Math 468 Potpourri: Hyperbolic Geometry

Spring 2012 1:00 MWF HB 453

Professor John Hempel
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Any student with a documented disability needing academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities should also contact Disability Support Services in Allen Center.

See Syllabus for information about the course content.

There are lots of good exercises in Bonahon's book – some are on material central to the subject. I will be recommending some of these for study, and discussion in class. I will use this web page for such recommendations together with any other information I feel could be useful. This could include additional problems, hints, references, announcements, and, perhaps, a pertinent joke.

For discussion beginning on Friday, 1/20, look at 2.2, 4, 7, 10, 11 (and any of the other problems which might be needed for these).

Without geometry life is pointless!

Problem. Let S^n be the n-sphere of radius $1/2$ centered at $(0, \ldots, 0, 1/2) \in \mathbb{R}^{n+1}$. Let $\sigma : S^n \to \widehat{\mathbb{R}^n}$ be stereographic projection from $(0, \ldots, 0, 1)$, and let $\rho : \widehat{\mathbb{R}^n} \to \widehat{\mathbb{R}^n}$ be inversion in the unit $(n-1)$-sphere centered at 0.
Describe the map $\sigma^{-1} \circ \rho \circ \sigma : S^n \to S^n$. Note you only need the case $n = 1$.

Problems for discussion in class: 2.14, 15, 19(at least through (d)).

For a review of some covering space theory try proving the following useful result:

Let $p : E \to B$ be a map which is a local homeomorphism and satisfies the path lifting property. Suppose B is connected, locally path connected, and weakly locally simply connected. Then p is a covering map.

Hint: Show that p satisfies unique path lifting and hence that two maps $f_0, f_1 : Y \to E$ which cover the same map $p \circ f_0 = p \circ f_1$ and agree at a point are equal provided Y is path connected (connected is enough). Then show that for a homotopy $h : I \times I \to B$ the function $\tilde{h} : I \times I \to E$ you get by first lifting $h|I \times 0$ and then lifting $h|t \times I$ for each $t \in I$ is continuous. Deduce That if U is a path connected open set in B with $\pi_1(U) \to \pi_1(B)$ trivial, then each path component of $p^{-1}(U)$ maps homeomorphically onto U via p.

Problems for discussion on 2/10 : 5.5, 5.8, 6.5, 6.6, 6.8.

Problems for discussion: 8.1, 8.2, 8.3, 8.5, 8.6.

Problems for discussion: 9.1, 9.5, 9.6, 9.7, 9.10, 9.11.

This page is maintained by John Hempel (hempel@rice.edu or, link to homepage).
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