

# HMMT Talk Topics

February 9, 2020

## 1 9:00am

1. **Adam Hesterberg**, MIT Postdoctoral Associate in Computer Science, will be teaching **Wagner's Theorem**: The graphs  $K_5$  and  $K_{3,3}$  are nonplanar. In fact, Wagner's Theorem says that a graph is nonplanar if and only if it contains one of those two graphs as a "minor". We'll define minors, prove that theorem, and state the most famous unsolved problem in graph theory, a generalization of the Four-Color Theorem.
2. **Sujay Kazi**, MIT Undergraduate, will teach an **introduction to quantum information**, and how it can be used to win a game with high probability.
3. **Andrew Lin**, MIT Undergraduate, will teach how to use **contour integrals**, a tool from complex analysis, to evaluate some integrals that can't be solved with ordinary calculus.
4. You may choose to attend NO CLASS at 9:00am.

## 2 10:00am

1. **Scott Sheffield**, MIT Professor in Mathematics, will provide an introduction to **martingales**, a topic in probability theory.
2. **Mira Bernstein**, former Tufts and Proof School Professor, will teach **The Scariest Theorem I Know**:  
Say there is a human trait (e.g. probability of being in a car accident) on which two groups (e.g. men and women) differ. Say also that there is a cost or benefit associated with this trait. For example, if your probability of being in an accident is high, then your insurance goes up – that's the cost.  
The theorem says that any algorithm for predicting such a trait will be either biased or unfair. I'll tell you precisely what I mean by "biased" and "unfair" in the talk, but the upshot is that, in some circumstances, there are no fair algorithms for prediction — not because the people who write these algorithms are sexist or racist or careless (though that may be true too), but because perfect fairness in these cases is just mathematically impossible.
3. **Maya Sankar**, MIT Undergraduate, will teach about the **probabilistic method**, a powerful technique to prove combinatorial theorems.
4. **Hahn Lheem**, Harvard Undergraduate, will present an introduction to **RSA encryption** using some number theory fundamentals.
5. You may choose to attend NO CLASS at 10:00am.

## 3 11:00am

1. **Jonathan Gruber**, MIT Professor of Economics, will provide an introduction to **health care reform** in the United States.
2. **Michael Sipser**, MIT Professor of Mathematics, will provide an introduction to the **P vs. NP problem**, a quintessential problem in complexity theory.

3. **Jeffery Yu**, MIT Undergraduate, will teach **Advanced Integration Techniques**, with a focus on the gamma and beta functions.
4. You may choose to attend NO CLASS at 11:00am.

#### 4 1:00pm

1. **Elena Glassman**, Harvard Professor of Computer Science, will be speaking about the Intersection of Artificial Intelligence and Human Computer Interaction: **Interacting with AI**.
2. **Andrew Sutherland**, MIT Professor of Mathematics, will be giving a talk on the **Sum of Three Cubes**, an advanced topic in number theory.
3. **Hahn Lheem**, Harvard Undergraduate, will be teaching an introduction to **Group Theory**, culminating in a proof of Lagrange's theorem and its application to number theory.
4. You may choose to attend NO CLASS at 1:00pm.



	Title	Speaker	Room #
<b>9:00 AM</b>	Wagner's Theorem	Adam Hesterberg	6-120
	Complex Analysis	Andrew Lin	2-190
	Quantum Information	Sujay Kazi	10-250
<b>10:00 AM</b>	Probabilistic Method	Maya Sankar	2-190
	The Scariest Theorem	Mira Bernstein	6-120
	RSA Encryption	Hahn Lheem	2-105
	Martingales	Scott Sheffield	10-250
<b>11:00 AM</b>	US Health Care	Jon Gruber	10-250
	P vs. NP	Mike Sipser	2-190
	Integration	Jeffery Yu	6-120
<b>1:00 PM</b>	Interacting with AI	Elena Glassman	2-190
	Sum of Three Cubes	Andrew Sutherland	10-250
	Group Theory	Hahn Lheem	6-120