MO Server*PoTD Solutions

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1 Introduction

This document is an set of problems and solutions which have been listed in the problems-of-the-day channel of the Mathematical Olympiads Discord Server. Problems are Olympiad-style and range from very easy to IMO P3/6 level, with difficulty indicated on a scale of 1-10, where 10 is IMO P3/6 and 5-6 is IMO P1/4 level.
Although the document has been compiled by a moderator, solutions will be typically member-submitted. As these are problems "of the day", the set of problems is continually growing and thus solutions will be welcome. If you wish to submit a solution please either PM a moderator of the Discord server (these will be clearly marked when you join the server) or submit a pull request. You will be credited if you wish.

2 Problems

Day 1 — Mar 26, 2019 (Number Theory, D4)
Does there exist an infinite sequence of positive integers $a_1, a_2, a_3, \ldots$ such that a_m and a_n are coprime if and only if $|m - n| = 1$?
Source: 2015 Romanian MoM, Q1

Solution to Day 1:
Submitted by (userID = *134837275161788416*).
Construct a sequence

$$a_n = p_{2n} \times p_{2n-1} \times \prod_{i=1}^{n-2} p_{2i-1+(n \mod 2)}$$

where p_n is nth prime. This can be shown to produce the require co-primality conditions.

*`https://discord.gg/NPnGZYH`
†Individual problem authors are listed beside each problem