Topics in Geometry, Math 425-2, Spring 2011

10-10:50 MWF CNS E201

Professor:	Lawrence Stout
Office:	C209C CNS
Office hours:	11-12 M T Th 3-4 M 1-2 W
Phone:	556-3038
e-mail:	lstout@iwu.edu
Web:	http://www.iwu.edu/∼lstout

Text:	Robin Hartshorne, **Geometry: Euclid and Beyond**, Springer, 2000
	Euclid, **Elements**, http://aleph0.clarku.edu/ djoyce/java/elements/toc.html
Software	*Geometer's Sketchpad* available in E204 and (soon I hope) E201

Course Description:

Geometry has been central to what mathematics is and how it is justified for over 2300 years. In the high school curriculum it is often where students are first introduced to proof. A lot of the content and approach was codified, organized, and written up by Euclid. Geometry underwent a revolution when Descartes showed how to do much of it analytically. A second revolution came in the 19^{th} century with the discovery of non-Euclidean geometries (those which violate the parallel postulate). Classic problems in Euclidean geometry (doubling the cube, squaring the circle, and angle trisection) were shown to be impossible by applying techniques that grew into modern algebra. Careful consideration by Hilbert led to a refinement of geometry based on incidence, betweeness, and congruence. The new fields of algebraic geometry, differential geometry, and geometry of numbers grew rapidly in the twentieth century. Projective geometry arose out of considerations of perspective in art. So there is now a large zoo of species of geometry to explore.

The more serious content of this course will be a look at Euclid to see what the earliest part of that tradition is and then a study of how Hilbert filled in some of the logical holes in Euclid's development. We will then look at how non-Euclidean geometries work by changing the parallel postulate in two different ways. The Hartshorne book covers a lot more of this material than we will be able to manage, but it has very good challenging exercises.

On Fridays we'll have hands on fun with other kinds of geometries and other kinds of questions about geometric objects. Possibilities include modern kinds of geometries (finite, digital, fractal, differential, convex), relations with art and mechanical technologies. For those of you who plan to teach I see this as a time for you to develop and try out modules you might use to enrich your teaching of geometry.

Written work and Grading

Part of the reason that I chose the Hartshorne book is that it has a well developed set of challenging problems. A significant portion (about 70%) of the grade in the course will come from written proofs of those problems. I'll ask each of you to choose a topic to present in one of the "fun Fridays" for about 10% of the grade. The remaining 20% will come from the final exam.

Attendance Policy

Classes and office hours are what you pay tuition for, so take advantage of them. I do not deduct points for classes missed.