Topics for the Math 970/971 Qualifying Exam

Point-set Topology

Toplogical spaces, continuous functions: topology, basis, subbasis, subspace topology, product topology, quotient topology, closed sets, closure, limit points, continuous functions, Pasting Lemma.

Homeomorphism invariants: separation properties (T_0, T_1, Hausdorff, regular, normal), countability properties, connectedness, path connectedness, compactness; local connectedness, local path connectedness, metrizability. Applications.

Occasional topics: Tychonoff Theorem, Limit point compactness, sequential compactness, completeness, Urysohn's Lemma, Urysohn Metrization Theorem, Tietze Extension Theorem, manifolds.

Homotopy and Homology

Fundamental groups and covering spaces: homotopic maps, homotopy equivalence, cell complexes, fundamental group, induced homomorphisms, free groups, group presentations, Seifert - van Kampen Theorem, covering spaces, lifting theorems, universal covering, deck transformations, normal coverings, Galois correspondence. Applications to group theory.

Homology theory: simplicial homology, singular homology, induced homomorphism, homotopy invariance, exact sequences, long exact homology sequence, relative homology, homology with coefficients, Mayer-Vietoris sequence, excision, Euler characteristic. Applications.

Occasional topics: Classification of surfaces, cellular homology, higher homotopy groups, Hurewicz homomorphism.