Course Goals: Math 462, Topology

I. Overview of Topology

Students should be able to demonstrate:

- familiarity with the abstract concept of open sets, equivalence relations.
- familiarity with elementary set theory.
- familiarity with the definitions of closed sets, a topology, of homeomorphisms and topological equivalence.
- the ability to relate the abstract notions of topology with the more concrete definitions for metric spaces, particularly for $\mathbf{R}^n$ as you might see in a course in real analysis.

II. Continuity

Students should be able to demonstrate:

- familiarity with the definitions of limit point, closure, interior, boundary, and metric function.
- the ability to prove elementary theorems involving continuity.

III. Compactness & Connectedness

Students should be able to demonstrate:

- the ability to prove elementary theorems involving compactness.
- the ability to prove elementary theorems involving connectedness and path connectedness.
- the ability to prove elementary theorems involving products of spaces.
- familiarity with the equivalence of compactness with closed and bounded within $\mathbf{R}^n$.

IV. Identification Spaces

Students should be able to demonstrate:

- familiarity with the definitions of identification space and fundamental region.
- familiarity with the basic examples of identification spaces: the Mbius strip, torus, Klein

bottle, projective spaces, cone, and attaching maps.

- the ability to prove elementary theorems involving identification spaces.
- familiarity with the gluing lemma.

V. *The Fundamental Group*

Students should be able to demonstrate:

- familiarity with the definitions of homotopic maps, the fundamental group, simply connected spaces, homotopy type, deformation retractions, and contractible spaces.
- familiarity with the path lifting lemma and the homotopy lifting lemma.
- the ability to calculate the fundamental group $pi_1(X,p)$ for simple spaces.
- familiarity with Van Kampen's Theorem to compute the fundamental group of a space.
- familiarity with the Brower Fixed Point Theorem.
- familiarity with the Jordan Curve Theorem.

VI. *Triangulations*

Students should be able to demonstrate:

- familiarity with the definitions of a graph, tree, polyhedron, an *n*-dimensional simplex, a simplicial complex, triangulations, barycentric subdivisions, simplicial approximation of continuous functions, the Euler characteristic.
- the ability to construct simple examples of simplicial complexes and compute their Euler characteristic.

VII. *Surfaces*

Students should be able to demonstrate:

- familiarity with definitions of surface, *n*-dimensional manifold, orientability, surgery, closed surface, the genus of a surface.
- familiarity with the classification theorem of compact, connected surfaces without boundary.
- the ability to determine the Euler characteristic of any surface.
- the ability to determine classify any compact surface.

VIII. *Knots*

Students should be able to demonstrate:

- familiarity with definition of a (tame or polygonal) knot, knot projection, Reidemister moves, equivalence of knots, the knot group, genus of a knot and the Seifert surface of a knot.
- the ability to compute the knot group of a given knot.
- the ability to determine the genus of the Seifert surface of a knot.
- the ability to provide justifications why two simple knot projections are nonequivalent knots

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