Jumping to Coincidences

Defying Odds in the Realm of the Preposterous

Lotteries..
Case #1

Same number 2-state winner

BOSTON (UPI) — Lottery officials say there is 1 chance in 100 million that the same four-digit lottery numbers would be drawn in Massachusetts and New Hampshire on the same night. That's just what happened Tuesday.

The number 8092 came up, paying $5,842 in Massachusetts and $4,500 in New Hampshire.

"There is a 1-in-10,000 chance of any four-digit number being chosen at any given time," Massachusetts Lottery Commission official David Ellis said.

"But the odds of it happening with two states at any one time are just fantastic," he said.
(a)

New Hampshire

0001   0002   .. XXXXX   ..   8092..   9999

M  0001   \sqrt{ }

a  0002   \sqrt{ }

s   

s   

XXXXX   \sqrt{ }

.   

.   

8092   \sqrt{ }

.   

9999   \sqrt{ }
(b) Massachusetts 8 pm 
xxxx 
New Hampshire 9 pm 
xxxx

(c) event / headline: “winning number is same in 2 states"
probability calculated: winning number is 8092 in 2 states

(d) prob(happens) ≠ prob(happens; is noted) ≠ prob(happens; is noted; is reported)
Lotteries...

Case #2

The lucky number is...

By Bob Sales
Globe Staff

David Hughes' number is 461.

As an employee of the Massachusetts Lottery Commission, he is prohibited from playing it in the Game. But as the commission's manager of systems and programs, he is in the perfect position to monitor it.

The number, which corresponds to the number on his locker at the University of Minnesota in the '40s, has not hit during the Game's 22-month history.

"I watch for it," said Hughes, who also once lived at 461 Gerard Ave., Minneapolis. "In fact, sometimes I have to put in a slip to test a machine and that's the number I always use."

Hughes played the number unsuccessfully in the Maryland lottery.

Hughes, a numerologist, chose his number as rationally as the majority of the Game's customers do. The numbers game thrives on impulsiveness.

Sellers of Game tickets report that customers play birthdays, Social Security numbers, addresses, phone numbers and digits that occur to them in dreams.

"When a baby is born they'll bet the weight, the length, the birthday and the number of the room the mother is in," said Phil Masotta, who has sold $6 million in winning lottery tickets in his Woburn delicatessen.

"I've had people come in and play a number because the alarm went off at a certain time—like 703 or 820," said Beny Beerman of Hancock's Tobacco Store in Quincy Square. "You'd be surprised at the number of people who come in and play the number on a ticket from the cleaners."

Just recently, Arthur Johnson of Schubert's Smoke Shop in South Boston did a double take when he sold a ticket to an officer from a nearby bank for the first time.

"He said he was playing the number on the pursuer's office when he was in the Navy years ago," said Johnson. "He said he saw the number on a license plate driving to work and he had to play it." The play was unsuccessful.

Sometimes, a number becomes a part of the public consciousness because it is prominent in the news. This is reflected in the play.

For instance, The Globe ran a picture of a Coast Guard boat rescuing a child on Page 1 on Jan. 27. The number of the boat—40533—was prominently displayed.

"I checked it," said Gene Ferris, manager of the Game Room in Prudential Center. "We had more than 200 tickets (on the first four digits). I would say that's an impulse play."

Actually, the winning number was close—3533—paying $7132 for $1. A three-digit play the final three figures. 533 paid 898.

The following Monday the winning four-digit number was 1040, the number which appears on Federal Income Tax forms that were in the process of being distributed. The payoff was $1994, more than $3000 less than the average four-digit payoff.

Since the payoff is predicated on the play, this means a large number of bettors played the number.

"Nobody complained about the low payoff," Ferris reported. As a football coach once said, winning is everything.

Apparantly seeking more for their money, bettors tend to play four different digits, rather than repeating numbers. There have been two notable exceptions to this pattern.

Although 0000 has never hit, it is always bet heavily. In other combinations, zero is lightly played.

The other exception occurred on July 7, 1977, when 56 percent of the bets made—more than 100,000 tickets—were on 7777. The winning number that day was 6409, paying $7370 for a $1 bet.

