P04 Solar Panel Farm V2

Laureano Arcanio   (February 2026)

Problem

A solar farm has a 900×900 ground area divided into unit square plots. Rectangular solar panels are placed on the ground, with sides parallel to the grid lines, and no two panels overlap.

For maintenance access, *in each row and in each column, exactly one unit square must be left empty.*

What is the *minimum number of panels* needed?

Solution (Extremal Argument using Erdős–Szekeres)

Because there is exactly one empty square in each row and in each column, the empty squares define a permutation of the set $\{1, 2, \ldots, 900\}$.

Let a be the length of the longest increasing subsequence and b the length of the longest decreasing subsequence of this permutation. By the Erdős–Szekeres theorem,

$$ab \geq 900,$$

which implies

$$a + b \geq 2\sqrt{900} = 60.$$

Using a standard extremal labeling argument, one can mark at least

$$900 + a + b - 3$$

unit squares such that no axis-aligned rectangle can cover more than one marked square. Therefore, each pallet can cover at most one marked square, and the number of panels is at least

$$900 + 40 - 3 = 957.$$

Hence, any valid configuration requires at least **437** pallets.

Answer

$$\boxed{957}$$