1.3 Starry, Starry Night, E03

1. [EMCC 2015/Guts22] Define a sequence of positive integers s_1, s_2, ..., s_{10} to be *terrible* if the following conditions are satisfied for any pair of positive integers i and j satisfying $1 \le i < j \le 10$: $s_i > s_j$ and $j-i+1$ divides the quantity $s_i + s_{i+1} + \cdots + s_j$. Determine the minimum possible value of $s_1 + s_2 + \cdots + s_{10}$ over all terrible sequences.

   <div align="right">Proposed by Yannick Yao</div>

   (Continuation) Find the second minimum possible value of $s_1 + s_2 + \cdots + s_{10}$, given that $s_{10} = 1$.

2. [CMIMC 2018/A8]

   Suppose $P(x)$ is a cubic polynomial with real coefficients satisfying $P(0) = 3$ and

   $$\left(x^3 - 2x + 1 - P(x)\right)\left(2x^3 - 5x^2 + 4 - P(x)\right) \le 0$$

   for all $x \in \mathbb{R}$. Determine all possible values of $P(-1)$.

   <div align="right">Proposed by David Joseph Altizio</div>

3. [AIME2 2019/11] Triangle ABC has side lengths $AB = 7$, $BC = 8$, and $CA = 9$. Circle ω_1 passes through B and is tangent to line AC at A. Circle ω_2 passes through C and is tangent to line AB at A. Let K be the intersection of circles ω_1 and ω_2 not equal to A. Find the length of AK.

   <div align="right">Proposed by Ivan Borsenco</div>

4. [COMC 2016] Alice plays the following game: on each move, she may add a stone to an initial empty pile, or she may add the number of stones currently in the pile to her score. She wants a score of exactly 2020. What is the minimum number of moves she needs to make to achieve this score?

   <div align="right">Proposed by Alex Song</div>