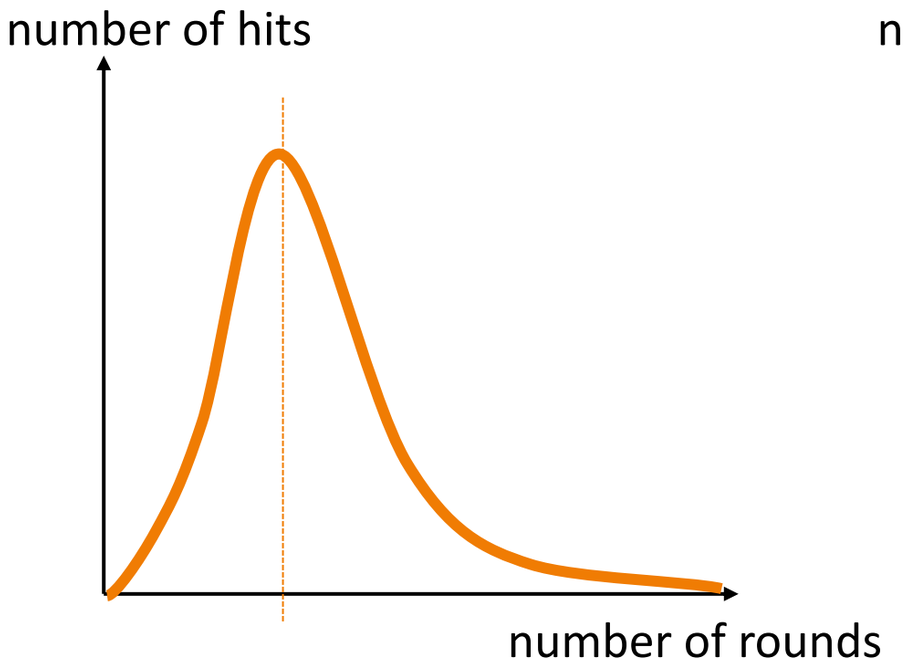
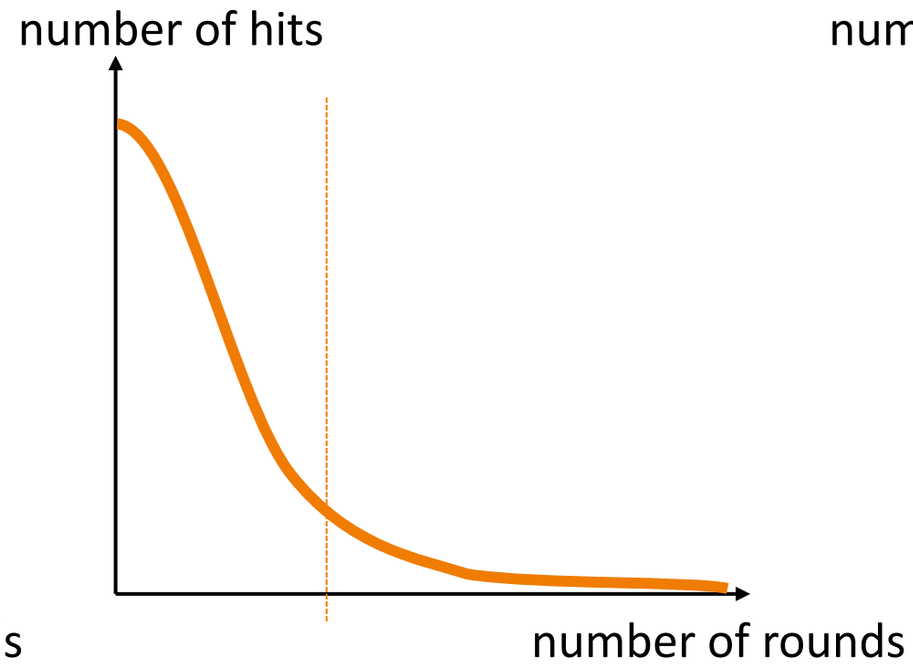
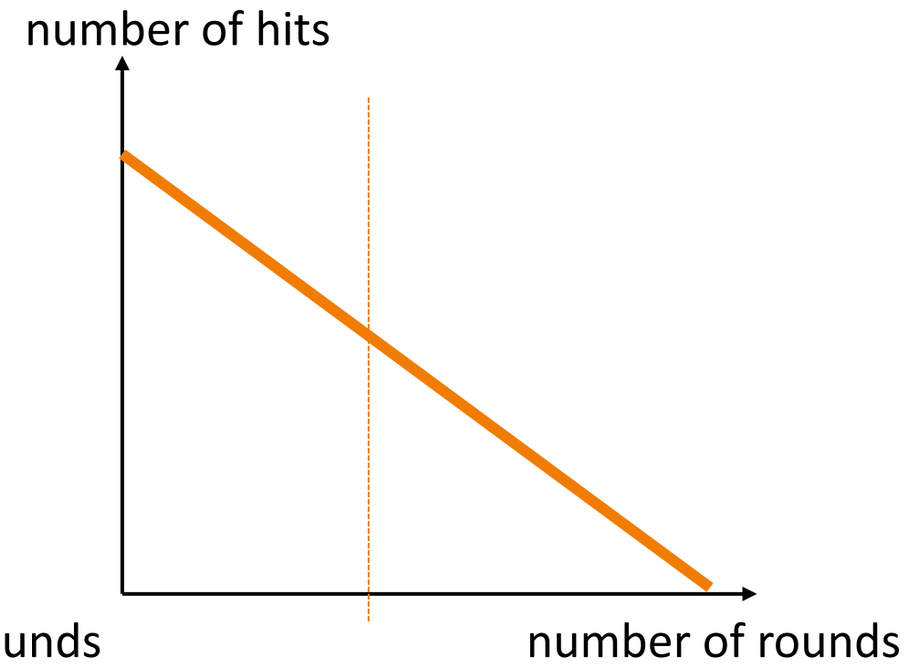
[Public] Python program

