Math 9412, Spectral Graph Theory
Summer 2015

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(Presentation Topics)

List of topics for student presentations:

1. **Discrete Selberg trace formula.**
   Refs: Terras (Rep Theory of Finite Groups-last chapter); Forman (determinant of Laplacians on graphs).

2. **Electrical networks on graphs.**
   Kirchhoff's current and voltage laws, Kirchhoff's theorem for resistive networks, Thompson and Raleigh principles.
   Reference: *Random walks and electric networks* by Doyle and Snell. Sternberg, Vol 2.

3. **Perron-Frobenius theorem.**
   Reference: Many refs available, e.g. P. Lax's Linear Algebra.

4. **Vertex and edge Ihara zeta function of a graph. The determinant formula.**
   Reference: A. Terras

5. **The fundamental group and covering space of a graph. Galois theory for graphs.**
   Reference: A. Terras

6. **Spectra of Laplacians on finite symmetric spaces.**
   Ref. A. Terras.

7. **Ramanujan Graphs.**

8. **Kolmogorov complexity.**

9. **Shannon's channel coding theorem.**

10. **The trace formula for regular graphs: discrete path integral approach.**
    Reference: P. Mnev

11. **Ploya's theorem for random walks in 1 and 2 dimensions.**
    References: many refs. available.

12. **Trace formula analysis of graphs.**
    Reference: B. Xiao, and R. Hancock.

13. **Coverings, heat kernels and spanning trees.**
    This is a very nice topic. 2 or 3 of you can team up and present the following paper: *Coverings, heat kernels and spanning trees,* by Chung and Yau.