

ARHITEKT

Let us model the drawing as a graph and try to find the link between the number of vertices V , the number of edges E and the number of rooms R while drawing. If there are multiple strokes between a pair of points, ignore all except the first one.

Initially, we are in the origin and no line segments have been drawn, so $V=1$ and $E=R=0$. When Mirko Jr. draws a line segment, there are two cases:

1. The line segment ends in a point we have not yet been in. V and E are incremented, but R isn't.
2. The line segment ends in a point already visited. V stays the same, but E and R are incremented.

Notice that before and after each stroke the formula $V - E + R = 1$ holds. This is the famous Euler identity for planar graphs (normally, the entire plane is initially considered to be one room, so the number 2 appears on the right side of the equation instead of 1).

Using this formula, the task is easy to solve: count the number of distinct points we traverse, and also the number of distinct edges in the graph. An additional trick is to multiply all coordinates by 2 and split every stroke into two half-strokes – this elegantly solves the problem of intersecting diagonals of a unit square.

DORUČAK

Let us first explain in an informal proof why such a line exists; an algorithm to find it follows from the proof.

Let $(0, b)$ be an arbitrary point on the y -axis. It is easy to see that a line exists that passes through $(0, b)$ and cuts the left burek in two equal halves. Its slope can be found using binary search. Let that coefficient be $a_L(b)$. Similarly, define a slope $a_R(b)$ for the same point $(0, b)$ and the right burek.

We want to find the value of b such that $a_L(b) = a_R(b)$. Then the desired line is $y = a_L(b) * x + b$. Let $a(b) = a_L(b) - a_R(b)$. We are looking for the value of b such that $a(b) = 0$.

Notice that $a_L(b)$ and $a_R(b)$ are continuous functions of b (without "jumps"). Because of this, $a(b)$ is also a continuous function of b .

When b is negative and sufficiently large in absolute value, then $a_L(b)$ will be negative, and $a_R(b)$ will be positive.

When b is positive and sufficiently large, then $a_L(b)$ will be positive, and $a_R(b)$ will be negative.

Because $a(b)$ is negative for small b , positive for large b , and continuous, it has to become zero at some point, and we can find that point using binary search.