**Presentation assignments for 583, Spring 2014**

**Leray-Serre Spectral sequence and applicatiions.** *Josh and James.*

(1) (Serre) fibrations
(2) Construction of the Leray-Serre spectral sequences for $H^*$ (with constant coefficients - assume the base is simply connected).
(3) Multiplicative structure of the Leray-Serre spectral sequence.
(4) Application: compute the ring $H^*(\mathbb{C}P^n, \mathbb{R})$.
(5) (optional) Cohomology with local coefficients.
(6) (optional) The Leray-Serre spectral sequences focohomology with local coefficients (any base).
(7) (optional) Applications: Calculate $H^*(SU(n), \mathbb{R})$.
(8) (double optional) $H^*(SO(n), \mathbb{F}_2)$.
(9) (at James' request) Cohomology of the Maclane -Eilenberg spaces $K(\mathbb{Z}/2, n)$.

Sources: [5] - primary, [6] - secondary.

**Finite generation of the group cohomology ring** $H^*(G, k)$ for a finite group $G$ with coefficients in a field of positive characteristic. *Becca and Riley.*
Sources: There are two proofs: topological and algebraic. Present the topological one. The original paper is by Venkov, 1961. Recommended source: [2, II.3.10.1].

**Čech and sheaf cohomology.** *Hao Chen.*

(1) Define Čech cohomology
(2) Define sheaf cohomology
(3) Construct the spectral sequence for Čech cohomology converging to sheaf cohomology.

Possible references: [4], [3, 3.7], [1, II.3]

## References


[1] Grothendieck topologies, Notes on a seminar by M. Artin, Harvard University Press (1962)
[2] D. Benson, Representations and Cohomology, Vol I, II, Cambridge University Press, (1998)
[3] S. Gelfand, Yu. Manin, Methods of Homological algebra, 2nd edition (2003)
[4] R. Hartshorne, Algebraic Geometry, (1977)
[5] J. McCleary, A User's Guide to Spectral Sequences, Cambridge University Press, 2nd edition, (2001)
[6] C. Weibel, An introduction to homological algebra, Cambridge University Press, (1995)