LSU E. J. OURSO COLLEGE OF BUSINESS

Dr. Chun's Numb3rs & Løgic

Lottery Tickets

Young H. Chun, Ph.D.

***Professor of Decision Science* &**
Cherie H. Flores Endowed Chair in MBA Studies

Problem of the Week: Part 1

Marilyn vos Savant, "Ask Marilyn," Parade Magazine, (May 24, 1992), pp. 28-29.

During a recent get-together, a group of good friends was discussing the lottery. Let's say the chances of winning the top prize are 1 in 7 million. Another engineer and myself said that if you buy two tickets, your chances of winning are 2 in 7 million (or 1 in 3.5 million).

The only other engineer in our group said that mathematically our logic was not correct, that with the first ticket the chances are 1 in 7 million and that the second ticket only changes the chances to 1 in 6,999,999 (and the third to 1 in 6,999,998, etc.).

Do we buy him a drink?

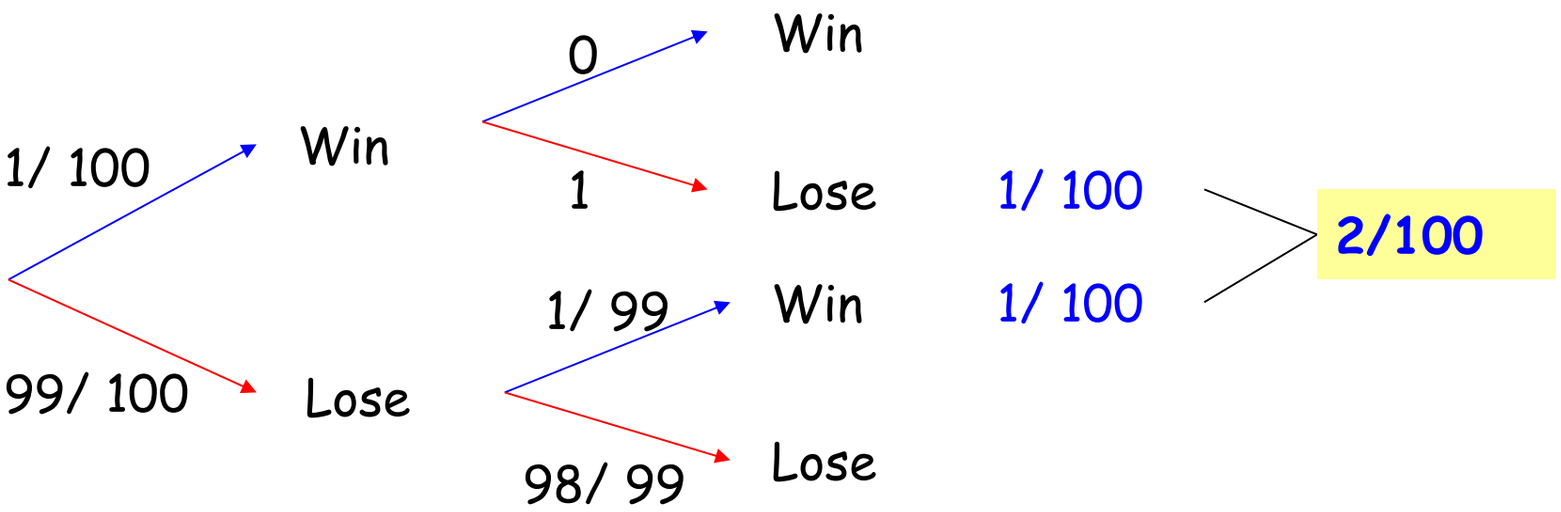
W. J. Banulski, Southington, Conn.

- **Case #1**: Sampling without replacement

  Suppose that one of 100 raffle tickets is the winning ticket

  P[Win with one ticket] = **1/100**

  Then, **P[Win with two tickets]** is **2/100** or **1/99** ?



