# Untan Programming Contest II

## Problem Analysis

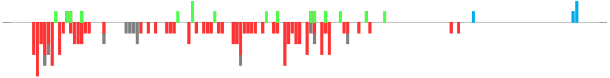
Universitas Tanjungpura

June 2022

# Contest Overview

- Participants: 41 (Out of competition: 3)
- Total Submissions: 292 (AC: 37, Pending: 34)
- Relatively easier than last contest
- No scoreboard resolver, considering using DOMJudge/Kattis next contest

# A: Operasi Aritmatika



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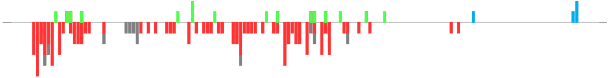

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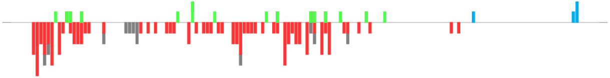

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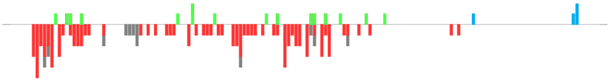

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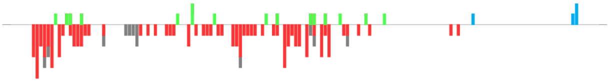

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- Since $C$ is an integer, we should only store the result of $A/B$ if $B|A$ and $B/A$ if $A|B$. Complexity: $O(1)$

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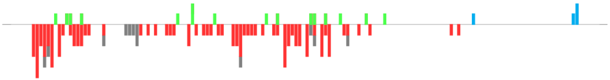

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Statistics: 130 submissions, 16 accepted, 4 unknown

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- Therefore, it is always optimal to pick the current most expensive two items and buy them. Let's sort the prices, then sum from the last element to the first with step of 2. Complexity: $O(n \log n)$

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Statistics: 59 submissions, 8 accepted, 4 unknown

# C: Bilangan Terdekat

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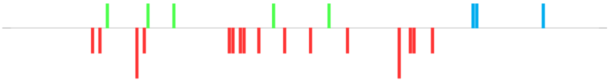

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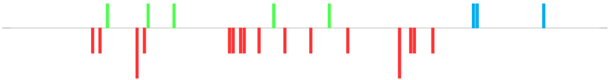

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- Be careful of precision error when doing this. Complexity: $O(T)$

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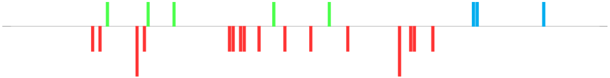

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- Store all powers of 2 and 3 in an array $A$. We will need $O(\log_2(10^9) + \log_3(10^9))$ space for this

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Statistics: 26 submissions, 5 accepted, 3 unknown

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**Problem**

Sort the music by their frequency. If they have the same frequency, prioritize the earliest input.

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- The second way is to realize that we can "attach" the original numbering on the input before sorting. So we will store it as (name, frequency, input_num). We first sort by frequency, then by input_num if the frequency is the same. Complexity: $O(n \log n)$

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Statistics: 21 submissions, 6 accepted, 6 unknown

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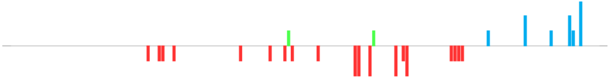

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How many minimum operations needed to make $x$ multiple of $y$ or vice versa?

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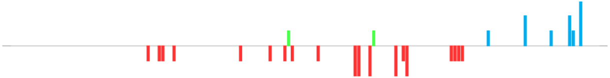

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- Notice that the answer can't exceed $|x - y|$ (make $x$ and $y$ the same). So, we are somewhat assured that brute force is possible.

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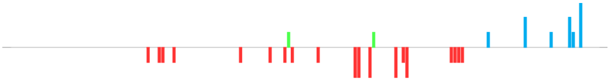

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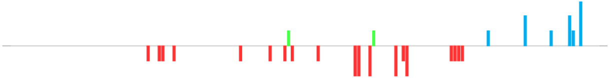

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- There are 3 cases:

  $x + a < y$: Do $b$ operations on $y$ (to $y + b$) so $x + a$ divides $y + b$
  $x + a = y$: We don't need any more operations on $y$ since they are the same number
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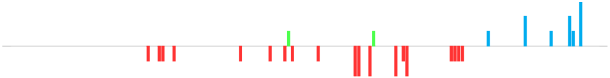

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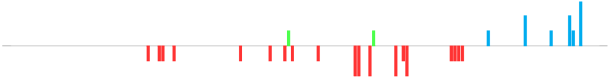

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Statistics: 36 submissions, 2 accepted, 10 unknown

# F: Two Water Jug Puzzle

**Problem**

Determine the minimum amount of operations to make both water jugs have the same volume.

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- Now, decompose $a$ and $b$ into their prime factors. To make $a$ and $b$ the same volume, for every prime factor, we have to make the exponent the same. Complexity: $O(\sqrt{a} + \sqrt{b})$

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# G: 7-Jackpot

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Choose 7 different boxes so it sums up to exactly 777.

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- Since every $a_i$ is distinct, denote $ok[x]$ if $x$ exists
- Iterate from the first item to the sixth item. **The seventh item** must have the value of $a_7 = 777 - a_1 - a_2 - a_3 - a_4 - a_5 - a_6$. This obviously would be TLE.

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- Make sure $a_7$ is not the same as the other six box chosen. Complexity: $O(1)$

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Statistics: 13 submissions, 0 accepted, 8 unknown

# H: Selamat Berbelanja

**Problem**

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- First, if there exist an item with an ending $000$, then it's possible
- If not, then if $k > 198801$, then it's possible. The proof is left to the reader

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## Solution

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- If not, then if $k > 198801$, then it's possible. The proof is left to the reader
- If $k \leq 199801$, we will solve this using dynamic programming

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- Observation: since we only want the total price to have an ending of $000$, only the last three digits matter. So, we will mod all price by $1000$

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- The next state $k+1$ will be computed as follows: for all possible changes in previous state, we include it in this state (do not buy the $k+1$-th item)

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- The next state $k+1$ will be computed as follows: for all possible changes in previous state, we include it in this state (do not buy the $k+1$-th item)
- For each possible state $i$ in $k$, then $i + a_{k+1} \mod 1000$ is also possible

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- Finally, we consider the possibility where we didn't buy the previous $k$ item and only buy this item, so $dp[k+1][a_{k+1} \mod 1000]$ is possible

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