Pachinko Simple Simulation [What is the hit distribution graph after spinning 10 million times?]







- Is there a lucky machine?　Is there a lucky rounds?

A pachinko machine is designed to draw a winning lottery with a probability of about 1/319 each time a ball enters the Prize-winning entrance.

Simple simulation **only for the first hit**.
(The hit during the probability change is not considered.)

Let's consider the case of making a graph of how many times the number of hits is high when it is rotated 10 million times.

First hit probability: 1/319.6

Which one do you bet?

1500 rounds No hit

Lucky, it's almost time to hit.

0 rounds (No bet)

Which one would you bet on heads or tails?

A game where you toss a coin and guess whether it will come up heads or tails
(Which comes out is 50% heads or tails)

Bet on what will come out next if the last 7 are all "heads"

Head 1 → Head 2 → Head 3 → Head 4 → Head 5 → Head 6 → Head 7 →

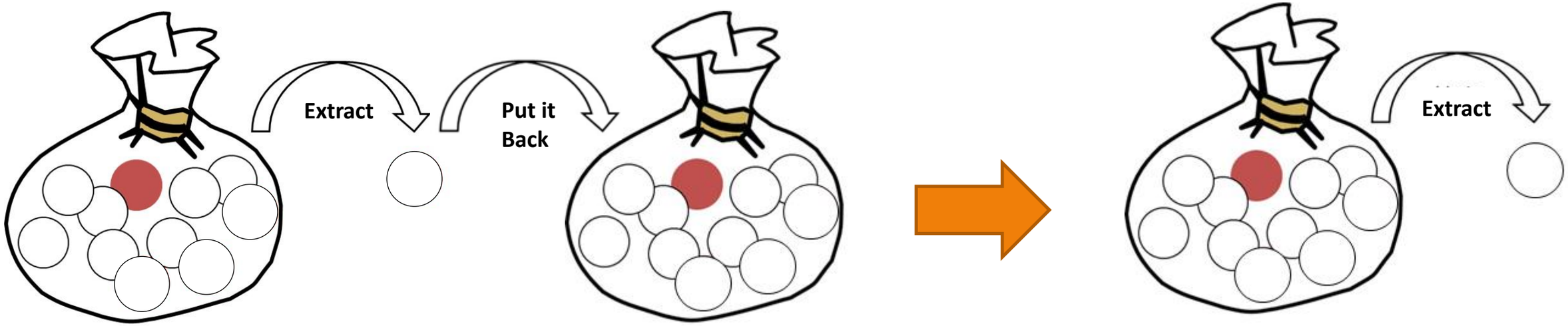
Are you betting
on heads or tails?

