Say you pick up 200 dollars on the street…

and you decide to spend it on lottery tickets to test your luck.

The lottery is $2 per ticket.

and the chance to get its $200 prize is **1/100**… sounds like a pretty good deal!

You figure that you have a pretty good chance of increasing the amount you picked up, because theoretically, you will get a prize after buying 100 tickets so at least you'll get your original money back if not increase it, right?

…but is this true? What are the probabilities of losing all your money without winning the prize? And if you want to make sure that you don't lose all of 200$, at what point should you stop buying the tickets, if you keep losing? What's the optimal decision to make which will let you end up with the most money?

—Here are the rules—
You can only spend $200 dollars.
You will buy one ticket at a time, and you will know its outcome right after you buy it.
You are NOT buying more if you win the prize.

So the first question: **what is your chance of NOT getting the prize after buying 100 tickets and using all your money?**

After running the “simulation 1” code, simulating the number of times your money ends up at 0, it turns out that there’s about a 36-7% chance of losing all your money without getting the prize… that’s more than 1/3! Maybe a little more than you have thought. Mathematically it makes sense though, because the probability of losing all the money is :

But the chance of winning the prize is 63-64%, more than 50%, so it’s still worth the try, right?

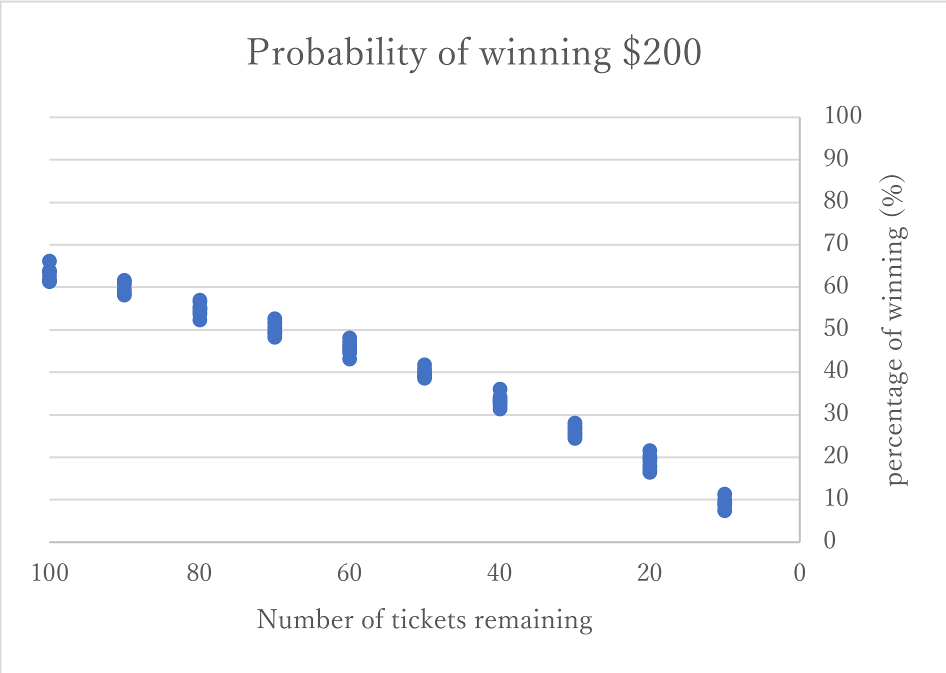
The next question is, **at what point should you stop buying if you keep losing?**
If you keep buying more and more without winning and just keep losing your money, wouldn’t you become more and more hesitant whether you will actually win? Because the following is what I imagine myself being like:
When I lose 10 tickets and have 90 more shots to go:

When I lose 50 tickets and have 50 more shots to go:

When I lose 99 tickets and only have 1 more shot to go:

…So now let’s actually calculate the actual percentage for winning depending on how many tickets you have left.

Here is a graph showing the chances of winning the prize with the remaining tickets(y%) after exhausting x number of tickets:



When you have 100 tickets left, you have more than 60% of winning.
When you have 70 tickets left, your chances are right around 50%.
When you have 50 tickets left, your chances are right around 40%.
…and when you only have 10 tickets left, you have a 10% chance of winning with those 10 tickets.

So does that mean you should just stop investing after buying 30 tickets if you didn't win anything, since that's where the chances of winning go below 50%?

The main question here is: does losing the first 30 tickets increase your chances of winning the remaining 70?
I set up another simulation (simulation 2) to address the following problem, simulating the percentage of winning in the 70 after losing the 30… and it turns out that **IT DOES NOT MAKE A DIFFERENCE**. No matter you win or lose the first 30, the chances of getting a winning ticket in the next 70 is the exact same as when you just start with 70—right around 50 %.

So what does this mean? What is your optimal move?

Looking back at our original purpose, the point of our simulation was to find the action that will make you the MOST MONEY, instead of looking too much at the possibilities themselves.
I set up yet another simulation (simulation 3) that computes the average money you end up with when you buy 30 and stop, and when you buy until you win.

And it turns out… **IT'S THE SAME**!! In both simulations, the average amount you end up with is $200. **WHAT!??!?!!?!?**

When I tried plugging in other values for n, it was still the same… whether you don't buy anything, buy until you win, or stop at a certain point, the average outcome turns out to be the same $200.

So it doesn't matter what you do. If you're feeling adventurous, try the lottery. If you're lazy, don't, and you don't need to feel that you missed out. Enjoy that $200. Because it means you have a 100% chance of keeping that 200$!

—Acknowledgement for something that I didn't take into account—

In this simulation, the rule was to stop when you win. But it is also possible to win twice or more after buying 100 tickets, but that possibility was not considered in these simulations. If we took that into account, maybe the optimal decision would be different. Or maybe, it will stay the same. Who knows?