MATH 611 (DUE 10/2)

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Exercise. (Problem 10, Chapter 1.3) Find all the connected 2-sheeted and 3-sheeted covering spaces of $S^1 \vee S^1$, up to isomorphisms of covering spaces without base points.

Proof.

> For the first part, I ended up with the two graphs in Figure 1.
>
> - There have to be exactly two points in a covering space with 4 edges.
> - Every other point has a neighborhood such that the point has only two edges.
> - A covering space has to be path connected.
>
> Based on these three things, it's not hard to get to the following two possibilities. However, I'm not sure if this is rigorous enough. Also, I don't know how this can be applied to the case of 3. There are many ways to connect vertices and it doesn't seem doable, which suggests that there might be better ways to solve this.
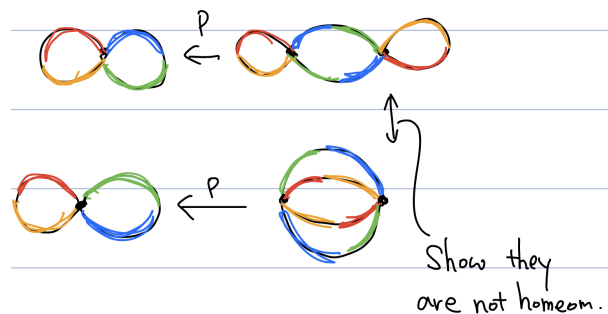
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FIGURE 1. Problem 10 Idea