Will the back come out soon?
The probability of 8 times in a row is 1/256

Is there a higher probability that the tails
will come out next time?

Simulation of spinning pachinko 10 million times

extraction with restoration



Extract from a bag containing 1 per 319

After checking, put it back in the bag.

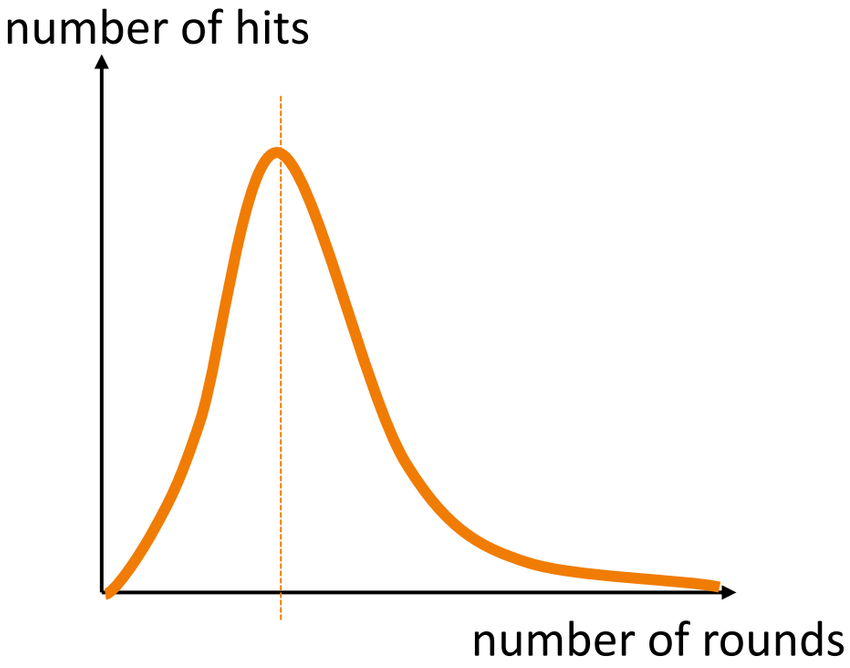
Extract from a bag containing 1 per 319 pieces.

Extraction under the same conditions each time

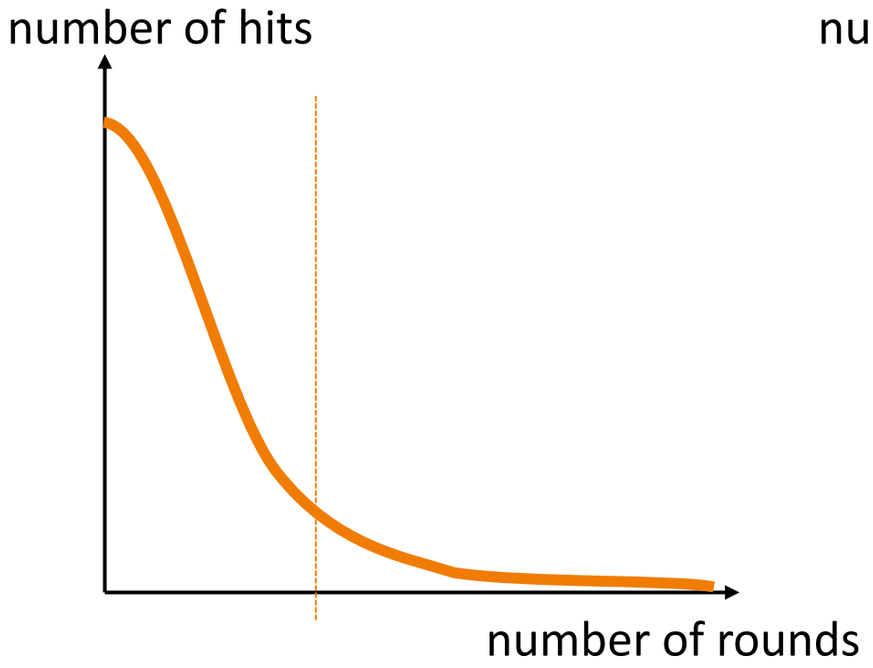
Count the number of times until you hit. If you get a hit, **the number of times will return to 0**.
Make a distribution graph that repeats 10,000,000 times to see how many times the hit comes out.

