MATH 138: KNOT THEORY, KNOT PRACTICE

FALL 2015

Place:	Library 204
Time:	Tuesday Thursday, 10:30–11:50A.M.
Instructor:	Kyle Ormsby (ormsbyk@reed.edu)
Office Hours:	Library 313, times to be determined
Textbook:	*The Knot Book* by Colin Adams
Optional text:	*Knots and Physics* by Louis Kauffman
Website:	people.reed.edu/~ormsbyk/138/

Summary. This course is an inclusive introduction to modern mathematics through the lens of knot theory. We will attempt to answer a fundamental question from topology: *When are two knots the same?* Our approach to the problem will focus on invariants, through which we will see how the notions of number, algebra, and category come to bear on knots. Topics include Reidemeister moves, Conway's theory of rational tangles, Seifert surfaces, Vassiliev invariants, and applications of knot theory in biology and chemistry.

Texts. The course will draw from multiple sources, but will loosely follow *The Knot Book* by Colin Adams, and it is highly recommended that students acquire a copy. Many readings and exercises will be assigned from this book. *Knots and Physics* by Louis Kauffman will serve as a secondary, optional text. Both books are available at the bookstore for purchase and copies are on reserve in the library.

Participation. All of our meetings will place an emphasis on active engagement with knot theory. Students are expected to do assigned readings in advance of class, and to participate in discussions and demonstrations.

Homework. Students will be placed into collaborative homework teams with 3-4 members. On a rotating basis, team members will take on the following roles:

Scribe The scribe is responsible for writing up the team's final solution set. This should be a clean, well-presented document representing the team's collective discoveries.

Reporter The reporter produces a cover sheet for the final solution set which records how group meetings went, how long the team met, and what difficulties or successes the team met. The cover sheet may also include sketches of alternate arguments and descriptions of differences of opinion within the group. Additionally, it must list the members of the team who attended each group meeting and their roles.

Clarifier During team meetings, the clarifier should assist the group by paraphrasing the ideas presented by other group members. The clarifier is responsible for ensuring that everyone in the group understands the solutions to the problems and is prepared to present solutions to the class if the team is called upon.

Date: 1.IX.15.

Manager The manager is responsible for arranging and running the group meetings. If the team has only three members, the manager should also take one of the other roles. When the homework is returned, the manager is responsible for photocopying or scanning the graded solutions and ensuring that all team members receive a copy.

All team members are expected to attempt all exercises before meeting with the team. You should come to the first meeting with a solution to or substantive question about each exercise. It is recommended that teams schedule at least two meetings each week so that the group has time to pool its efforts and focus attention on challenging problems.

Excellent solutions take many forms, but they all have the following characteristics:

- they are written as explanations for other students in the course; in particular, they fully explain all of their reasoning and do not assume that the reader will fill in details;
- they include a paraphrasing of the problem;
- when graphical reasoning is called for, they include large, carefully drawn and labelled diagrams;
- they are neatly written or typeset;[1] and
- they use complete sentences, even when formulas or symbols are involved.

The cover sheet produced by the reporter must be stapled to the front of the solution set and must include:

- each team member's name and role,
- notes on any absences from team meetings, including explanations (if possible),
- dates and times of each meeting,
- comments on how the group worked together, and
- optionally, additional comments regarding the course or the assignment.

Each homework problem will be graded according to the following five-point scale:

5 – Perfect, well-communicated solution.
4 – Right idea with minor errors in mathematics or exposition.
3 – Right idea with major problems in execution.
2 – Incorrect solution with significant idea.
1 – Incorrect solution with relevant idea.
0 – None of the above.

Late assignments *will not be accepted*.

Technology. The use of electronic devices (cell phones, computers, tablets, calculators, *&c*) is strictly prohibited in the classroom without prior authorization from the instructor. That said, legitimate uses of technology (*e.g.*, note-taking) will be accommodated — just talk to me first.

Tests and grades. We will have two take-home midterms and a take-home final exam. All exams are open book, open internet, open instructor. You may not collaborate with your classmates or other individuals on the exam problems. The final presentation of your solutions must be your own and must be properly cited.

Your exams, homework, and class participation will be taken into account in the determination of your final grade.

[1] Interested students are encouraged to prepare solutions in the LaTeX document preparation system. A guide to LaTeX resources is available on the course website.