Department of Mathematics, U.C. Berkeley

Math 240, Alan Weinstein, Fall 2003

Literature Research Assignment

The aim of this assignment is to familiarize you with some of the literature in riemannian geometry, as well as with the techniques for searching this literature, and to give you experience in writing and reading mathematical exposition.

Each student should choose a topic and have it approved by me. A good topic is in the form of a question whose answer may be found by a search of the periodical literature, recent or otherwise. Some samples are given below.

The final output of the project should be a well-prepared report, with a correctly formed bibliography, in the style of a mathematical paper. The format of choice for the paper is LaTeX. You may turn in your paper electronically. (The ideal way to do so will be to post it at a website in "pdf" format; I will explain this later in the semester.) Once the papers are turned in, each person will write a "referee's report" of one of the papers.

Papers written for a similar assignments in my previous courses can be found via my web page (`http://math.berkeley.edu/~alanw`). I hope to produce a similar web "volume" for this year's papers.

On Tuesday, October 14th, the Math Librarian, Ann Jensen, will give a presentation on the use of some of the electronic and paper facilities for searching the periodical literature.

Here is a timetable for the project.

October 2	Initial choice of topic due
October 14	Meet in 450C Moffitt Library for presentation by librarian
October 21	Topic must be approved by this date
November 13	First draft due (hard copy)
November 25	Final version due (duplicate hard copies)
December 4	Last class (discussion of papers, referees' reports due)

A note on citations: If you use a word-for-word (or approximately so) quotation from a published source, you should indicate this clearly, with a reference to the source. You can find guidelines for such citations at

`http://www.lib.berkeley.edu/TeachingLib/Guides/Citations.html`

and, for internet sources,

`http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Style.html`

Here are some sample topics:

- What are the latest "records" for isometric immersion and embedding of manifolds in euclidean spaces of the lowest possible dimension?
- To what extent do the eigenvalues of the laplacian (on functions or forms) determine the geometry of a riemannian manifold?
- How are nonsmooth distance functions used in riemannian geometry?
- What is known about the possible holonomy groups of riemannian manifolds?
- How are harmonic maps used in string theory?
- Why are harmonic coordinates "better" than normal coordinates?
- Which manifolds admit riemannian metrics for which the geodesic flow is ergodic?

You might also try looking at the arXiv or searching on words like "riemannian","curvature" or "minimal" in MathSci or in the Current Contents Index on the Melvyl system to get some ideas for topics.

Another good source of topics is the book, *Riemannian Geometry during the Second Half of the Twentieth Century*, by Marcel Berger (Amer. Math. Soc.).