If 1/319 is repeated 10 million times, what kind of graph do you think will be the relationship between the number of hits and the number of rounds?

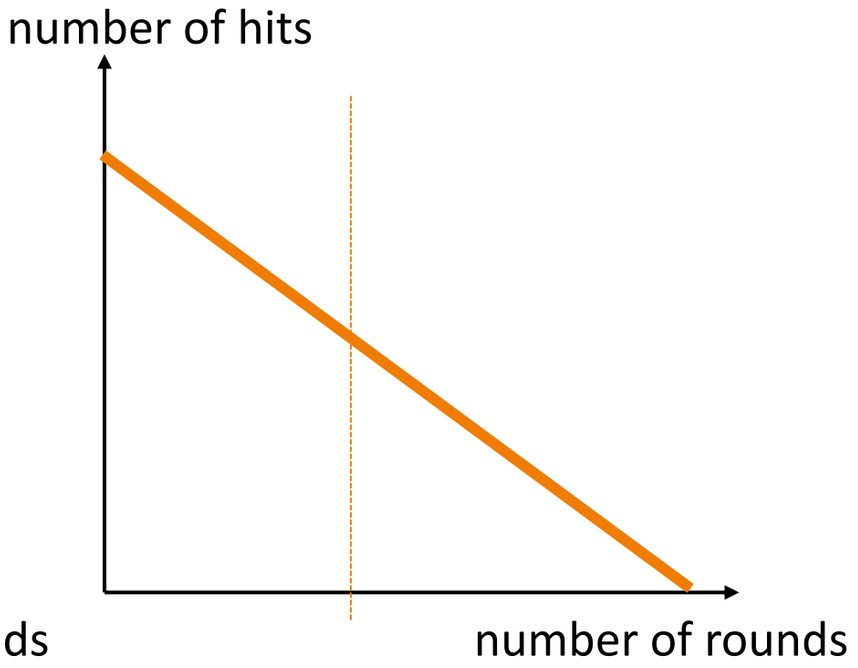
Hit per round distribution graph



Specific round is peak



The hit gradually decreases with each round.



The hit decreases linearly with each round.

Python program

Published on Hobby-IT site
https://hobby-it.com/

```python
import random
from google.colab import files

maxNum     = 1000000000             # How many bet at this simulation
maxBet     = 5000                   # Max Bet count
checkCount = 200                    # Check Hit / 200 count
dayCount   = 2000                   # 2000 count / day

checkCountDiv = maxBet//checkCount  # 25
dayCountDiv   = maxNum//dayCount    # How many days (1000000000 / 2000)

hitCount = [0] * (maxBet + 1)
hitCheck = [0] * (checkCountDiv)    # How many Hit per Check count
betCount = [0] * (checkCountDiv)    # How many Bet per Cehck count
dayCheck = [0] * (dayCountDiv)
hit = 0

for num in range(1, maxNum):
    hit += 1
    betCount[((hit-1)//checkCount)] += 1
    count = random.randint(1,319)
    if count == 319 or hit == maxBet:
        if hit == maxBet:
            print('hit Over maxBet')
        hitCount[hit] += 1                      # How many Hit per Bet Count
        hitCheck[((hit-1)//checkCount)] += 1    # How many Hit per Check Count
        dayCheck[((num-1)//dayCount)] += 1      # How many Hit per Day
        hit = 0

# Output
with open('result1.txt', 'w') as f:
    for num in range(1, (maxBet+1)):
        f.write(str(num) + "," + str(hitCount[num]) + '\n')
files.download('result1.txt')

with open('result2.txt', 'w') as f:
    for num in range(0, checkCountDiv ):
        f.write(str(num) + "," + str(hitCheck[num]) + "," + str(betCount[num]) + '\n')
files.download('result2.txt')

dayHit = [0] * 30
for dNum in range(0, 30):
    for num in range(0, dayCountDiv ):
        if dayCheck[num] == dNum:
            dayHit[dNum] += 1
with open('result3.txt', 'w') as f:
    for num in range(0, 30):
        f.write(str(num) + "," + str(dayHit[num]) + '\n')
files.download('result3.txt')
```

Random number generation (1 to 319)

repeat 10 million trials
Maximum number of revolutions to hit (5000)
To grasp the number of hits per 200 rotations
To know how many hits per day

Due to the array declaration, 25 200 rotations are required up to 5000 rotations
Due to the array declaration, 2000 rotations are required up to 10 million rotations (how many days are required)

Tried 10 million revolutions
Random numbers from 1 to 319 are taken out, and the time when 319 comes out is a hit.
(If it is turned up to 5000 rpm, it is a hit, but it has never turned so far.)

