ACCESS 2007
Week 4 Group Assignment

Part I: Making fractals:

(1) Reconstruct a fractal: For one of the interesting fractals in the class notes or on our web page, reconstruct the affine maps from the mapping L-picture. Check your work with the TESTMAP procedure, and when you get the template right regenerate your fractal. (Depending on which fractal you choose, you may find that you need to do some fine-tuning of the parameter values to get the fractal as nice as you would like.) Explain how you use the L-diagram to reconstruct the parameter values of the affine transformations; explain this reconstruction in detail for just one of your transformations. This explanation may be inserted as text into your Maple fractal file, or you can write the explanation in MS Word.

If you use Word for your explanation, and wish to display mathematical formulas, symbols, or equations, you can use the "Insert/Object" menu choice, and (at least in Marriott) use the "CorelEquation!2.0" equation editor. If you prefer instead to write your explanation in the Maple fractal file, you can display mathematics in text fields by first creating it as output of a Maple command, then copying and pasting the Maple output into the text field. (I used this trick for the bmi.mws file, for example.)

(2) Make an original fractal: perhaps you have a shape you want to create, or maybe you want to see what kind of fractal you get from an interesting template. Experiment! Make something that you would be proud to have in the on-line art gallery. If your group finds several fractals you really like please send them to us, but one will suffice. I've already seen some really beautiful examples of your work, and may ask some of you if I can post your creations.

Part II: Power laws and the Body Mass Index:

(3) Find the power law which best fits our ACCESS height-weight data, by starting with the **bmi.mws** file on our home page, importing the ACCESS height-weight data from the appropriate link, and reworking the calculations. As necessary change both the text and command details, in order to create a document which explains and shows the power law you derive. At the end of this document create a **single** display which includes the following items (perhaps using different colors and a key to explain which curves are which):

(a) our class height-weight data points

(b) the graph of the power law function you found

(c) the graph of the power law function which was obtained from the national data, in the bmi.mws file.

(d) the curve of points for which BMI = 18.5 (the current lower recommended bound for adults).

(e) the curve of points for which BMI = 24.9 (the upper recommended bound for adults).

Using this display, discuss how well the BMI seems to fit with our data and the national data, compared to the two other power laws. Focus separately on children and adults in this discussion.

(4) Research BMI, and write a short (e.g. 4-6 page) report on what you find. I know from past years that there is some great original source material hidden in Marriott Library, but in order to find it you might want to first do an internet search to find the historical name attached to the BMI index. Some interesting questions to answer are:

(a) What is the B.M.I. and how is it applied?

(b) When was BMI originally invented, and by who? Was a different power suggested in case one wished a power law which included children as well as adults? (Hint: the answer to this question is yes, but not even Wikipedia knows it yet.)

(c) How do BMI tables and guidelines get modifed for children?

(d) Some on-line references explain the different BMI ranges for children as being (mainly) because body fat and muscle composition changes as people grow up. Such references also sometimes explain the fact that very tall people (like basketball players) have high BMI's because of all their muscles. For example, Karl Malone's height of 6-9 and weight of 256 lbs yields a BMI of 27.4, i.e. "overweight." Even skinny Andrei Kirilenko's height of 6-9 and weight of 225 lbs yields a BMI of 24.1, near the upper recommended range. You guys might not remember her, but Mary Lou Retton was a famous short, muscular gymnast, with height 4-9 and weight 92 pounds, for a BMI of 19.9 - almost underweight???? My (Nick's) thesis is that one of the main reasons why you have to change BMI ranges for different heights (hence also for children's ages), is that BMI is based on the wrong power...so you shouldn't do age-based BMI at all, rather it should be height based. Or, if you used the correct scaling law, you could have a universal BMI for everyone, at least after their baby fat goes away at age 5 or so. Scientifically attack or defend my thesis, based on your mathematical work (in particular (3e)), further calculations, or on whatever reasoning and resources you can find. Remember Jon Seger's advice - it is your scientific job to question conventional wisdom and to support your own conclusions.

Due date and what you should email us:

Nick (njk4@utah.edu) and Jen (guajardo@math.utah.edu) should receive your work on Thursday July 12, before midnight. Each group should send a single email, with attachments for parts (1)-(4) above. For parts (1), (2), (3) above, send ".mws" attachments **with the output removed** - we will regenerate everything from your commands, by executing your worksheets. (For the fractal work we will first load the procedures in "Lpictures.mws."). Make sure this process will work with your files, before you send them! For part (4), and possibly for the explanation part of (1) you may use your favorite word processor, e.g. M.S. Word. Have fun!