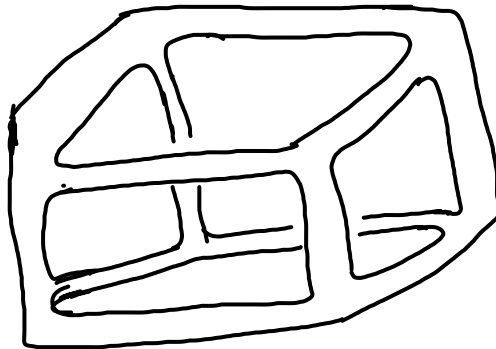# Course on Symmetry, Topology and Entanglement

Homework 3

- **Instructor**: Kargarian - Vaezi

- **Semester**: Fall 2022

- **Handed out**: Monday 09-08-1401

- **Due date**: Monday 23-08-1401 in class

1. *Reimann surfaces* – Determine to which orientable closed manifolds the following surfaces belong?



2. *Fermi surfaces* – Open any standard textbook on solid states like solid state physics by Mermin-Aschcroft. Determine the topological structure of the Fermi surface as a closed manifold for a few metals such as Cupper, Nickel, etc.

3. *Deformation* – Suppose an infinite rode is passing through the holes of a 2-torus as shown below. Is it possible to hang it one from one handle?
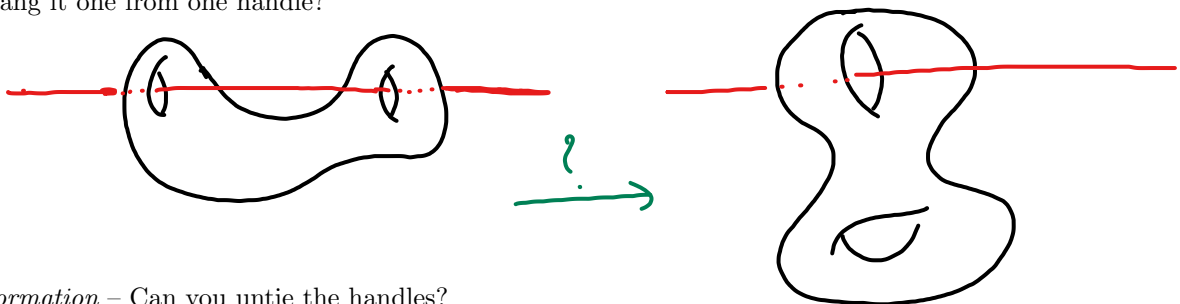


4. *Deformation* – Can you untie the handles?
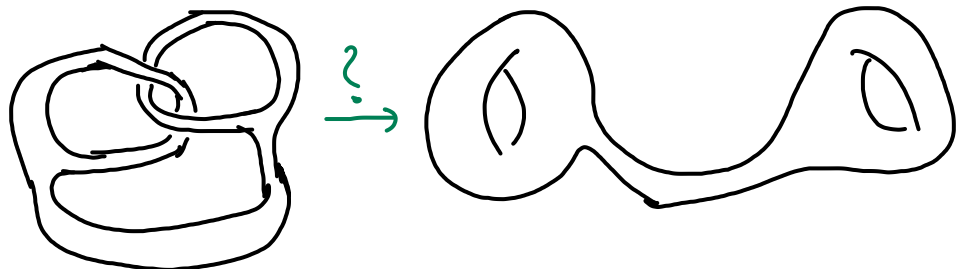


5. Again visit the arXiv (https://arxiv.org/list/cond-mat/new) until the due date of this assignment and select one paper of your own interest. It could be purely theoretical, experimental, or combination of both. You don't need to read the paper carefully and reproduce the results anymore. All you have to do is to grab the main points reported and the methods employed to resolve the problem. Prepare a half-page summary including things that you don't understand, the title and the arXiv id number.