TOPICS FOR MATHEMATICS 246A, WINTER 2007

Preface
Prerequisites

I. Foundational and geometric background

1. Categories and functors (Hatcher, § 2.3)
2. Barycentric coordinates and polyhedra (Hatcher, § 2.1)
3. Subdivisions (Hatcher, § 2.1)

II. Homotopy and cell complexes

1. Homotopic mappings (Hatcher, Ch. 0; Munkres, §§ 51, 58)
2. The fundamental group (Hatcher, §§ 1.1 – 1.3, 1.A – 1.B; Munkres, §§ 52, 54)
3. Abstract cell complexes (Hatcher, Ch. 0)
4. The Homotopy Extension Property (Hatcher, Ch. 0, § 2.1)

III. Simplicial homology

1. Exact sequences and chain complexes (Hatcher, § 2.1)
2. Homology groups (Hatcher, § 2.1)
3. Homology and simplicial complexes (Hatcher, § 2.1)
4. Chain homotopies (Hatcher, § 2.1)
5. Comparison principles (Hatcher, §§ 2.1 – 2.2)

IV. Singular homology

1. Definitions (Hatcher, § 2.1)
2. Eilenberg-Steenrod properties (Hatcher, §§ 2.1, 2.3)
3. Proofs (Hatcher, §§ 2.1 – 2.3)
4. Excision (Hatcher, §§ 2.1, 2.3)
5. Homology and the fundamental group (Hatcher, § 2.A)

V. Geometric applications

1. Degree theory (Hatcher, §§ 2.2)
2. Theorems of Jordan and Brouwer (Hatcher, §§ 2.A – 2.B; Munkres, §§ 61 – 64)
3. Simplicial approximation (Hatcher, § 2.C)
4. The Lefschetz Fixed Point Theorem (Hatcher, § 2.C)
5. Dimension theory (Munkres, § 50)

VI. Homology and differential forms

1. Cohomology and coefficients (Hatcher, §§ 2.2, 3.1)
2. Smooth singular chains
3. Differential forms and Stokes' Formula
4. de Rham's Theorem