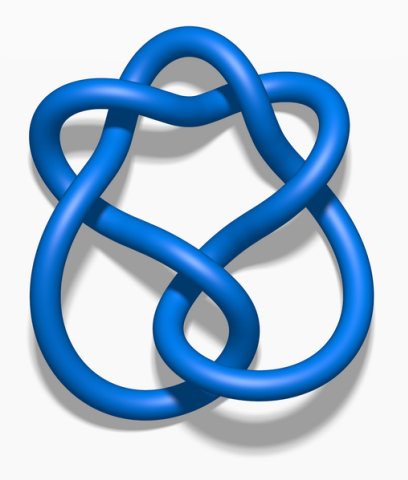
MATH 3094: KNOT THEORY (FALL 2017)

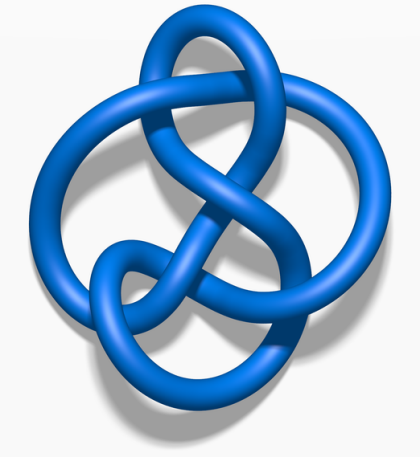
Knot theory is the study of knotted loops in space. See the figure below for examples of two interesting knots. This field, originally developed from a failed attempt in physics to model the structure of an atom, is now an interdisciplinary field within mathematics, with connections to areas such as ***algebra***, ***geometry***, ***graph theory***, ***linear algebra***, and ***topology***.

By applying the tools and machinery of these other mathematical fields, we are often able to determine whether or not two knots are **equivalent**, that is, whether or not we can deform two knots in space to look like each other. A key strategy to distinguish knots is to use **knot invariants**, where a knot invariant is something (a number, a polynomial, a group) associated to each knot so that is has the same value on equivalent knots.

An example of a polynomial knot invariant is the **Jones polynomial**, which can be used to show that the two knots depicted below are not equivalent: the knot on the left has Jones polynomial $t^2 - t + 2 - 2t^{-1} + t^{-2} - t^{-3} + t^{-4}$ and the knot on the right has Jones polynomial $-t^3 + 2t^2 - 2t + 3 - 2t^{-1} + 2t^{-2} - t^{-3}$. Since these are different polynomials, then the two knots are not equivalent. This tells us that, even with an infinite amount of time, we will never be able to deform the knot on the left to be the knot on the right!

In this course, we will explore the field of knot theory and its connections to other mathematical areas.





Prerequisites: A course in ***multivariable calculus*** (e.g. Math 2110Q: Multivariable Calculus or Math 2130Q: Honors Multivariable Calculus), a course in ***linear algebra*** (Math 2210Q: Applied Linear Algebra), and ***a course in proof writing*** (Math 2710: Transition to Advanced Mathematics or Math 2141Q: Advanced Calculus). Enrollment requires instructor permission.

Questions? Email the instructor, Adam Giambrone, at `adam.giambrone@uconn.edu`.