P[X or Y] = P[X] + P[Y] – P[XY] = 1/100 + 1/100 - 0 = **2/100**

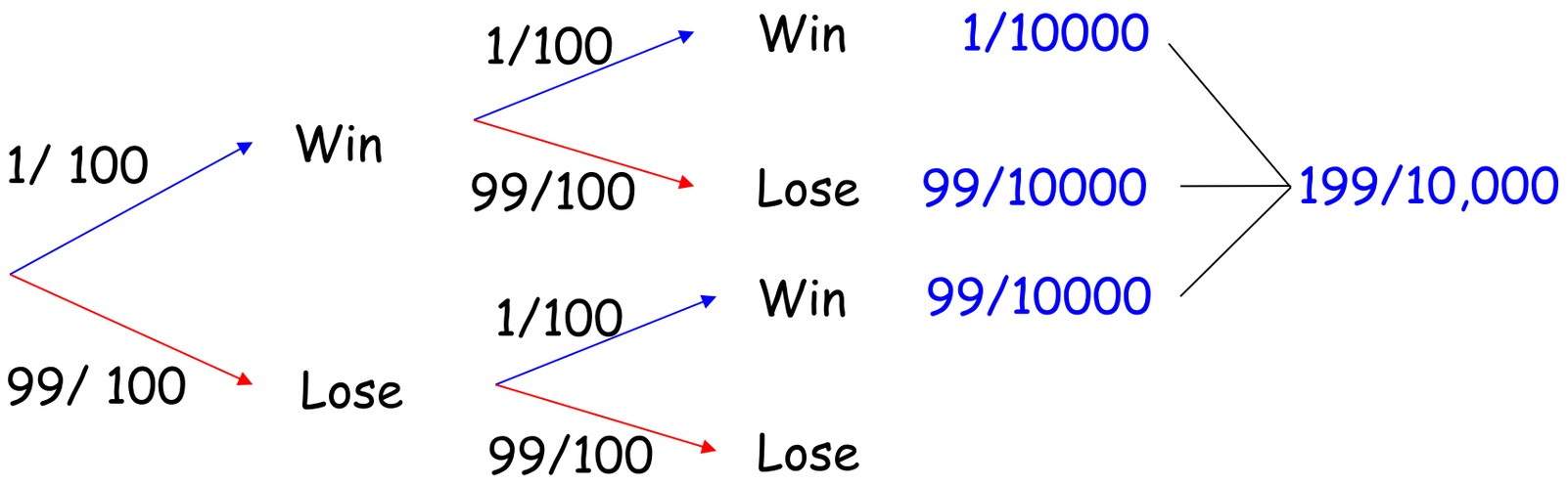
P[Win with one of *n* tickets] = ***n*/100**

- **Case #2**: Sampling with replacement

  Suppose that the chance of winning in a roulette game is 1/100.

  P[Win with one trial] = **1/100**

  Then, **P[Win with two trials]** is **2/100** or **1/99** ?



P[X or Y] = P[X] + P[Y] – P[XY]

