Math 317, Fall 2015

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Office hours: after class or arranged on request — send e-mail

Course web page
`http://www.math.uchicago.edu/~may/317`

Class: MWF, 1:30 – 2:30, E203
(That is an estimated stopping time, like an airplane's estimated time of arrival.)

Graders:

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Homework: Problems are or will be posted on the course webpage, together with reading assignments: not all required material will be fully covered in the lectures.*
When posted in advance, problems may be subject to change, but with notice.
I'm assuming that the problem sets do not have to be printed out for you.

An assignment will be given every week. Problems are to be turned in one week from the time they are handed out. While late problems will be accepted, they may not receive full credit. Problems are meant to help learn how to write: do not give pages of pointless detail, but do be convincing. Use your judgment.

You are not expected to do every problem perfectly. You are expected to try every problem and to complete as many as you can. You are encouraged to collaborate. The goal is to reach full understanding, no matter how. You are expected to write up your work carefully and rigorously. No phrases like "it is obvious", "it is trivial", "it is clear", or anything else of that sort.

No R's will be given to people who do most of the homework and get most of it right in a reasonably timely and readable fashion; C's will be given if there is serious lack of understanding or if a significant portion of the homework is not done or is often done late. *Late packets of homework are unfair to the grader.* As a rough guideline, I expect people to complete, *accurately*, at least 75% of the homework problems. The more the better. I do look over the homeworks myself. But the problems are intended to be fun: do what you can, and don't agonize over them. Work together, but write up the problems by yourself.

Exams: I hate them. However, there is an argument for them in the Fall quarter. I'll probably give a take home midterm and a take home final. We will see.

The goals of the course are mixed and perhaps conflicting: to explain basic algebraic topology, including homotopy theory and homology and cohomology theory at least through the Poincaré duality theorem; to explain basic related homological algebra; to introduce categorical language and ways of thinking; to give some idea of "homotopical algebra", the general methodology developed by algebraic topologists but applicable to many other fields, and to give at least an impressionistic view of some more advanced topics in algebraic topology.

The lectures will sometimes closely duplicate the text, sometimes explain parts of it without going into detail, sometimes be discursive and digressive.* Interruptions and questions are more than welcome. Classes start promptly at 1:30, please.

The text is my book A concise course in algebraic topology, University of Chicago Press, available free at

`http://math.uchicago.edu/~may/CONCISE/ConciseRevised.pdf`

The basic material to be covered is in Chapters 1-21. At least capsule introductions to the material in Chapters 22-25 will surely be given, if only in digressions, and other topics will likely crop up in digressions to digressions.*

Some may find Concise too concise. You are invited to use other books to supplement. A list of textbooks is given on page 232 of Concise. There are others that are more recent:

Allen Hatcher. Algebraic Topology. Cambridge University Press
`http://math.cornell.edu/~hatcher/AT/ATpage.html`
Since Hatcher's book has become standard (although from a Chicago standpoint I view it more as an advanced undergraduate text), I will give a comparison. It covers roughly the same material as the first 22 chapters of my book, but from a different, and complementary, perspective. Its focus is on a direct and efficient approach to the topology that maximizes geometric intuition and minimizes general theory and relationships with other fields. For example, I introduce categories and functors on page 13 and limits and colimits on page 16. Hatcher introduces categories and functors on page 161 and limits and colimits on page 311 (and then only for groups). I often use the algebraic topology to introduce and illustrate general ideas that are interesting and important in their own right. Hatcher introduces general ideas only when it is absolutely impossible to avoid them. His approach may well be better suited for a first introduction to algebraic topology. Mine is intended to double as an introduction to a wider circle of mathematical ideas.

Another very good book, at roughly the same level as mine but certainly not concise:
Tammo tom Dieck. Algebraic topology. EMS Textbooks in Mathematics.
220 pages on homotopy theory, 100 pages on homology, 90 pages on bundles and manifolds, only getting to cohomology, 90 pages, on page 405. There are two technically novel chapters beyond that. Perhaps more difficult, certainly more detailed, than Concise.

James F. Davis and Paul Kirk. Lecture Notes in Algebraic Topology. Graduate Studies in Mathematics, 35, American Mathematical Society.
This book is also a little more advanced and geometric. It assumes that you have already seen the fundamental group, covering spaces, CW complexes, and singular homology.

Marcelo Aguilar, Samuel Gitler, and Carlos Prieto. Algebraic topology from a homotopical viewpoint. Springer Verlag.
This book is somewhat similar in spirit to mine, but slower, more elementary, and more detailed. It says almost nothing about relations with other fields, including geometric topology. For example, it says nothing about manifolds and Poincaré duality and as little as possible about homological algebra and categorical concepts.

* Limerick (author Unni Namboodiri)
There once was a professor named May,
who when asked about his teaching would say
"to avoid making goofs
I leave out the proofs
and go ten times faster that way".

But that was 35 years ago; with your help I should be able be able to slow down.