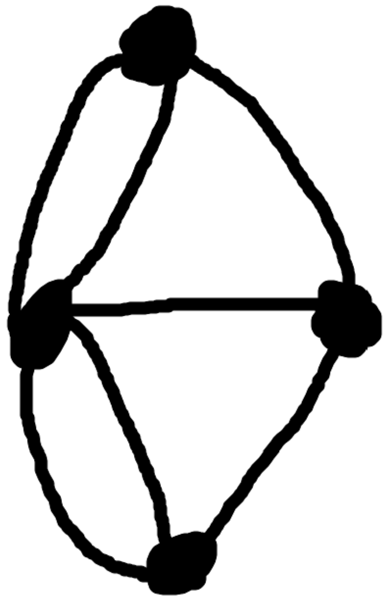
Essay ***π***(3.141...):
Another way of solving the seven bridges of Königsberg problem. ***Counting free!!!***

(This is the other part of the duology that literally just became one a week away from the end of the contest while on the shower)

By:Jon Aguiar

If you're the type of person to read math essays written for a competition you've probably already heard about the problem on the title because it's like graph theory 101 at least on the internet, and it's pretty clear why it's a fun story and it feels approachable which are both great things for explaining maths to people but that's not the point, the main idea shared about it is how Euler came saw the problem took out all unnecessary information like the shape of the islands and all that and ended up with this:



(This could honestly be one of the most recognizable graphs but I digress)

Now, if you know anything about how Euler solved it was that he solved it by realizing that for a path to go through every connection, it had to either end on the same point where it started or a different one and that both cases could be denoted by if every point had an even number of connexions or only 2 had an odd number. Knowing this he counted the number of connections in every point and realized that there were 4 points with an odd number which made it impossible to go through every connection once which solved the problem cleanly and neatly.

But what if?

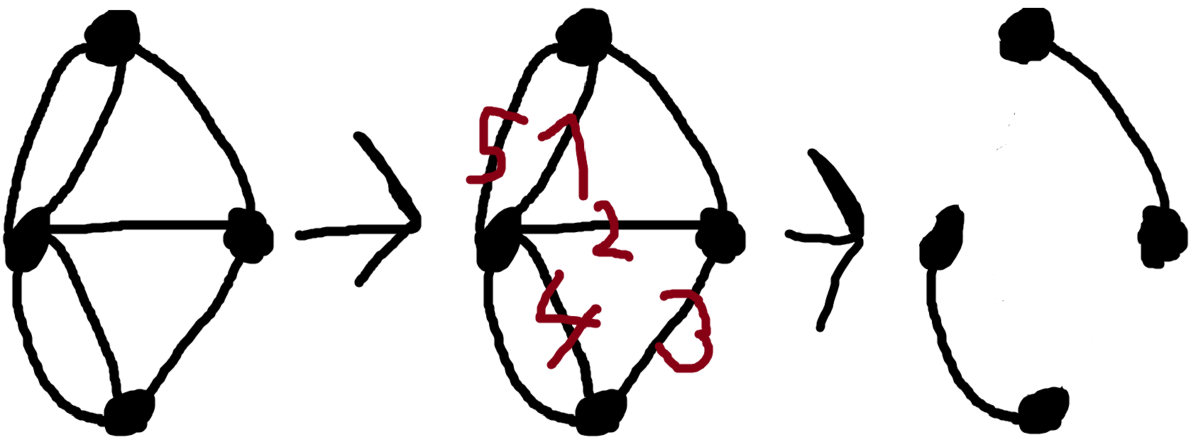
What if I told you that there's another way? A way free of counting, possibly even more intuitive than the one that already exists? You can click this link(
Essay e(2.738...):How to make a digon (kinda it's complicated and a lot of semantics) …)
if you wanna leave or if you aren't ready yet, but I'll be waiting for you to keep reading when you're prepared to have your mind blown…

