CO 739 Combinatorics of Feynman diagrams, Winter 2018
MWF 10:30-11:20 MC 6486

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Outline

We will be studying some combinatorial aspects of Feynman diagrams. There are different sides to it for different tastes. From those with enumerative tastes we will think of perturbation theory as a theory of formal power series with operations which are combinatorial in nature but inspired by the underlying physics. For those with graph theoretic tastes we will think of Feynman diagrams as graphs and investigate interesting structural and algebraic graph theory questions that one wouldn't think to ask without the physical motivation. For those with algebraic tastes we will talk about renormalization Hopf algebras, an interesting class of combinatorial Hopf algebras. For those more physically minded we will look at things from a rigorous discrete math perspective in a way which is both interesting and useful.

You do not need to know any physics to take this course. You should know the very basics of generating functions and graph theory and not be afraid of tensor products. You should know more than that about at least one of enumerative combinatorics, graph theory, algebra, or quantum field theory.

Grading

Homework will be roughly biweekly and due on Fridays in class. For your final project you have a choice of a written project or a presentation (or something else if you can make the case).

Final project 40% Homework 60%

You are welcome to discuss the homework assignments with your classmates, but you must **write them up independently** and **explicitly acknowledge** any discussions. Late assignments may be considered on a case-by-case basis, but **only** if you have contacted me **before** the deadline.

Formalities

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.

[Check www.uwaterloo.ca/academicintegrity/ for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the undergraduate associate dean. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline,
http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm.
For typical penalties check Guidelines for the Assessment of Penalties,
http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals,
http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm.

Note for students with disabilities: Access Ability Services, located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the Access Ability Services at the beginning of each academic term.