Problem 1. *Classify all separating curves on a surface* S_g *up to homeomorphism.*

Problem 2. *Show that if* $i(a,b) \neq 0$ *and with* T_a, T_b *nontrivial. Verify that* $[T_a, T_b] \neq 1$. *Do this by drawing pictures.*

Problem 3. *Given a surface* S *with* n *punctures. Let* Σ_n *be the permutation group. Recall a mapping class of* S *is allowed to permute the punctures. Prove that the natural map* $\mathcal{MCG}(S) \to \Sigma_n$ *is a well-defined surjective homomorphism. The kernel is called the* pure mapping class group *of* S.

Problem 4. *Verify the claim that if* a *and* c *are nonseparating curves with* $i(a,c)$ *equal to 0 or 2 then there is a curve* b *with* $i(a,b) = i(b,c) = 1$.

Problem 5. *What conditions must a set of Dehn twists satisfy in order for the intersection of their centralizers to be trivial?*

Problem 6. *Show that the center of every finite-index subgroup of* $\mathcal{MCG}(S_g)$ *is trivial for* $g \geq 3$.

Problem 7. *Suppose that a group* G *acts on a connected graph* X *by automorphisms, transitively on vertices and edges. Fix two vertices* $u, v \in X$ *and let* $h \in G$ *be such that* $h(v) = u$. *Show* G *is generated by* G_u *(the stablizer of* u*) and* h.

Problem 8. *Prove that the mapping class group of the torus is isomorphic to* $\mathrm{SL}_2(\mathbb{Z})$. *Also do this for the mapping class group of the once-punctured torus.*

Problem 9. *For a surface* S *of genus* $g \geq 2$, *prove there are at most* $3g-3$ *pairwise disjoint (free homotopy class of) essential simple closed curves on* S.

Problem 10. *For the Klein bottle* K^2, *find all the free homotopy classes of essential simple closed curves. Hint: there are only finitely many! What is the curve graph of* K^2*?*

Problem 11. *In the curve graph of a surface, what does it mean for two vertices to have distance* 2*? Find a path of length* 3 *in the curve graph of* S_2.