MATH 165B - Introduction to

Complex Variables

Names:

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Topic: An interactive exploration of complex valued mappings through visualizations of the Riemann Sphere

Sub Topics:

1. Stereographic Projection.
2. Möbius Transformations.
3. Conformal Mappings.
4. Computer Graphics.

Problem:

I want to make a web application that allows one to visualize Möbius transformations, and Conformal Mappings by Stereographic Projection of the Riemann Sphere onto the Complex Plane.

Following the video Möbius Transformations Revealed by Douglas Arnold and Jonathan Rogness, I want to shine a light atop of the Riemann Sphere that will cast rays through the surface of the sphere onto the Complex Plane.

The semi-transparent grid of the sphere will then be projected onto the plane, the shadow of the sphere on the plane will transform with the sphere as the sphere gets rotated and inverted.

Then we will be able to apply a conformal map to the grid and see the image of the mapping both on the plane and on the sphere, and see what happens under möbius transformation to the image of the conformal map.

Another possible turn of this project is to see conformal mappings as wrappings of the plane onto surfaces. Like when you see yourself in a fun house mirror.

Computations:

I will use the computer language Clojurescript, and the rendering library Reagent, together with a wrapper of three.js called threeagent that allows me to make WebGl powered 3D applications that run in web browsers. On the server side, I will use static web hosting through Amazon Web Services buckets.

You will find the code at: https://www.github.com/rjacuna/sphere

You will find the application at: http://www.drakezhard.org

Bibliography:

Trott, M. The Mathematica GuideBook for Programming. New York: Springer-Verlag, 2004.

Kythe, P. K. Computational Conformal Mapping. Boston, MA: Birkhäuser, 1998.

Needham, T. Visual Complex Analysis. Clarendon Press, 1998

Communications and Work Group Plan:

1. I will constantly remind my right hemisphere to get this done. I'll leave the homework to the left hemisphere for the remainder of the quarter.

2. The files will be uploaded to github.com/rjacuna, and drakezhard.org as soon as any progress is made.

3. Math will be at the center of everything. In fact If I don't use math in this project I won't be able to get anything done.