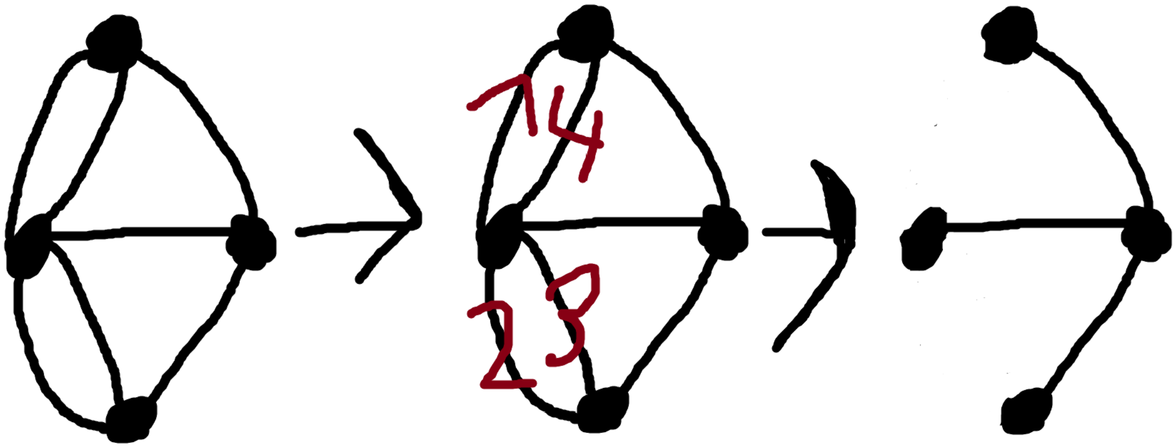
You can just erase any loops that you see, and if you end up with 2 or more disconnected connections or with a graph that's a point with 3 or more lines coming out of it then congratulations you know the graph is impossible to go through every connection only once.

Wanna see how with multiple graphs for examples?

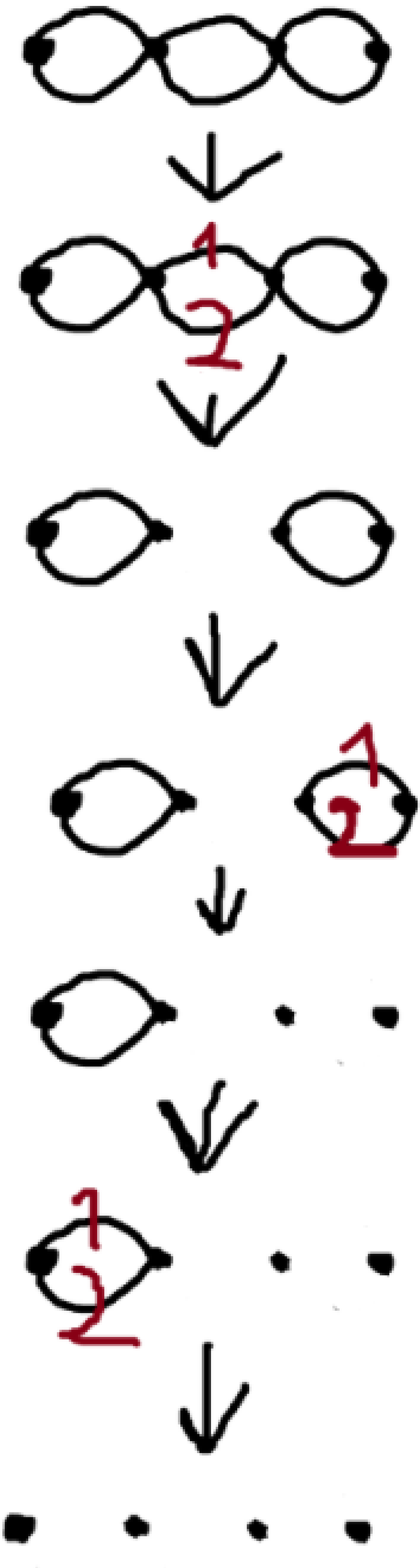
Well here they are: (The numbers are to mark the order of the connections in the loop)

Königsberg: (There are multiple erasable loops these are just a few of them)





3 connected loops: (again this can be done in multiple ways this is just one to showcase the rule about erasing all loops that can be seen also notice how we end up with single points unconnected that’s the objective if we can erase every line or just have a single line left with any number of unconnected points we have confirmed it can be done)


1
2
1
2
1
2

I could go on with more graphs but the larger they are and the longer it gets so I'm not going to just so this whole essay isn't just drawings made in paint.

Well then how exactly does this work? Well it's actually really simple if a little obtuse. Loops when you go through them you aren't really doing anything since you start and end in the same place which means they can be erased and the route we'd have to do would stay the same which turns the loops into a simple detour also since we know that everything's connected we can infer that even though there can be a lot of loops since they're all connected a route must exist to go through them which means that this technique is a technically valid way of know if a graph can be drawn in one go or rather that the graph has an eulerian path.

Yeah that's about it, I don't really know where to expand this so I'll leave it at some 720 approx words.

The link that's already above is for the other essay on graph theory go check it out if you want here's it again for your convenience

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