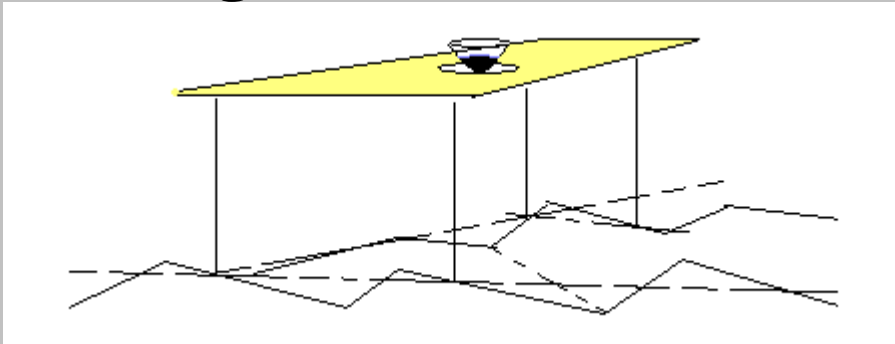


Turning the tables



Mathematicians find an application of their science in nearly everything they do, says S.Ananthanarayanan.

Pure mathematics is often viewed as a pursuit of *pure* knowledge truly removed from common persons' concerns, unlike dentistry or commerce, which have direct application. But in the Mathematician's mind, the environment teems with examples and proofs of ideas that seem, to others, to live entirely in mathematicians' minds or their notebooks.

Mathematics in life

Common examples of math theory getting useful are of probability theory, linear programming and number theory. Unlike geometry or compound interest, which were developed through application, these subjects found application quite independently of their academic development. Probability theory has led to the whole field of statistics and the science of betting, or the prediction of the outcome of things that depend on chance. The science has helped describe the distribution of values to fall uniformly around a *mean* value. If a graph is plotted of the number of times a value shows up against the values themselves, the curve rises as it gets near the mean value and then falls off. Mathematics has shown in detail how sharp the peaking is for different distributions and also such things like how likely is a value exactly at the peak, or within a certain distance, either lower or higher, than the peak and so on.

Linear programming is the detailed study of simultaneous equations, that nightmare of middle school and has become the guiding light for nearly all organized business these days .A simple example is in pricing a product. If the price is high, only few customers buy. If the price is low, many customers buy but the returns are low. Mathematics helps work out just the price at which the number of customers makes for most money in the cash register. When there are several products, whose sales affect the sales each other and even discounts for buying early, the exact pricing to maximize revenue takes complex mathematics and computers to work out.

Number theory was about series of numbers and prime numbers and recurring decimals and the like – an unlikely field to become useful in the marketplace. But today, with computers working with a different kind of number system – based on 2 in place of 10, which is the base of usual numbers, mathematics has become an inevitable part of a

computer engineer's training. Again, for devising methods that sort or search through massive data bases in the best time, the study is entirely advanced math. And the, for e-commerce applications, where transactions have to be kept secret, the codes devised depend heavily on very abstruse number theory principles.

Toppling tables

André Martin, a physicist at CERN, in Geneva, has used complex math to prove a curious thing we may have all noticed in the cafeteria – that tables often wobble, because when three legs of the table find their place on the ground, the fourth leg is sometimes left a little above the ground. The reason, of course, is that the ground is generally not perfectly plane. The result is that the table is wobbly and more likely than not, your coffee is going to spill.

What André noticed is that despite this nagging thing about cafeteria floors, it was generally possible to turn or move the table about so that the wobble nearly disappeared. André then decided to see if there was some mathematics that said that a *fairly* even floor should have at least some sets of four points, in a square, that are all in the same plane. If this were mathematically true then it would be a great relief to people at cafeterias, because they could always adjust their table to be stable before the coffee arrived.

André assumed some limits to how much the random slopes of the floor could go off the level, that the four legs were the corners of a perfect square and that the legs were thin – and with some pretty complex math about the distribution of the levels possible in the floor – he has proved that one orientation of the table where all four legs touch the ground has to be there. The table may be a little tilted, but it would be stable!
