MATH 849 - Topics in Topology

Fall 2019

General information

Instructor: Martin Frankland

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Office hours: Tuesdays 4-5, Wednesdays 2-3, Thursdays 4-5, or by appointment.

Format: The course consists of directed reading along with regular meetings. There are no lectures.

Textbook: While the course has no official textbook, here are some recommended references.

- P.G. Goerss and J.F. Jardine, *Simplicial homotopy theory*, Birkhäuser Verlag, 1999.
- C. Weibel, *An introduction to homological algebra*, Cambridge University Press, 1994.

Prerequisite: MATH 323 or similar course. Recommended: MATH 441/841 and MATH 442/842.

Course outline

The topic of this reading course is the Dold–Kan correspondence, which is an equivalence between simplicial abelian groups and (non-negatively graded) chain complexes of abelian groups. The importance of the theorem is the bridge it establishes between topology and algebra. On the one hand, simplicial sets can be used to model topological spaces. On the other hand, chain complexes appear in various parts of algebra and are amenable to computations.

The course will go through some background material on simplicial sets, simplicial abelian groups, chain complexes, and basic homological algebra. Then we will study the constructions involved in the Dold–Kan correspondence, a sketch of the proofs, and some applications. Focus will be put on computing some explicit examples. Possible applications include:

- Models for Eilenberg–MacLane spaces $K(A, n)$ in simplicial sets.
- Non-additive derived functors defined via simplicial resolutions.

Grade determination

- Term paper: 70%
- Oral presentation: 20%
- Drafts and progress updates: 10%

Term paper

The main component of the course is to write an expository paper on the Dold–Kan correspondence, including some background material and a bibliography. Evaluation will be based on accuracy, quality of the exposition, and contribution beyond the literature (in the form of worked examples or filling in details of proofs).

Oral presentation

There will be an oral presentation towards the end of the semester. Evaluation will be based on the presentation itself as well as preparation work.

Missed course work

Information about missed course work can be found in the *Academic Regulations*, section "Deferral of Final Exams or Course Work", available at:

https://www.uregina.ca/student/registrar/resources-for-students/academic-calendars-and-schedule/undergraduate-calendar/sections.html

See in particular the sections "Grounds for Deferral" and "Supporting Documentation".

Academic integrity

Handing in any material copied from the internet or another source is stricly forbidden and will be considered cheating. **Cite sources** that you consult, for instance Wikipedia, Math Stack Exchange, MathOverflow, the nLab, online course notes, or textbooks.

Scholastic offences are taken seriously and will not be tolerated. For more information, please consult the *Student Code of Conduct and Right to Appeal*, section "Academic Misconduct", available at:

https://www.uregina.ca/student/registrar/resources-for-students/academic-calendars-and-schedule/undergraduate-calendar/sections.html

as well as the *Faculty of Science Student Handbook*, section "Academic Integrity", available at:

`https://www.uregina.ca/science/assets/docs/pdf/programpdf/new-student-manual.pdf`

Accessibility

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`https://www.uregina.ca/student/accessibility/`