File1

Output the number of hits for each rotation to a file

File2

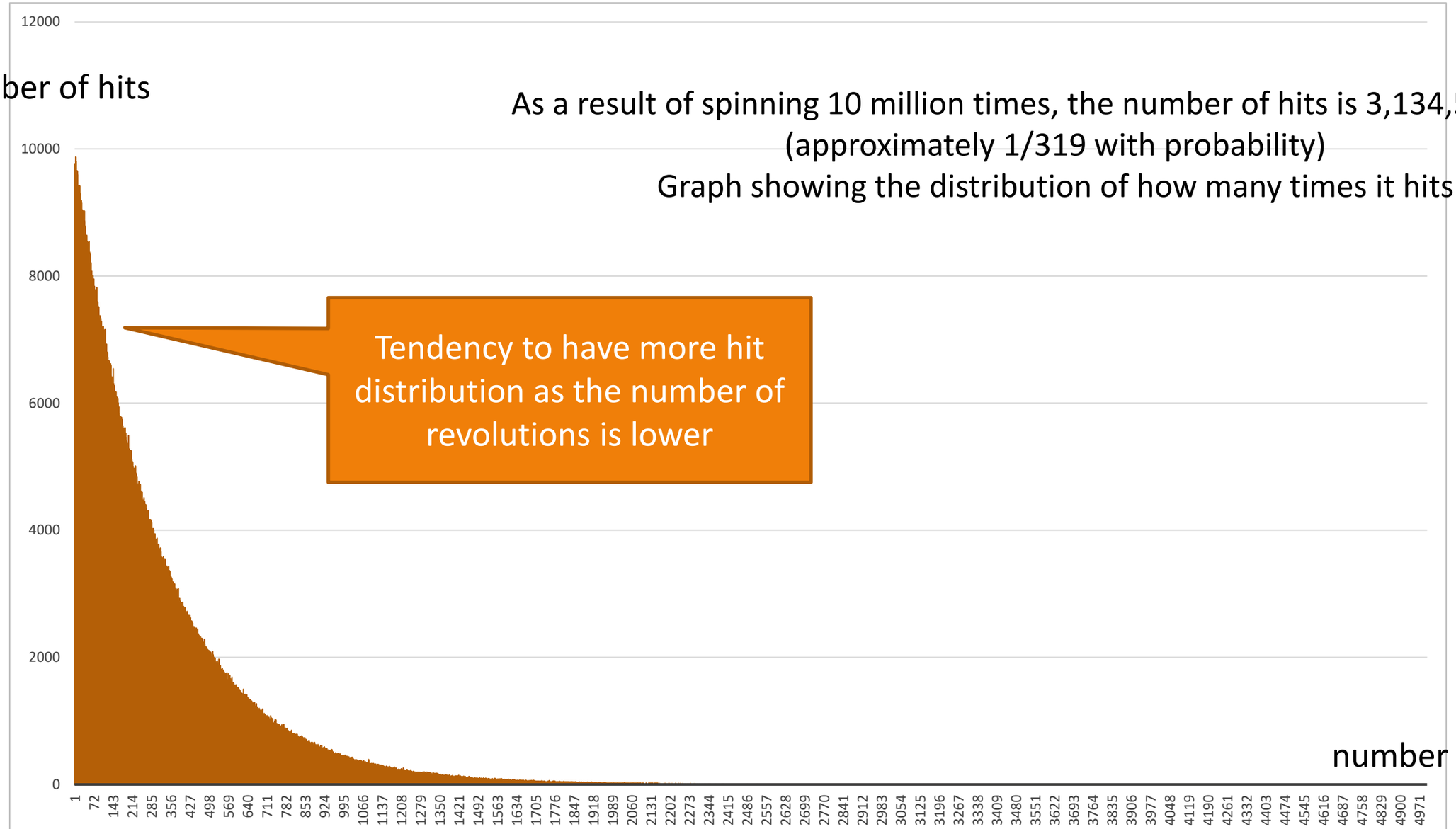
Output the number of hits per 200 rotations to a file