Other heavy plays predicated upon the calendar include Dec. 31 of each year when the play is on 1231, and July 11, 711. Neither has been a winner on the correct date.

During the Game's 22-month existence, the illegal numbers pool has switched its payoff from the racetrack parimutuel pool to the legal number. In that period, no winning number has ever been repeated, although the same four digits have won a second time in different sequence. Hughes, the expert, doesn't expect to see duplicate winners until about half of the 10,000 possibilities have been exhausted.
Boston Evening Globe of February 6, 1978: interview with lottery official David Hughes on how bettors choose numbers in Massachusetts Daily Lottery (the *Game*), played daily:

During the Game's 22-month existence (approx 660 draws), the illegal numbers pool has switched its payoff from the race-track parimutuel pool to the legal number.

In that period, **no winning number has ever been repeated**, although the same four digits have won a second time in different sequences.

Hughes, the expert, doesn't expect to see duplicate winners until about half of the 10,000 possibilities have been exhausted.
<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
</tr>
</tbody>
</table>

Distribution of birthdays

434/365 = 1.2

Duplicate: Yes
n = 27
1981

Yes x = 607A
n = 37
1982

Yes x = 607A
n = 33
1983

No △ = 607A
n = 20
1984

Yes □ = 607A
n = 21
1986

Yes □ = 607C
n = 19
Summer 1987

Yes ♦ = 607C
n = 39
Summer 1988

Yes ♦ = 607C
n = 31 (Summer 1989)
660 drawings in Massachusetts...
• no repeat (660 distinct numbers)
• “don't expect repeat until approx 5000 draws”

<table>
<thead>
<tr>
<th>Implied...</th>
<th>Reality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case # 1</strong></td>
<td></td>
</tr>
<tr>
<td>unlikely events do happen</td>
<td>event not that unlikely</td>
</tr>
<tr>
<td><strong>Case # 2</strong></td>
<td></td>
</tr>
<tr>
<td>if fair, should not expect repeats</td>
<td>if fair, should expect repeats</td>
</tr>
<tr>
<td>hasn't been a repeat ...</td>
<td>prob(no repeat) = 22 x 10^{-9}</td>
</tr>
</tbody>
</table>

So… lottery is fair!

H₀: H₁: H₂: data are wrong!
"Sorry... 7 separate #s had repeated...

Misinformation was a sin of omission and a too hasty glance at our listing of previous winning numbers"

Prob(numbers are all distinct)..

<table>
<thead>
<tr>
<th>10</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>660 draws</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.9995</td>
<td>0.8845</td>
<td>0.6085</td>
<td>0.1348</td>
<td>0.0107</td>
<td>2 x 10^{-10}</td>
</tr>
</tbody>
</table>
Lotteries, Case 3 (Montreal Gazette July 28, 1982)

Once or twice a year, the Quebec Super Loto pays out money accumulated from unclaimed prize-money by adding 500 cars as bonus prizes.

Instead of mechanically drawing the large list of winning numbers from the 2.4 million tickets sold for each drawing, the Loto generated the 500 winning numbers using a computer.
<table>
<thead>
<tr>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>003A190</td>
</tr>
<tr>
<td>046A987</td>
</tr>
<tr>
<td>049A093</td>
</tr>
<tr>
<td>051A329</td>
</tr>
<tr>
<td>060A622</td>
</tr>
<tr>
<td>075A034</td>
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<tr>
<td>083A859</td>
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<tr>
<td>085A946</td>
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<tr>
<td>088A003</td>
</tr>
<tr>
<td>089A910</td>
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<td>098A681</td>
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<tr>
<td>104A211</td>
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<td>132A021</td>
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<td>133A767</td>
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<td>133A775</td>
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<tr>
<td>391A997</td>
</tr>
<tr>
<td>393A615</td>
</tr>
<tr>
<td>424A399</td>
</tr>
<tr>
<td>432A285</td>
</tr>
</tbody>
</table>
$10 ticket wins buyer two Olds

TORONTO (CP) — Antonio Gallardo has won two Oldsmobile Cutlass Supremes on a single $10 Super Loto ticket.

Gallardo, who had been shopping for a new car, was given the ticket by his sister, visiting from California.

She bought him the ticket when she heard there were 500 cars being given as bonus prizes last Sunday.

