

# Advent of Code - Day06

Hilmir Vilberg Arnarsson

December 6, 2023

## The Problem

This problem is relatively simple to understand. Let  $x$  be the amount of time that the button is held down. Then,  $x$  is also the velocity of the boat. Furthermore, the distance travelled will be:

$$f(x) = (t - x)x = tx - x^2$$

where  $t$  is the length of the race in milliseconds. We want to find the number of ways for  $f(x) > d$  where  $d$  is the record length in the race. Therefore, we get:

$$\begin{aligned} f(x) > d &\iff x^2 - tx + d < 0 \\ &\iff (x - r_1)(x - r_2) < 0 \\ &\iff r_1 < x < r_2 \quad (*) \end{aligned}$$

where

$$r_1 = \frac{t - \sqrt{t^2 - 4d}}{2}, \quad r_2 = \frac{t + \sqrt{t^2 - 4d}}{2}.$$

We then simply have to find positive integer solutions for  $(*)$