File3

Count the number of hits per day (2000 rotations) and output to a file

Simulation result 1

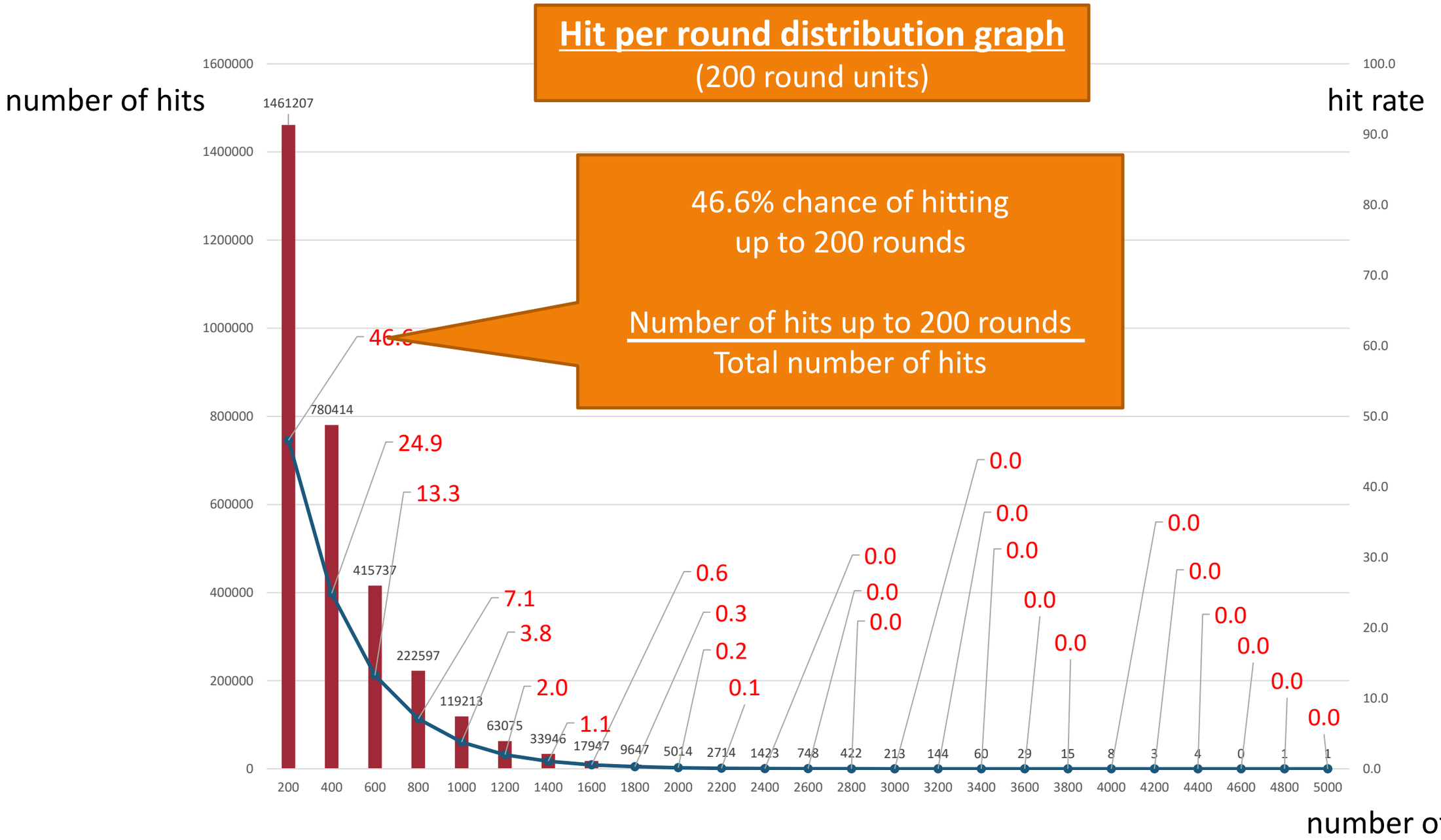
Hit per round distribution graph



As a result of spinning 10 million times, the number of hits is 3,134,582 times.
(approximately 1/319 with probability)
Graph showing the distribution of how many times it hits

