

Task 3

An observer standing on an exoplanet is looking through the transparent wall of a horizontal vacuum tube in their lab, when suddenly two side-by-side ideal pendula fly magically past at $0.8c$. When the observer notices the pendula are synchronized, she glances at her watch. Let t be $1/10\pi$ times the approximate number of seconds that elapse in the observer's frame until the objects are next synchronized. Given the following information about the lengths of the pendula, find t . On this planet, $g = 1 \text{ m/s}^2$.

1. The first pendulum's length in meters is the number of distinct unary operators that accept a truth value in two-value logic and return a truth value in three-value logic.
2. Given a 3-tensor A and a 2-tensor B with m components (in each dimension), the second pendulum's length in meters is n , where the naive algorithm to carry out the multiplication $\Sigma_c A_{abc} B^{cd}$ for all a, b, d runs in time $\mathcal{O}(m^n)$.
3. The third pendulum's length in meters is the number of initial half-twists in a Möbius strip such that when it is cut lengthwise down the center it yields a strip with four half-twists.