Prof. Markus Hausmann
Dr. Elizabeth Tatum

Program: Seminar on group cohomology
WS 2023/24, On Tuesdays 14:15-15:45, Room N000.7

1 10.10.23 Jacqueline Sifft	**Group rings and group (co-)homology**: Sections 1.1.1 and 1.1.2 in [L], bar and simplicial resolution [L, Sec. 1.2.1], group (co-)homology with coefficients in a $\mathbb{Z}G$-module, functoriality in the group and the module [L, Sec. 1.2.2]
2 17.10.23 Lucces Cecchino	**Low-dimensional examples**: Description of H_0 and H^0 as (co-)invariants [L, Sec. 1.3], H_1 and H^1 as abelianisation and homomorphisms [L, Secs. 1.4.1 and 1.4.2], H^2 via abelian extensions [L, Thm 1.5.10 and Cor. 1.5.12]
3 24.10.23 Tobias Schmid	**Group (co-)homology via projective resolutions**: Sections 1.6.1 and 1.6.2 in [L], Examples: (co-)homology of finite cyclic groups [L, Cor. 1.6.13] and free groups [L, Cor. 1.6.23]
4 31.10.23 Jannek Müller	**Classifying spaces 1**: BG, EG and their properties [L, Sec. 4.1.1], classifying spaces and their uniqueness [L, Thms 4.1.10 and 4.1.11]
5 7.11.23 Yordan Toshev	**Classifying spaces 2**: Examples [L, Ex. 4.1.16 - 4.1.20] and (possibly) [L, Thm. 4.1.13], group (co-)homology via classifying spaces [L, Sec. 4.1.4]. Application: If BG is finite dimensional, then G is torsion-free
6 14.11.23 Ids Dankert	**Derived functors**: universal property, group (co-)homology via derived functors, expression in terms of Tor and Ext [L, Secs. 3.1.1-3.1.5] (see also [B, Secs. III.0-2])
7 21.11.23 Fynn Noah Wedek	**Transfer maps**: Definition of transfers, double coset formula [B, Sec. III.9], Applications: The (co-)homology of finite groups G is $\lvert G\rvert$-torsion [B, Cor. III.10.2], detection of cohomology by Sylow subgroups [B, Thm. III.10.3]
8 28.11.23 Bastian Rittmeyer	**Product structures**: The cross-product in homology and the cup-product in cohomology. Kuenneth theorems. [B, Secs. V.1-3] The cohomology ring $H^*(G)$. Example: the cohomology ring of cyclic groups.
9 5.12.23 Hannah Geron	**Tate cohomology of finite groups**: Definition and properties [B, Sec. VI.1-5]
10 12.12.23 Sven Ulf Schmitz	**Free actions on spheres I**: Theorems IV.4.1 and IV.4.3 in [B] on classifications of p-groups with a cyclic subgroup of index p or a unique subgroup of order p, see also [L, Sec. 1.6.3].
11 19.12.23 Emanuele Cortinovis	**Free actions on spheres II**: Theorems 4.3.7 and 4.3.3 in [L], see also [B, Sec. VI.9] on periodic cohomology rings
12 9.1.24 Melvin Weiß	**Cohomological dimension**: Algebraic definition of cohomological dimension [B, Sec. VIII.2] and its (more or less) equality to the geometric dimension [B, Thm. VIII.7.1 and Cor. VIII.7.2]

13 16.1.24 Praneet Srivastava	**Geometric group theory and bounded cohomology I**: Word metric, Cayley graph and quasi-isometries [L, Sec. 2.1.1], amenable groups [L, Sec. 2.1.2]; definition of bounded cohomology [L, Sec. 2.3.1] and its application to amenability [L, Thm. 2.3.10]
14 23.1.24 Oleksandr Kharchenko	**Geometric group theory and bounded cohomology II**: Applications of bounded cohomology: Quasi-morphisms [L, Sec. 2.3.3] and stable commutator length [L, Sec. 2.3.4]
15 30.1.24 Jaime Guerrero	**(Co-)homology of amalgamated products** [B, Sec. II.7] Amalgamated products, realization through $K(\pi, 1)$'s [B, Thm. 7.3] and the associated Mayer-Vietoris sequence [B, Cor. 7.7]; Application: Homology of $SL_2(\mathbb{Z})$ [B, Ex. 3, Section II.7] (also consider the cohomology ring); trees and amalgamations [B, Appendix].

References

[B] K. Brown. *Cohomology of groups*, volume 87 of *Graduate Texts in Mathematics*. Springer-Verlag, New York-Berlin, 1982.

[L] C. Löh. Group cohomology. *Lecture notes, avaliable at http://www.mathematik.uni-regensburg.de/loeh/teaching/grouphom_ss19/.*