**Content:**
Singular homology and cohomology is an algebraic and combinatorial method of constructing invariants for topological spaces. This is in contrast with the deRham cohomology treated in Topology 1 where one uses differential methods to obtain closely related topological invariants. A main theme in the course is the interplay between the algebraic constructions of 'homological algebra' and the geometry.

We will use homology to study the homotopy theory of spaces. If $X$ is a topological space, one of the most interesting invariants is the group $\pi_n(X)$ of homotopy classes of maps from a sphere $S^n$ into $X$. Using homology, we will compute this group in some (very) special cases. In general, these groups are incredibly hard to compute, and even the group $\pi_n(S^2)$ is unknown for moderately large $n$.

Topics:

- Axioms of homology theory and their verification for singular homology
- CW-complexes and cellular homology
- Cohomology and The Universal Coefficient Theorem
- Künneth Theorem and products
- Duality Theorems
- Connection between homology and homotopy, such as Whitehead's theorem
- Maybe Hurewicz' theorem.