CALIFORNIA STATE UNIVERSITY, LONG BEACH

THE MATHEMATICS COLLOQUIUM

Presents

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Speaking on

Expander and Ramanujan Graphs

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Abstract:
Think of a communications network as a graph. Each vertex represents a person (or a telephone, or a computer) in the network; two vertices are connected by an edge if they can communicate directly with one another. When designing a communications network, one naturally wishes that any message originating somewhere within it will propagate as rapidly as possible. There are various measurements which describe how well a graph spreads messages. One of these is called the expansion constant of the graph. Roughly speaking, the better the expansion constant, the better the network.

A graph is called k-regular if every vertex has degree k. In a large communications network, one wants to minimize the number of edges used (we do this by making all our graphs k-regular and keeping k fixed). If one attempts to create k-regular graphs with more and more vertices, but without increasing the degree (keeping k fixed), the expansion constants of the graphs may very well become infinitesimally small as the networks become poorer and poorer. A family of expander graphs is an infinite sequence of k-regular graphs, with k fixed, such that the expansion constant does not go below a fixed lower bound.

One can also measure expansion of graphs using what is called the spectral gap of a graph, which is closely related to the expansion constant of a graph. Roughly speaking, graphs with the best possible spectral gap are called Ramanujan graphs. Families of Ramanujan graphs are also expander graphs (as long as k is larger than 2).

In this talk, I will give an introduction to this subject. The talk will be accessible to undergraduates. That is, as long as you know what an eigenvalue is, then you will be okay.