Tendency to have more hit distribution as the number of revolutions is lower

Simulation result 2



Simulation result 3

回転数	当たり回数	全Bet回数	割合	1 Bet確率
200	1461207	466321685	46.6	0.313347
400	780414	248856794	24.9	0.3136
600	415737	132977917	13.3	0.312636
800	222597	70942543	7.1	0.313
1000	119213	37811560	3.8	0.315282
1200	63075	20156485	2.0	0.312927
1400	33946	10744644	1.1	0.315934
1600	17947	5707458	0.6	0.314448
1800	9647	3029760	0.3	0.318408
2000	5014	1602734	0.2	0.31284
2200	2714	860844	0.1	0.315272
2400	1423	458067	0.0	0.310653
2600	748	247573	0.0	0.302133
2800	422	135156	0.0	0.312232
3000	213	73258	0.0	0.290753
3200	144	37739	0.0	0.381568
3400	60	16923	0.0	0.354547
3600	29	8863	0.0	0.327203
3800	15	4628	0.0	0.324114
4000	8	2519	0.0	0.317586
4200	3	1480	0.0	0.202703
4400	4	659	0.0	0.60698
4600	0	400	0.0	0
4800	1	292	0.0	0.342466
5000	1	18	0.0	5.555556

The hit rate is high, but the number of bets is also large, so the probability is the same for all rotations
The probability of hitting once is 1/319 (about 0.31347%)

The ratio of hits at 201 to 400 rpm is "24.9%“
Since this is a percentage from the whole, the percentage from the rest after subtracting the hit up to 200 is "about 46.6%"

The probability of winning when spinning 200 times is "about 46.6%"

Also, (probability) calculate whether it matches the theoretical value

If the probability of winning is 1/319 and there are 200 chances, can you calculate by multiplying by 200? ? ?

$$(1/319) \times 200 = 0.626959\cdots$$
$$= 62.69\%$$

It doesn't match "46.6%",
and of course it can't be calculated so easily!

Simulation result 4

I'm not sure, so I asked ChatGPT.

There is 1 hit out of 319. What is the probability of winning within 200 times if this lottery is re-extracted?
Please answer in English.

This problem can be solved using the binomial distribution.

First, the probability of winning in one trial is 1/319. Assuming that 200 trials are conducted independently, the number of times X the hit is drawn follows a binomial distribution B(200, 1/319). Here, B(n, p) represents the binomial distribution with n trials and a success probability of p.

Note that since re-sampling is being performed, even if a hit is drawn once in one trial, there is a possibility of drawing a hit again in the next trial.

Based on this information, the probability of winning within 200 trials can be calculated as follows:

P(X≥1) = 1 - P(X=0)
= 1 - (1-1/319)^200
≈ 0.5221

The answer is great, but the calculation is wrong?

Therefore, the probability of winning within 200 trials is approximately 0.5221, or about 52.21%.

