LOTTERY FRAUD

Solving crime using math

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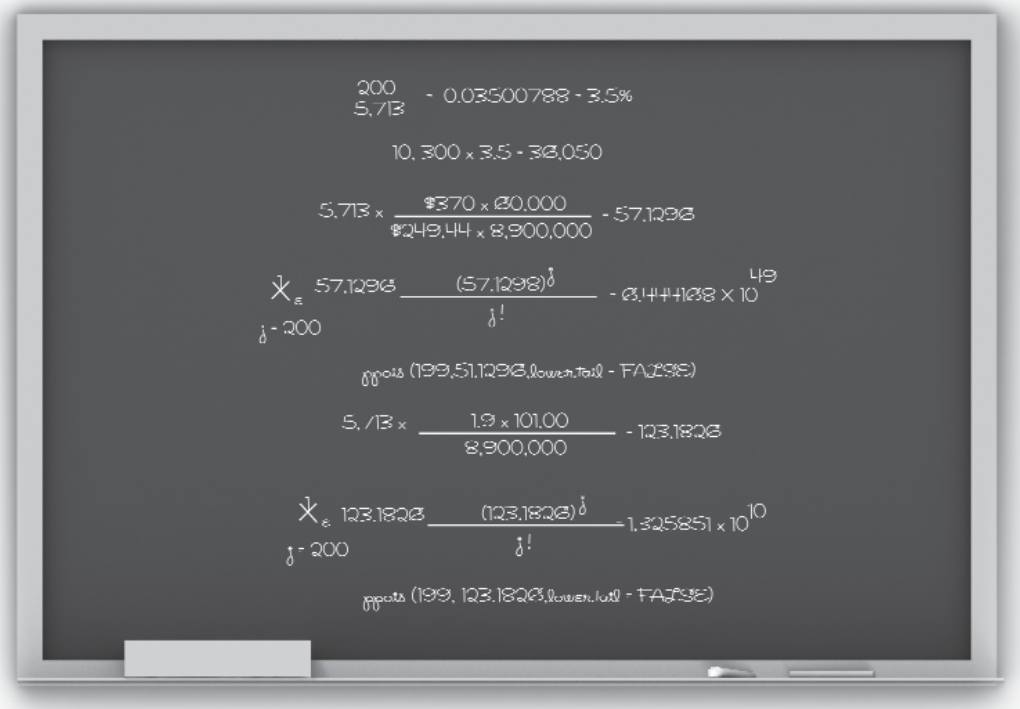

On the CBS television series NUMB3RS, crime-fighting mathematician Charlie Eppes boldly declares, "Everything is numbers!"

Well, that might be an exaggeration. But my involvement in a recent investigation into lottery fraud has convinced me that statistical analysis can indeed be used to uncover fraudulent behaviour that might otherwise pass undetected.

Many lottery players simply hand their tickets over to the local store clerk, asking if they have won anything. This opens the door for unscrupulous clerks to pretend that a winning lottery ticket won nothing (or just a tiny prize), then later claim the big lottery jackpot for themselves.

Does such fraudulent behaviour actually occur?

In 2001, Bob Edmonds, a 75-year-old resident of Coboconk, Ontario, claimed that a local retailer had defrauded him out of a $250,000 winning lottery ticket. Subsequent investigation proved him correct, and in 2005 the Ontario Lottery and Gaming Corporation (OLG) finally settled with him for $150,000. However, the OLG fought the case very hard before settling (incurring $425,000 in legal costs), and insisted on a gag order to keep the settlement confidential. This raised suspicions about whether the OLG was hiding other similarly fraudulent wins by other store clerks. The CBC television program The Fifth Estate asked me to look at the numbers.

Through a Freedom of Information request, the CBC ascertained that between 1999 and 2006 there were a total of 5,713 major Ontario lottery wins (of $50,000 or more), of which about 200 (3.5 per cent) were identified as being won by people who worked in stores that sold lottery tickets. (Store clerk wins were only recorded if the lottery winner answered yes when the OLG asked if they worked at a store. Some winners might have lied, so the true figure could be higher than 200.)

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The question was: how many major prizes should we have expected these sellers to win? And what were the odds that they would win 200 or more of them honestly — by pure luck alone?

