CS 1301 – Lab 4
3D Design Lab – Design an Object!
(85 points)

Due: Friday, March 27th, 2015 before 11:55 PM EST

THIS IS AN INDIVIDUAL ASSIGNMENT!
You should work **individually** on this assignment. You may collaborate with other students in this class. Collaboration means talking through problems, assisting with debugging, explaining a concept, etc. You may not exchange code or write code for others. For individual assignments, each student must turn in a unique program. Your submission must not be substantially similar to another student's submission. Collaboration at a reasonable level will not result in substantially similar code to another students assignment.

Files to submit:
1. myDesign.scad

2. myDesign.stl

For Help:
· TA Helpdesk – see class website
· Email TAs

Notes:
- **Don't forget to include the required comments and collaboration statement** (as outlined on the course syllabus). **Failure to do so will result in no credit for the assignment!**
- **If any syntax error messages pop up when your TA hits F5/F6 "Compile and Render" to grade your homework files, you will lose 50% of your points!**

Design an Object! (85 possible points)

Your TAs are bored! Your mission for this assignment is to come up with something interesting designed in OpenScad. If it's really super cool, we'll print a physical copy for you. [Note that some objects can not be 3D printed, read below...] Your object design may be of any size, but if you want us to print it, keep in mind that we can't print anything larger than about 100x100x100 mm so we may have to scale your design down if you don't keep it in the appropriate size range. [Technically the Z/height axis can go up to 180mm.....but plastic doesn't grow on trees you know....]

You can download the OpenScad program from here: http://www.OpenScad.org
The manual is here: http://en.wikibooks.org/wiki/OpenSCAD_User_Manual

3D printing details:

The object you design does not need to support 3D printing (We can only print a few objects each semester due to time constraints anyways.) However, if you design your object for 3D printing, it will be considered when we decide which one(s) to print. Things that make an object 3D printable.

- A flat base. The objects are printed on a piece of glass that is flat, so the bottom should either be flat, or have some "legs" that all end at the same flat plane.

- Enough contact with the print base. If your object is an upside down cone, the part that touches the print base won't have enough strength or adhesion to keep the object from falling over when we print it!

- Minimal overhangs. We can print objects with overhangs, but to do so we need to turn on "support material" which adds extra "scaffolds" underneath overhangs to support them from below to keep them from falling down due to gravity. It is possible to have a 45 degree angled beam that will slowly grow upwards without support material, but anything more than about 45 degrees may require support material. (It is also possible to "bridge" a flat area between two support materials without support material, but results can sometimes be less than ideal.) The best way to avoid all of these issues is to try and position your piece with the largest side "down" such that it gets smaller and smaller as it goes up. For example, if you designed a table with 4 legs, flip it upside down using a rotate() command so that it prints with the "top" of the table against the build plate, and the legs sticking up into the air.

- Judicious use of plastic. Plastic costs money, and the more plastic your design uses, the longer it takes to print. We can make the interior of your object "honeycombed" to save on the amount of plastic we use, but if you design it to be hollow from the start it saves even more time and plastic. A wall that is 5mm thick will be plenty strong for most uses.

Grading criteria:

- **(15 pts)** Your documentation and the OpenScad code (comments, variable names, etc.) should explain what the object is, what it's for, and what gave you the idea for it.
- **(45 pts)** Your object should demonstrate that you understand and are proficient with fundamental CSG and OpenScad principles such as:
  1. Variables, modules and module calls.
  2. Looping/iteration and conditional execution.
  3. Solid primitives such as cube, cylinder (and cones!), spheres, etc.
  4. Transformations such as rotate and translate, along with blocks.
  5. Unions, intersections, and differences of solid objects and other CSG features such as hulls. (note that you don't have to use all of these operations, but you should demonstrate that you know how a few of them work.)

- **(20 pts)** Your design file (.scad) should compile and render correctly without any errors when the user hits the F6 key. [If the F5 render option doesn't give output that is very similar to the F6 output, please document this in your code.]

- **(5 pts)** Your object should do something useful, or look cool, or be both useful AND cool!

Idea Hints: If you can't think of something you want to do, here are a few suggestions:
- Make a model of your favorite building.
- Design a replacement part for a common object.
- Make a cool looking box or vase.
- Make a case or holder for a phone, camera, or other electronic device.
- Build a whirligig or moving toy.
- Model an animal (harder than it sounds with OpenScad!)

Turning it In:
Please submit your file, myDesign.scad to T-Square before the deadline. Also be sure to use the "Compile & Render" option (F6) to compile/render your design, and then use the "Design->Export as STL" menu option to save an STL (object) version of your design. This allows our TA's to look at your STL file without having to wait for the compile & render step to complete (if you have a complicated design, it may take extra time).

Note that you will not be able to open or view the .STL file on your computer without using a piece of software such as MeshLab – http://meshlab.sourceforge.net