Little did she know that the ticket would get them both new cars.

"I just couldn’t believe it," said Gallardo, 35, a library assistant.

In Montreal, a Loto Quebec Corp. official said the chance of a single bonus number coming up twice is one in 46,181,926.

And the chance of a ticket number coming up twice in the same type of car (200 of the 500 prize cars were Cutlasses) is one in 289,471,120.
N = $2.4 \times 10^6$ tickets; \hspace{1cm} n = 500 prizes... drawn by computer

• 1 number drawn twice

**message..**  
Binomial  
n = 500

**Reality**  
prob[**SOME** no. drawn twice]  
not negligible

$$\pi = (1/2.4) \times 10^{-6}$$

$$\approx (1 - 0.5n / N)^n = 0.95$$

prob(2) = $2 \times 10^{-8}$ (!!!)

$$\Rightarrow \text{prob(} \geq 2 \text{ repeats)} \approx 0.05$$
• **Message..**

"events happen more frequently than they should"

better to calculate prob. from viewpoint of indiv. player

**you can beat the odds; buy lots of tickets!**

• **Reality**

lottery officials should calculate probability of such an event

now, loto Québec sorts the numbers drawn and **checks** them !!!
Lotteries.

Case #4

Odds-Defying Jersey Woman Hits Lottery Jackpot 2d Time

By ROBERT D. McPADDON

Defying odds in the realm of the preposterous — 1 in 17 trillion — a woman who won $3.3 million in the New Jersey state lottery last October has hit the jackpot again and yesterday laid claim with her fiancé to an additional $1.5 million prize.

"Shocking — definitely shocking," said 32-year-old Evelyn Marie Adams, the manager of a 7-Eleven convenience store in Point Pleasant Beach, after she redeemed her third winning ticket in last Monday's Pick-6 Loto game.

"They say good things come in threes, so . . ."

A Two-Time First

Actually, Mrs. Adams said she would probably not try for a third coup after last night's drawing, for which she had already bought a batch of tickets. "I'm going to quit playing," she said. "I'm going to give everyone else a chance."

She was the first two-time million-dollar winner in the history of New Jersey's lottery, state officials said. They added that they had never before heard of a person winning two million-dollar prizes in any of the nation's 23 state lotteries.

For aficionados of miraculous odds, the numbers were mind-boggling. In winning her first prize last Oct. 24, Mrs. Adams was up against odds of 1 in 3.2 million. The odds of winning last Monday, when numbers were drawn in a somewhat modified game, were 1 in 5.2 million.

And after due consultation with a professor of statistics at Rutgers University, lottery officials concluded that the odds of one person winning the top lottery prize twice in a lifetime were 1 in about 17.3 trillion — that is, 17,300,000,000,000,000.

Mrs. Adams bought both her winning tickets at the convenience store she manages, a store owned by her fiancé, Herman Basehore, 45, who shared her winning ticket. The couple, who became engaged in December, plan to be married in April, sell the store and pursue mutual interests in music.

Both are divorced. Mrs. Adams has a 10-year-old daughter by her previous marriage and Mr. Basehore, a French horn player and conductor who has a degree in music, has a 21-year-old son.

In last October's lottery, Mrs. Adams held 8 correct numbers out of 39 choices and split a $7.9 million jackpot with Philip Martucci Jr., of Cape May Courthouse. In this week's lottery, Mrs. Adams held 6 out of 42 numbers and shared half of a $2.98 million jackpot, or $1,486,815, with her fiancé.

The other $1,486,815 in this week's lottery game was won by Ronald Mack, a 28-year-old Linden, N.J., truck driver, who will share the prize with his fiancé, 23-year-old Connie Steen, of Hopewell. They had planned to be married in April 1987, but have now moved up their wedding date to this spring.

The winnings from the two lotteries will be paid out over the next 20 years. After 20 percent deductions for taxes, Mrs. Adams's average annual payout from the first jackpot will be $159,400, and she and Mr. Basehore will each receive an additional $28,800 a year on this week's jackpot, for a combined total of $218,000 a year over the next 20 years.

Machine Picked Numbers

Mrs. Adams said she had been playing the state lottery since its inception and estimated that she had spent $5,000 on tickets, raising her $25-a-week purchases to $100 a week after winning her jackpot last fall.