To answer these questions, we first needed to know the total number of retail lottery sellers at any given time. The OLG said they didn't know this figure, so we had to sort through the numbers and figure it out.

There are 10,300 lottery ticket sales locations in Ontario. A Fifth Estate survey indicated there were about 3.5 sellers per location, or about 36,050 sellers total. By contrast, an OLG executive had testified in court that there were "50,000 or 60,000" such sellers. Then, just five days before the Fifth Estate program was to air, the OLG unexpectedly presented a brand new table, now claiming a total of 140,000

sellers. On closer inspection, this turned out to mean 101,000 active sellers plus 39,000 annual "turnover" (former employees, who weren't actually relevant to the count).

We also needed to know how much these sellers spend on lottery tickets compared to the general adult population. Again the OLG said they didn't know. So the Fifth Estate did another survey, concluding that the average lottery seller spends about 1.5 times as much as an average adult. (The OLG later conducted its own survey and got a similar answer of 1.9. And Corporate Research Associates Inc. [CRA] studied this same question in Atlantic Canada and obtained a factor of 1.52 — virtually identical to the Fifth Estate figure.)

From all of these numbers, what can we conclude?

Using the figure of 60,000 sellers (from the OLG's court testimony), together with the spending factor of 1.5 (from the Fifth Estate and CRA surveys), we would expect that, in the absence of fraud, lottery sellers would win about 57 of the major prizes between 1999 and 2006 — far less than the 200 they actually won. The probability of their winning 200 or more by pure luck alone would be unimaginably small — less than one chance in a trillion trillion trillion trillion.

Even taking the largest OLG estimates — 101,000 sellers spending an average of 1.9 times as much as the general adult population — we would still expect just 123 major seller wins over this time period. The probability of their winning 200 or more major prizes would then be less than one chance in seven billion — again, absolutely inconceivable.

It was clear that lottery sellers were winning significantly more major lottery prizes than could be accounted for by chance alone. The statistics proved the existence of widespread lottery fraud.

Regarding store type, only about one-fifth of retail lottery sellers work at independent convenience stores, but a much higher percentage of the defrauding instances occurred in such stores. (The OLG wouldn't tell the CBC precisely how many, but an OLG "FAQ" webpage later admitted that 53 per cent of the recorded insider wins were specifically from sellers at convenience stores.) This large number of convenience store wins could not have arisen purely by chance.

It was also interesting to consider retail store owners as a separate group, disregarding non-owner employees. Those owners won about 83 of the major wins between 1999 and 2006. We didn't know the precise number of retail store owners (and again, the OLG wouldn't say), but even under the most generous assumptions, we would expect at most 25 owner wins — far fewer than 83. This provided still more evidence of fraud.

When the Fifth Estate episode finally aired in October 2006, the story immediately became front-page news. The issue was debated in the Ontario legislature, the government was put on the defensive, and the Ontario Ombudsman launched a full investigation.

At first, the OLG tried to refute the statistical findings. They hired their own consultants, denied there was significant lottery fraud, and insisted that the Edmonds case was simply an isolated incident. But the evidence against them was overwhelming. By the time the Ombudsman issued his report, five additional cases of lottery fraud had been identified, the OLG's handling of the situation was thoroughly criticized and discredited, the OLG's CEO had been fired, and many people agreed that reforms were needed.

On the positive side, the OLG has now instituted some specific policy reforms. Customers are instructed to sign their lottery tickets before redeeming them. And self-checker machines allow customers to easily learn what they've won before handing their tickets to anyone else.

Other provinces also got involved. Soon after the Fifth Estate program aired, British Columbia's Ombudsman launched a similar investigation, which found the British Columbia lottery system "open to fraud by retailers trying to cheat customers," and led to the firing of the British Columbia Lottery Corporation's CEO. A study I later conducted for the Nova Scotia Gaming Corporation found that during the period between 2001 and 2006, the number of major lottery wins by Nova Scotia retail store owners was also inconceivable by pure chance alone — so lottery ticket sellers must have defrauded customers there, too.

Cases like these illustrate that statistics have an important role to play in determining the extent of fraud. We all know that seemingly random occurrences can accumulate into hard evidence. The challenge is to recognize situations where statistical analysis might help, then use careful probabilistic modelling to determine whether or not the observed results could have occurred through pure chance alone. ■

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