

## SYLLABUS FOR MATH 191, SPRING 2018

**Instructor:** Morgan Weiler  
**Location:** Tu&Th 2-3:30, 2 Evans  
**Email:** morgan.w@berkeley.edu  
**Website:** [https://math.berkeley.edu/~morganw/spring\\_2018/191/191\\_main.html](https://math.berkeley.edu/~morganw/spring_2018/191/191_main.html)  
**Office hours:** W 12-2 and by appointment for project meetings, 1039 Evans  
**Faculty advisor:** John Lott  
**Textbooks:** *The Knot Book*, Adams (required);  
*Topology from the Differentiable Viewpoint*, Milnor (recommended)  
other resources will be made available

**Prerequisites:** Familiarity with mathematical proofs at the level of Math 55 and at least one of Math 110 or Math 113 (can be taken concurrently). Math 104 encouraged. Most importantly, curiosity and a willingness to work on open-ended problems!

**Description:** This class will prepare you to do your own investigations into the theory of knots, culminating in a self-chosen open-ended project. Topics to be covered include representing knots and links, projections, Reidemeister moves, examples of knots, operations on knots, prime decomposition, fundamental group, simplicial homology, numerical invariants, polynomial invariants. Additional topics will be based on student interest, e.g. fibered knots, categorification of invariants, knots in low-dimensional topology, hyperbolic knots and three-manifold geometry, knots in contact and symplectic geometry, links of singularities.

Details about the requirements for the short and long projects will be posted on my webpage. These will both include weekly meetings during office hours and a paper (3-6 and 7-10 pages) as well as an in-class discussion (short project) and 15 minute presentation (long project).

If you require DSP or other accommodations, please let me know as soon as possible.

Here is a rough outline of the **course schedule**:

- January:** Knot presentations, operations, taxonomy, basic invariants; isotopy, fundamental group.
- February:** Knot polynomials, short project planning meetings, simplicial homology.
- March:** Spillover. Euler characteristic and simplicial homology, short project meetings, discussion, and due date (second week of March); long project planning meetings.
- April:** Categorifying polynomial invariants. Knots in low-dimensional topology.  
Hyperbolic geometry and knots. Long project meetings and presentations (last week of April).
- May:** Long project presentations and due date.

### Assignments and grading:

**Long Project and Presentation:** 50%

**Short Project and Discussion:** 20%

**Homework and Readings:** 15%

**Attendance and Participation:** 15%

You can miss up to 2 class meetings *besides the project presentations* without it affecting your attendance grade, however, if you do, please make sure to meet with me to make sure you are caught up on the material.