Though she described herself as a person who likes to gamble, she did not pick her own winning numbers. She let the lottery machine do it for her in both cases, a procedure called "Quick Pick."

The first winning number was 5-11-12-21-22-31; the second was 12-15-25-31-33-42.

Will luck change their lives?

"At the moment, with all the attention, it is rather overwhelming," said Mr. Basehore, who has owned his store for more than 14 years and has taught music in public schools. "We're still the same people. We really don't want to change. I had already made plans to sell this year, even before the first win."

"They say good things come in threes, so . . ."
Defying odds in the realm of the preposterous - 1 in 17 trillion - a woman who won $3.9 million in the New Jersey state lottery last October has hit the jackpot again and yesterday laid claim to an additional $1.5 million prize...

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New Jersey woman wins 6/49-type game twice!!

14 oct '85      11 feb '86

6 / 39                6 / 42

prob = 1/(3.5 x 10^6) x 1/(5.2 x 10^6) = 1 / (17 x 10^{12})
Assumptions

(i) 14 oct '85 & only 11 feb '86

(ii) 1 ticket each time

Reality

had played weekly for several years

several tickets / week

more tickets after oct '85

4 - 5 tickets / week ...

Prob(win) = 10^{-6} per week

n = 200 weeks..  prob( win 2 times) = 2 \times 10^{-8}

n = 1500 weeks (30 years)  prob( win 2 times) = 1 \times 10^{-6}

10^6 persons (30 years)  average ( # who win 2 times) = 1

50 \times 10^6 persons (U.S.A.)  average ( wait / repeat winner) = 4 yrs
REAL MEANING of \( \text{Prob}(\bullet) = \frac{1}{17 \times 10^{12}} \)

5 x \( 10^9 \) persons (world population) x 3400 generations

NY Times was correct to call the odds "preposterous" !!!
There are pitfalls in figuring the odds of seemingly rare events occurring

Several years ago, newspapers reported that in an apparent odds-defying event, a New Jersey woman won the state's lottery twice in a four-month period.

The chances of winning the lottery twice in a lifetime, one paper reported, were so staggeringly low that they bordered on the miraculous — one in about 17 trillion.

Those calculations, the paper said, were given by the state's lottery officials who had consulted with a Rutgers University statistics professor.

Now the denominator, 17 trillion, is obviously a very large number. It's several thousand times larger than the number of people in the world, about 5.5 billion. It's more than 100 times larger than the estimated number of stars in the Milky Way galaxy.

It's nearly five times larger than the U.S. national debt in dollars.

In fact, although the two wins of the New Jersey lottery jackpot may have been a miraculous event from that woman's point of view, the fact that someone would win a lottery twice is not necessarily a miracle, according to some statisticians who have subsequently studied the problem.

Furthermore, that particular woman's chances of winning the jackpot twice really weren't as small as the lottery officials claimed. Her chances were still small, but not nearly as tiny as one in 17 trillion.

That's all according to an analysis of the event that's included in a report by Dr. James A. Hanley, a biostatistician at McGill University in Montreal, in the current issue of the American Statistician.

Dr. Hanley's paper, sent to me by Dr. Paul D. Minton, a Richmond area consultant in statistical design, analysis and quality control, deals more generally with pitfalls in figuring the odds of seemingly rare events.
Birthdays...
Case #1

Two sets of quintuplets, same day

It was a statistician's dream: two sets of quintuplets born the same day in the USA.

But the experts couldn't agree on what statistic to use. Figures of one in 41 million, one in 70 million and one in 85 million were tossed out Tuesday — and that was just for the birth of one set of quintuplets.

The Helms quintuplets, four girls and a boy, were born Monday night in Peoria, Ill. They were in critical condition Tuesday.

During the pregnancy, restaurant manager Ron Helms teased his wife, Rosalind, saying, "We were going to have five boys and have our own basketball team."

In Las Vegas, the birth of the Jenkins quint was marred by the death of one of the five sisters. The other four were in stable condition Tuesday.

Robin Jenkins, 30, who gave birth to the Nevada quintuplets 11 weeks early, didn’t use fertility drugs.

