

Nobody Solves the Quintic Web Site

There is a truly lovely and relatively easy topological proof of one of the most fundamental results of Galois theory, that there isn't a "formula" for solving equations of degree 5 and up. I have given talks to explain that proof (e.g., <http://drorbn.net/cumc20>, <https://www.math.toronto.edu/~drorbn/Talks/Sydney-1708>, and <https://www.math.toronto.edu/~drorbn/Talks/CMU-1504/>) and they are on video. But the animations I have used are clunky and need to be modernized. Would you be interested in doing that?

At minimum you will need to re-implement the animations in my talks so as to run stably within a web browser. Even better if you will be able to add and improve, perhaps making it into a full web site explaining and exploring the proof.

Requirements. You must learn and feel fully comfortable with the proof and you must care for presentation. You must feel comfortable with graphics programming. You will have to show me that you have relevant experience.

Warnings. There is a fair chance that I will be away for a good portion of the summer, or possibly even for all of it. So much of our communications will have to occur over zoom. Given my time constraints, only absolutely excellent students will be considered, and it is very possible that no one will be chosen.

Posted on November 4, 2024.

Status. Not assigned. If you are interested, see [Summer Research Awards for Undergraduates](#) on the math department web site.

Drawing Large Knots and Seifert Surfaces

The software I currently have for drawing large knots wastes a lot of real estate (e.g., <https://drorbn.net/AcademicPensieve/Talks/UBC-241004/DK300SnapPyDiagram.pdf>). It ought to be possible to do better! Would you try? As for [Seifert surfaces](#), I don't even have a general program (though see some [pictures](#) and an [illustration](#)). Would you fix that?

Requirements. You must care for aesthetics and have ideas how to make it better. You must feel comfortable with graphics programming in Mathematica. You will have to show me that you have relevant experience.

Warnings. There is a fair chance that I will be away for a good portion of the summer, or possibly even for all of it. So much of our communications will have to occur over zoom. Given my time constraints, only absolutely excellent students will be considered, and it is very possible that no one will be chosen.

Posted on November 4, 2024.

Status. Not assigned. If you are interested, see [Summer Research Awards for Undergraduates](#) on the math department web site.

Knot Families and their θ Invariant

The primary purpose of this project will be to code as many “families” of knots as you can identify in a way that will be clean and useful for others. A secondary purpose will be to compute the θ invariant of many knots in these families, in the hope of finding patterns and making conjectures. you may want to listen to my talk at <http://drorbn.net/to24> to see what θ is about.

Examples of families: torus knots, pretzel knots, twisted torus knots [arXiv:2411.13003](https://arxiv.org/abs/2411.13003), knots with diagonal grid diagrams [arXiv:2412.13796](https://arxiv.org/abs/2412.13796), Montesinos knots, double-torus knots (Hirasawa, Murasugi), torti-rational knots, the Conway and Kinoshita-Terasaka families as in [arXiv:2409.03557](https://arxiv.org/abs/2409.03557), ...

Requirements. You must be excellent at combinatorial programming in Mathematica. You will have to show me that you have relevant experience.

Warnings. There is a fair chance that I will be away for a good portion of the summer, or possibly even for all of it. So much of our communications will have to occur over zoom. Given my time constraints, only absolutely excellent students will be considered, and it is very possible that no one will be chosen.

Posted on November 4, 2024.

Status. This project was already assigned in the summer of 2025 (see <https://www.math.toronto.edu/~drorbn/Students/#Lalani>). If it will be assigned again, some work will have to be repeated yet the idea would be to go *beyond*.

Further Ideas

-

Further Retired Ideas

- Implement Fiedler's [arXiv:2506.17738](https://arxiv.org/abs/2506.17738) (paper withdrawn by Fiedler).