## METU Department of Math. Spring 2014 Math422 Instructor: Sergey Finashin

Plan of Lectures

Lecture 1. Homeomorphisms, topological invariants: connected components, compactness. Examples: intervals, polygons, letters. H/W-1: topological classification of letters.

Lecture 2. Homotopic maps, contractibility, deformation retraction. Homotopy equivalence of graphs, wedge of circles. Invariants: Betti numbers of graphs: H/W-2. Simply connectedness, Riemann theorem.

Lecture 3. Simple closed curves, regular (immersed) plane curves, regular homotopy. Invariants: winding number with respect to a point (index of a region), turning number: H/W-3.

Lecture 4. Quotient topology, quotient map, contraction. H/W-4: triangle. Cylinder, cone, suspension. Mapping cylinder, cone and torus. Disjoint union, wedge of spaces.

Lecture 5. Gluing of spaces along a homeomorphism of subsets, connected sum. Manifolds, classification of surfaces. Cutting surfaces into polygons: cylinder, torus, Möbius band, Klein boutle. H/W-5: contraction.

Lecture 6. Detection of the result of gluing: Euler characteristic, matching of orientations. Surfaces with boundary, number of boundary components. Making holes and connected sums. N2 as Klein boutle. H/W-5.

Lecture 7. Words presentation of polygons: rotation, inversion, cutting/pasting, folding. N1#T2=N3 via polygon cutting/pasting and via substitutions in words. One- and two-sided curves. Separating cuts. Fundamental groups of surfaces.

Lecture 8. Boundary-connected sums. Knots/links, their diagrams, spans (Seifert surfaces). Determination of the topological type of the spans.

Lecture 9. Graphs on surfaces. Triangulations and Δ-complexes, 2-complexes. Simplicial complexes.

Lecture 10. Chain complexes and their homology. Simplicial homology. Geometric meaning and calculation for graphs. Calculation for the Δ-triangulation of a torus.

Lecture 11. Cell complexes, polygonal presentation, calculation of their cellular homology.