But Rosalind Helms, 27, had taken the fertility drug Pergonal.
Births Case 1 (from USA TODAY on March 4, 1987)
Two sets of quintets, same day

It was a statistician's dream: two sets of quintuplets born the same day [Monday March 2, 1987] in the USA [one set of four girls and a boy, in Peoria Ill. and a set of five girls in Las Vegas]. But the experts could not agree on what statistic to use.

Figures of one in 41 million, one in 70 million and one in 85 million were tossed out Tuesday - and that was just for the birth of one set of quintets.

[The mother of the Nevada quintuplets, who were born 11 weeks early, didn't use fertility drugs; the mother of the Illinois quintets had taken the fertility drug Pergonal].
August 3 is a grand-slam event for Mary Wohlford — her first four daughters were born on that date in four different years.

The odds of that happening are staggering 1 in 17 billion!

“When August 3 used to roll around, everyone would wonder, ‘Will she or won’t she?’ — and I always did,” said Mary.

Her first August 3 child, Connie, arrived in 1949. She was followed by Sandra in 1951, Ann in 1952 and Susan in 1954.

All were born in Freeport, Ill., and delivered by the same doctor in the same hospital in the very same room.

“The doctors and nurses were amazed, but it was not planned that way, and the girls weren’t all due August 3,” said 64-year-old Mary.

“It’s just what happened. And it’s a blessing — I don’t have any problem remembering birthdays.” But the August 3 streak ended after Mary and her late husband Walter moved their growing family from Freeport to Dyersville, Ill.

“Maybe there was something in the Freeport water,” jokes Mary. “After we moved in 1955, we had four more girls over the next nine years and none of them were born on August 3.”

When that date rolled around every year, the Wohlforders threw one big party and invited friends of all four girls.

“We treated each one alike — and each had her own cake,” said Mary.

Added eldest daughter, Connie Holmes: “We didn’t mind sharing our birthday and we never felt slighted. August 3 always turned into a big celebration — like Christmas and the Fourth of July rolled into one!”

— STEVE PLAMANN
Births Case 2 (from National Enquirer on June 28, 1990)

4 sisters beat 1 in 17 billion Odds - They All Share the Same Birthday

August 3 is a grandslam event for Mary Wohlford - her first four daughters were born on that date in four different years.

The odds of that happening are a staggering 1 in 17 billion.

Her first August 3 child, Connie, arrived in 1949. She was followed by Sandra in 1951, Ann in 1952 and Susan in 1954. All were born in Freeport, Ill. and delivered by the same doctor in the same hospital in the very same room. "The doctors and nurses were amazed, but it was not planned that way, and the girls weren't all due August 3" said the mother. But the August 3 streak ended after the parents moved their growing family from Freeport to Dyersville Ill. "Maybe there was something in the Freeport water" jokes the mother. "After we moved in 1955, we had four more girls over the next nine years and none of them were born on August 3rd."
Births Case 3 (from the Montreal Gazette in May, 1989)

Double trouble in Moose Jaw school

*caption to a photograph showing six sets of twins*

Every morning, teachers at Prince Arthur school in Moose Jaw, Saskatchewan see double - and it's not because of what they were up to the night before.

Six pairs of identical twins attend the school, which has an enrollment of 375. Identical births occur once in 270 births.
Births Case 4 (Montreal Gazette, week of May 8, 1991)

Double trouble Down Under

caption to a photograph showing five sets of twins

It was a very busy week in the obstetrics department of Baulkham Hills Private Hospital in Sydney Australia, as five mothers gave birth to twins. Hospital officials offered no explanation of the sudden run of multiple births, but the proud mothers are happy to pose with their infants. Everyone’s doing well.
Montreal Gazette, week of May 15, 1991…

No Double trouble anywhere this week

no photograph, no twins

Montreal Gazette, week of May 22, 1991…

No Double trouble anywhere this week

no photograph, no twins

Stay posted..
On the side of a barn in Texas
• Texas Sharpshooter
CONCLUSIONS

• We tend to see sample space with selective vision

• Remedy: imagine headline BEFORE event and enumerate all the sub-events that would be eligible

• For claims that a very rare event occurred ... be suspicious of probability calculations !