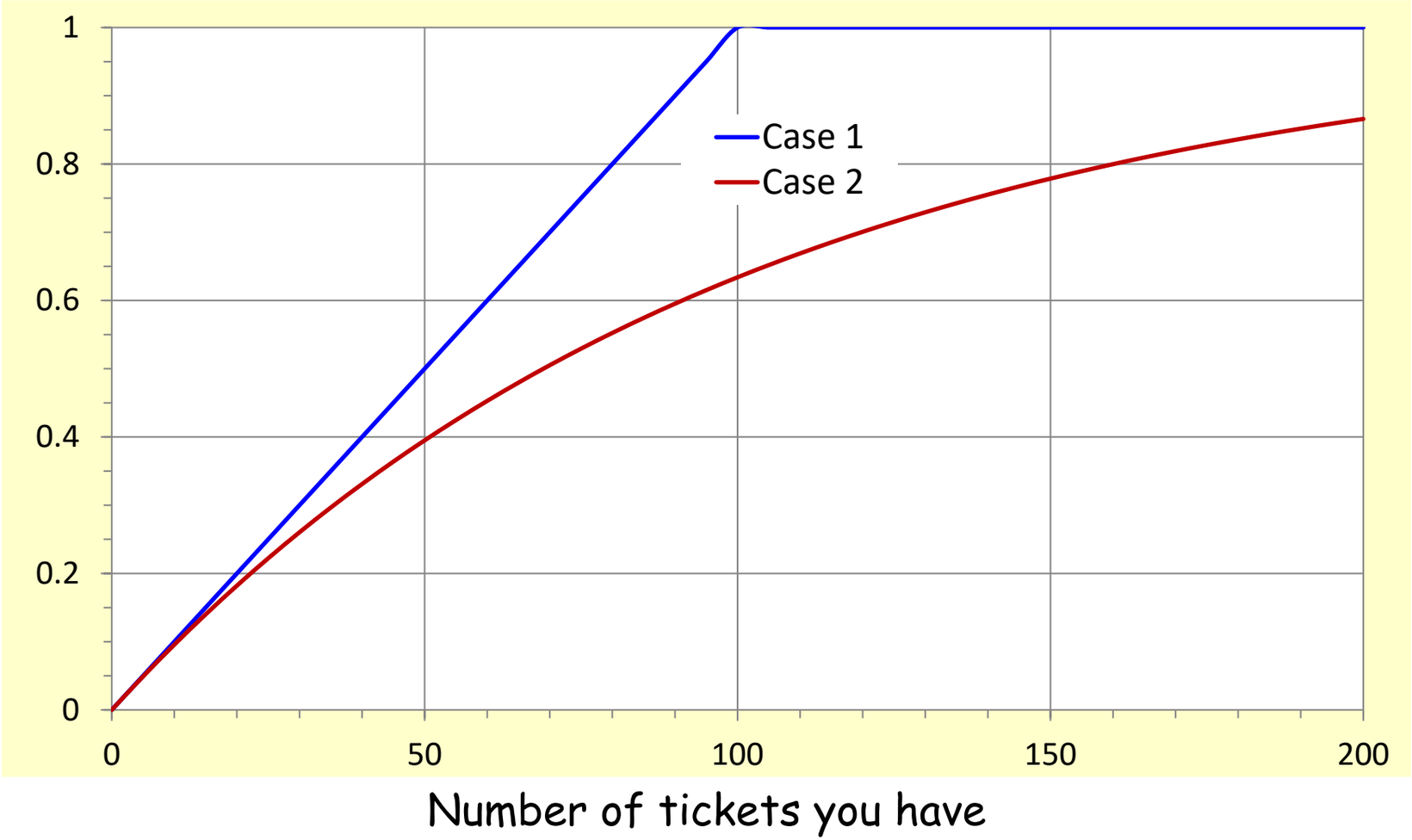
= 1/100 + 1/100 - 1/10,000 = **199/10,000**

P[Win with at least one of *n* trials] = $1-(99/100)^n$

- **Comparison**: P[Win with one ticket] = 1/100

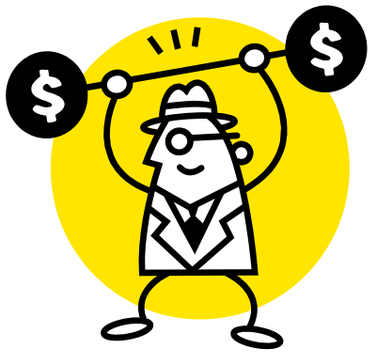
  Case 1: P[Win with one of *n* tickets] = *n*/100

