Oh, and make sure you have a copy of Lawrence Weinstein and John A Adam's handy guide in your back pocket.

Guesstimation looks more like a work of contemporary fiction than a mathematics text. The matt cover is almost as small and as white as a cocktail napkin, and inside, quirky pen and ink illustrations accompany each

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of the seventy or so problems. Despite a stridently humorous approach, the authors of this pocket tutorial have two serious aims: to give lay readers an understanding of the meaning of large numbers and to help them make rough common-sense estimates from a few scant facts.

The opening chapter outlines their three-step guesstimation strategy: 1. Try to guess the answer, 2. If you can't guess, break the question into individual problems that you can guess, 3. If you can't guess these, try to establish possible upper and lower bounds. Apart from deconstructing your problem into more manageable components, perhaps the most useful trick in this book is step three. Not sure how many clowns would fit in a VW Beetle? Well, it definitely has to be somewhere between 1 and 100. We could take the average of these two numbers, and get a guess of 50. But that's fifty times the lower bound and only half the upper. What we really want is a number that's the same factor away from each. So, Weinstein and Adams use the geometric mean of the two numbers instead, in this case giving a guess of 10, which sounds more likely.

Chapter two is a concise introduction to large numbers, coefficients, powers, units and conversions. Even the least maths-confident reader will quickly gain an understanding of why numbers are presented as they are, and learn how to read and manipulate them. A useful section on accuracy and significant figures includes the apocryphal story of the museum warder who described a dinosaur skeleton on display as 75 million and 3 years old ("because it was 75 million years old when I took the job three years ago").

So, how does all this work in practice? Let's take the footballer example above. To work out the distance covered we need to know the speed he runs, and how long he runs for. You probably don't know how fast he runs. But you probably do know that athletes run a mile in about four minutes. That's 15 miles an hour (or around 7 metres per second). Since he won't run all the time, we also need to factor in a walking speed (say 1 metre per second). If he walks for half of the time, and runs for the other half, his average speed will be $(7+1)/2$, or 4 metres per second (around 8 miles per hour). If he's not substituted, he'll play for 1.5 hours. The total distance covered is given by multiplying his speed (8) by the time played (1.5), giving 12 miles. If you didn't know about the four minute mile, you might have recalled that sprinters cover 100 metres in about ten seconds (that's 10 metres per second). Using this figure at the start won't make an awful lot of difference, though; the answer is a surprisingly long way. It's up to you whether that makes you reassess the value of footballers' salaries or not.

There are nine chapters of weird and wonderful problems just like this. While many are obscure, trivial and downright silly, the book's subtitle is justified by one chapter on risk and no less than four devoted to energy related topics (including guesstimating the energy generated by gasoline, batteries, wind turbines, uranium, the Sun and... um... gerbils). Throughout, the focus is on obtaining answers to within a factor of ten. This, the authors claim, is usually enough to help you make a sensible decision.

Careful thought has been given to how readers will learn the secrets of guesstimation. After only three quick examples, you're thrown straight in to try your own problems. If you falter at the first hurdle, flip the book upside down to reveal a set of useful hints. If you're still stuck, turn the page for a brief solution (never more than two pages long), often accompanied by a helpful reality check. When necessary, brief introductions to basic science concepts are also provided. The problems get more difficult as you progress, so you may find yourself reading a lot of the book upside down as you near the end!

An excellent appendix helps relate massive or miniscule numbers to real life dimensions. How big is a micron? Roughly as thick as the film of a soap bubble. And a square millimetre? Around the size of a pin head. What about 10^7 kg? Oh, that's the weight of the RMS Titanic. Or 10^{10} kg? More or less the weight of the Great Pyramid of Giza. Presumably, this last figure was itself guesstimated on the back of a cocktail napkin sometime between 2,500BC and the present day.

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There are even 33 additional, unsolved problems for practice, ranging from how much carbon dioxide a person emits to the atmosphere, to the size of helium balloon you'd need to lift your car off the ground. Work your way through *Guesstimation* and you'll not only hone your analytical skills and learn some basic science. You'll also never be stuck for bar-room conversation again.

Book details:

Guesstimation

Lawrence Weinstein and John A Adam

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About the author

Anna Faherty read physics at Cambridge before working in publishing for fifteen years. She commissioned the *Modular Mathematics Series* and recently worked on 50 mathematical ideas you really need to know. Anna is now a freelance writer and consultant working with a diverse range of clients including the Science Museum, the National Maritime Museum and *Time Out London Guides*.



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