

# MANY CHEERFUL FACTS

presents

## The Prime Number Theorem for Graphs

a talk by David Zywina

12:10 am - 1:00 on Wednesday, April 6th, in room 1015.

When studying a finite graph, it is often useful to consider its closed paths. A particularly interesting kind of closed path is one with no immediate back-tracking, which we will call a *prime geodesic*. These "primes" play a role analogous to the usual primes of arithmetic. In particular, the problem of counting prime geodesics of certain lengths, turns out to be very similar to that of the classical *Prime Number Theorem*.

Through Ihara's analogue of the Riemann zeta function, we will explore these new primes. There will also be mention of *Ramanujan graphs* which are connected to the graph-theoretic "Riemann hypothesis".

Finally, time permitting, we will recast everything in a geometric point of view. Replacing our nice discrete graph with something bigger, like a Riemann surface of constant negative curvature.

*I am the very model of a modern Major General,  
I've information vegetable, animal, and mineral,  
I know the kings of England, and I quote the fights historical  
From Marathon to Waterloo, in order categorical;  
I'm very well acquainted, too, with matters mathematical,  
I understand equations, both the simple and quadratical,  
About binomial theorem I'm teeming with a lot o' news,  
With many cheerful facts about the square of the hypotenuse!*

- Gilbert & Sullivan  $P \circ P$