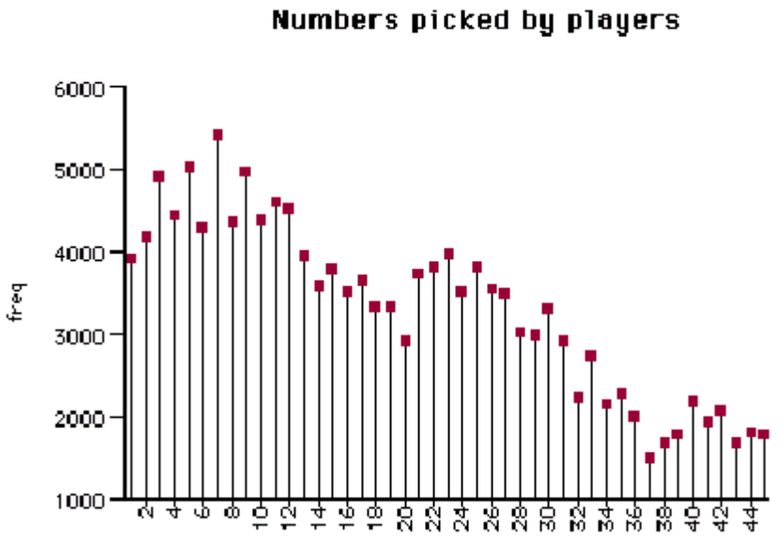
  Case 2: P[Win with at least one of *n* trials] = $1-(99/100)^n$



Problem of the Week: Part 2

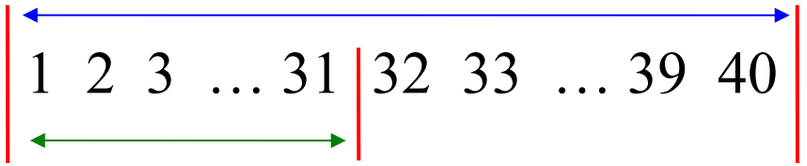
"A lottery ticket is a winner when its 6 numbers match those drawn from a 40-number pool. A ticket purchaser, basing his selection on family members' birthdates, thus restricted his possible winning combinations to numbers 1 through 31.





Did he *decrease* his chances of winning by his eliminating numbers 32 through 40 from his possible choices? Your answer could quite possibly prevent World War III from breaking out in our family."

Lewis B. Hall, Baltimore, Maryland



* **Case 1**. P[Win| Any 6 numbers] = 1 / C(40, 6)

= 1 in **3,838,380**

My Dad	8	My Mom	17
My Son	21	My Daughter	12
I	4	My Wife	15

* **Case 2**. P[Win | Any 6 numbers ≤ 31]

= P[All six winning numbers ≤ 31] * P[Pick the six winning numbers]

= C(31, 6) / C(40, 6) * 1 / C(31, 6)

= 1 / C(40, 6) = 1 in **3,838,380**

* Toss a die and pick one number!

In Lotteries, Lucky Numbers Will Only Win You Less

Popular picks are no more likely to hit than others
— and mean more potential winners when they do

Wall Street Journal (October 9, 2015)

If you are like many people, you picked numbers with personal meaning. Perhaps you jotted down a birthday or an anniversary. Possibly you threw in a 7 or some other lucky number. Or maybe you went for a pattern like 1, 2, 3, 4, 5, 6.

