

# 2023/24 Mini Contest I

Editorial

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# Statistics

| Problem         | Attempts  | Full       | Max       | Mean      | Std Dev      | LQ       | Median   | UQ          | Subtasks                                                                                                   | First Solve         |
|-----------------|-----------|------------|-----------|-----------|--------------|----------|----------|-------------|------------------------------------------------------------------------------------------------------------|---------------------|
| TC2411 Pachinko | 12        | 40         | 40        | 8.417     | 10.843       | 0        | 9        | 9           | <div>7   2</div> <div>9   7</div> <div>6   1</div> <div>10   1</div> <div>8   1</div>                      | Wong Ho Ki 00:48:14 |
| TC2412 Bluejack | 1         | 60         | 25        | 25        | 0            | 0        | 25       | 0           | <div>8   1</div> <div>17   1</div> <div>14   0</div> <div>21   0</div>                                     |                     |
| TC2413 Roulette | 5         | 100        | 35        | 15.6      | 11.876       | 3.5      | 18       | 26.5        | <div>7   4</div> <div>11   3</div> <div>13   0</div> <div>17   1</div> <div>24   0</div> <div>28   0</div> |                     |
|                 | <b>12</b> | <b>200</b> | <b>52</b> | <b>17</b> | <b>18.69</b> | <b>0</b> | <b>9</b> | <b>33.5</b> |                                                                                                            |                     |

# Pachinko

TC2411

# Subtask 1

$$1 \leq N \leq 10$$

Try solving the problem manually.

For all  $N$ , there is a valid solution with  $P_2 = N - 1$ .

Expected Score

7

Cumulative

7

## Subtask 2

$$N = \frac{x(x+1)}{2}$$

$N$  is a triangular number.

The maximum possible rows of the arrangement is  $x$  where  $P_i = i$ .

Expected Score

9

Cumulative

16

# Observation

A valid arrangement can be represented by two numbers,  $R$  and  $d$ .

$R$  is the number of rows and  $d = P_i - P_{i-1}$ .

Therefore,  $P_i = 1 + (i - 1) \times d$ .

Sum of  $P_i = R + d \times \frac{(R-1) \times R}{2}$ .

# Subtask 4

$$1 \leq N \leq 2000$$

Loop all  $R, d$  and find the valid arrangement with maximum  $R$ .

Expected Score

17

Cumulative

26

# Subtask 3

$$1 \leq H \leq 3$$

When  $H = 2$ , there is always a valid arrangement.

When  $H = 3$ , there is always a valid arrangement if  $N$  is a multiple of 3.

~~Otherwise, output saf.~~

Read problem statement carefully.

Expected Score

6

Cumulative

32

# Full Solution

$$\text{Sum of } P_i = R + d \times \frac{(R-1) \times R}{2} = N$$

$$N - R = d \times \frac{(R - 1) \times R}{2}$$

$$d = \frac{2 \times (N - R)}{(R - 1) \times R}$$

Loop all  $R$  and check if  $d$  is an integer.

Expected Score

40

Cumulative

40

# Bluejack

TC2412

# Subtask 1

$$N = 2$$

Simulate the process.

Expected Score

8

Cumulative

8

# Subtask2

$$1 \leq N \leq M \leq 8$$

Simulate the process again.

Expected Score

17

Cumulative

25

# Subtask3

$$N = M$$

It can be proved that the answer is  $2^N$ .

Expected Score

14

Cumulative

39

# Full Solution

Use dp.

$dp[i]$  = the number of distinct drawing sequences that have the sum equal to  $i$

$$dp[0] = 1$$

$$dp[i] = \text{sum of } dp[i - C_j] \text{ where } C_j \leq i$$

Expected Score

60

Cumulative

60

# Roulette

TC2413

# Observation

Let  $S_i$  be the index of the  $i^{\text{th}}$  number in the interval.

At the beginning,  $S_i = i$ .

When the wheel spin to the left by  $x$  slots,  $S_i = (S_i + x - 1) \% N + 1$ .

When the wheel spin to the right by  $x$  slots,  $S_i = (S_i - x - 1 + N) \% N + 1$ .

# Subtask 1

$$K = 1$$

The only number in the interval is the answer.

Expected Score

7

Cumulative

7

## Subtask 2

$$1 \leq N, Q \leq 5000$$

Loop the interval each time and find sum/maximum value by `+/max()`.

Expected Score

11

Cumulative

18

# Subtask 3

$$1 \leq N \leq 5000$$

Precompute.

There are only  $N$  possible distinct interval.

Compute all possible cases and save the answers.

Expected Score

24

Cumulative

31

# Subtask 4

$$C = S$$

Use partial sum to compute the sum of the intervals + Subtask 3.

Expected Score

17

Cumulative

48

# Subtask 5

$$1 \leq N \leq 10^5$$

If  $C = S$ , Subtask 4.

If  $C = M$ , precompute the interval by sliding window + multiset.

Expected Score

48

Cumulative

72

# Full Solution

Sliding Window Maximum

<https://assets.hkoi.org/training2022/ds-i.pdf#page=95>

|                |     |
|----------------|-----|
| Expected Score | 100 |
|----------------|-----|

|            |     |
|------------|-----|
| Cumulative | 100 |
|------------|-----|