Math 4060 (Cherry) Geometry Art Project

What to turn in:

- Bring your finished project to class with you on Monday, May 1 for show-and-tell.
- You should also bring a short write-up explaining your project and some mathematics behind it. How much you should write will vary with your project. For some projects, a short paragraph might be appropriate. For other projects, you may want to write a page or two.
- Prior to class on May 1, you should e-mail a good photograph (or photographs or video) of your project to <wcherry@unt.edu>

Who to work with: You may work alone, or you may work in small groups. Projects done by groups will be expected to be better both in terms of artistic quality and mathematical content. For instance, a project done by three people will be expected to be three times as involved or in some way three times better than a project done by one person for the same grade. If you are making only one small thing, your groups should be only one or two people. If you are making several related things, it might make sense for you to have as many people in your group as things you are making, assuming the things are all of comparable complexity. If you are planning some very elaborate dance choreography or other performance art, it may be appropriate to have a larger group, particular if costumes *etc.* will be involved. If you are planning on a group with more than four people in it, you must get your project approved in advance and submit a proposal explaining who in the group will be responsbile for which aspects of the project.

What to do?

The following are some suggestions. You may also search for your own projects, but it may be wise to discuss your ideas with your instructor first.

1. **Rusty Compass.** You may create a pattern that could have been made historically with a "rusty" compass. Your write up should explain how to make your pattern with a "rusty" compass. A more involved project along these lines might make a replica of historical Islamic art, including a detialed descrption of how the piece could be made with a "rusty" compass.
2. **Origami.** Make some geometric objects (for instance a regular pentagon) using the rules of origami. See Hartshorne's exercises 28.12 to 28.16 for origami rules and some ideas. Your write-up related to this project should make a connection to "Hilbert's tools." A larger group project related to origami could be to do all of Euclid's Book I constructions in origami. If you choose this project, be sure you also include a good explanation of the math involved.
3. **Penrose tilings.** Read about Penrose tilings (for example on Wikipedia). Make a related art project and write a short essay explaining Penrose tilings and your project.
4. **Three dimensional polyhedra.** Visit

   `http://www.georgehart.com/virtual-polyhedra/vp.html`

   for a huge collection of ideas. Your project should be more involved than just the Platonic solids. Consider, for instance, a project related to the Kepler-Poinsot polyhedra or the Archimedean Polyhedra. See also the last chapter of Hartshorne. The photographs between pages 460 and 461 of Hartshorne give some examples of simple one-person projects.
5. **Knitting.** sarah-marie belcastro [who insists on spelling her name without capital letters] has some knitting projects:

   `http://www.toroidalsnark.net/mathknit.html`

   sarah-marie's knitting projects that connect well with our course include: the hyperbolic plane and the projective plane. Klein-bottles illustrate more a topological than a geometric concept, but they are fun anyway. A crochet version of the hyperbolic plane (and a lot of related math) can be found here:

   `http://www.math.cornell.edu/~dwh/papers/crochet/crochet.html`

Note, they key to making a crocheted or knitted hyperbolic plane is to increase the number of stitches in a constant ratio as you go out. If you choose a large ratio, like 2, this is quite difficult. You will probably find something like $4/3$ or $5/4$ easier.

6. **Dance Routine.** Choreograph a dance routine illustrating a ruler and compass construction of a regular pentagon. Perform your dance routine and have someone videotape it.

7. **Finite Geometries.** You can think of a creative way to illustrate the points and lines in a finite projective or affine plane (as we studied in section 6 of Hartshorne). If you are less creative, a Google image search will give you some ideas.

8. **Hyperbolic Tesselations.** See Hartshorne's Exercise 39.13 and also:

   `http://aleph0.clarku.edu/~djoyce/poincare/poincare.html`
   `http://en.wikipedia.org/wiki/Hyperbolic_tiling`.

   If you really want to get crazy, do a 3d-version

   `http://en.wikipedia.org/wiki/List_of_regular_polytopes#Tessellations_of_hyperbolic_3-space`

9. **The regular 17-gon.** Do something based on the construction of the 17-gon illustrated on page 257 of Hartshorne.