$$P_{(X \geqq 1)} = 1 - P_{(X=0)}$$

Probability of hitting 1 or more times

Subtract the probability of never getting hit from 1

$$= 1 - (1-1/319)^{200}$$

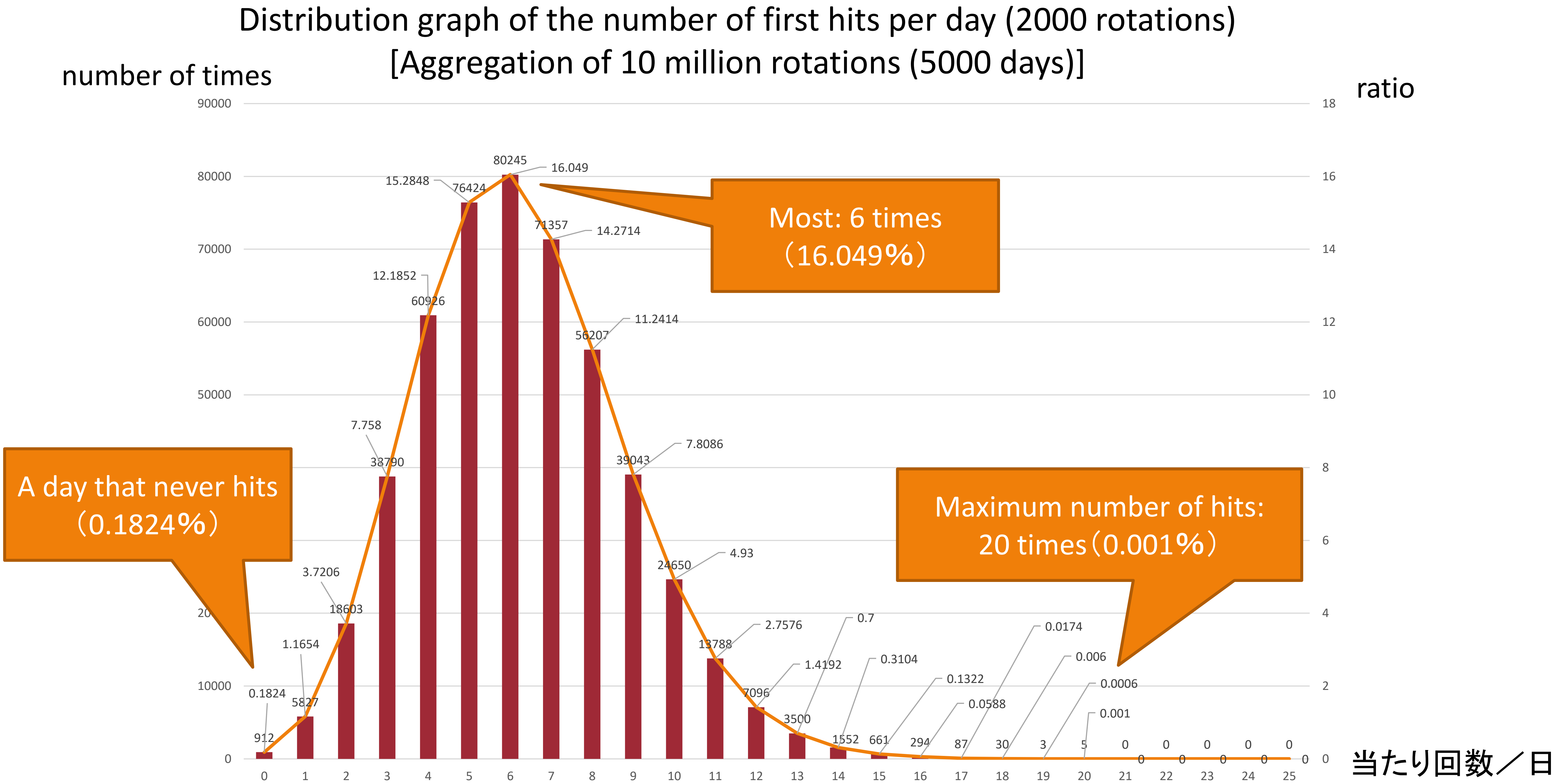
The probability of never hitting is 1 minus 1/319(same for 318/319)

$$= 0.466312\cdots$$

$$\fallingdotseq 46.6\%$$

The theoretical calculation values matched, so the simulation was correct!

Simulation result 5



Discussion and Summary

・Is there a rotation speed that hits the most?
Not exist. The lower the number of rotations, the greater the distribution of the number of hits, but the probability is not high.From 1 to 200, about half (46.6%) of the total hits.

・Is it worth aiming for the addictive table or the hitting table?
Theoretically, the odds are the same, as the lottery will be held at 1/319 each time regardless of past conditions. All the machines have the same probability, so no matter which one you hit, it all depends on your luck.

・Which is better, moving the table or sticking to it?
Theoretically, the probabilities are the same, so it's hard to say which one is better.

・How addictive is it?
There were more than 4,000 (nearly 5,000) hits, so it's possible that there were no hits for two days. However, 99.9% hits up to 2200 rpm

・Is the rotating table really good?
"It's definitely good." The probability increases with the number of turns. The lower the cost per time, the better.

If you have any requests for simulations, please let me know!

We look forward to hearing from you in the comments section or on our website.

(Anything related to IT, including electronic work, is OK.)