

Please let me know if any of the problems are unclear, have typos, or have any other mistakes.

Exercise 3.1. Draw all four-crossing diagrams of the figure-eight knot (4_1) . You may assume without proof that the figure-eight is distinct from the unknot and the two trefoils. [Hint: a piece of string, or a strip of paper, will be helpful.]

Exercise 3.2. Suppose that K is a knot in \mathbb{R}^3 . A *Seifert surface* for K is a finite, connected, orientable surface F in \mathbb{R}^3 so that $\partial F = K$. For each knot K with six or fewer crossings find a Seifert surface. It may help to make a paper model.

Exercise 3.3. Here is the *knot game*. A group of (at least) five people stand in a circle, facing the centre. Everybody closes their eyes and places their hands near the centre. At random, everybody clasps two other hands. (It is considered poor form to clasp your own hands together.) Everybody now opens their eyes and ponders the one-manifold made of people.

Is it connected? Which knot or link is it? Prove your answer is correct without cutting or tearing the one-manifold.