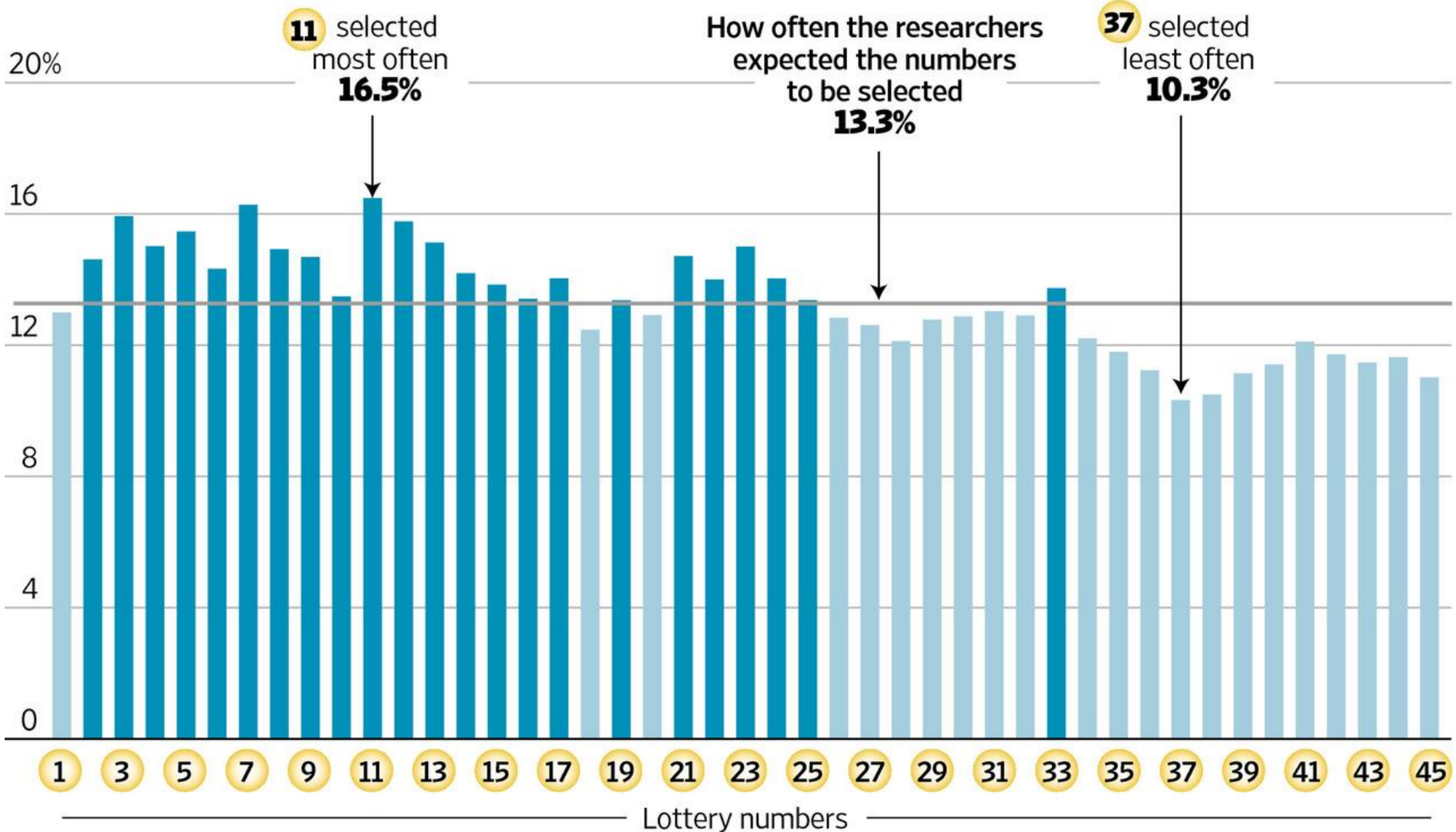
Those numbers may feel more satisfying than a computer-generated selection, but they are no more likely to win.

"You can spend your whole life playing 1, 2, 3, 4, 5, 6, and you'll have the same chance of winning as someone who played 1, 12, 25, 36, 38, 41. It does not matter in terms of winning. It matters in terms of dividing the pot."

Random Selection

A study of 5 million tickets in the Dutch Lotto found that players often picked numbers that had personal meaning, formed patterns or were primed in memory, leaving an unexpectedly uneven distribution.

How frequently individual numbers were chosen



Joke of the Week

Ask Marilyn, *Parade Magazine*, (June 9, 1996), p. 18

"For many years, I have been trying to win the Louisiana lottery. Since using my wife's birth date has been no help, should I dump this wife and find another with a more promising birth date?

Even though my wife is a delight and perfect in every other way, apparently her birth date stinks. It is very important that I win the lottery or go to debtors' prison. Would my odds increase with a new wife?

– Peter Murray, Slidell, La."

Movie Trivia

A police officer promises to share his lottery ticket with a waitress in lieu of a tip.

It Could Happen to You (1994)

A police officer promises to share his lottery ticket with a waitress in lieu of a tip.