CS 109 – C/C ++ Programming for Engineers w. MatLab– Summer 2012
Homework Assignment 6
Using Barycentric Coordinates Using Matlab

Due: **Wednesday 25 July by 8:00 a.m., via Blackboard.** Optional hard copy may be turned in during lab on Thursday.

Overall Assignment

For this assignment, you are to repeat homework assignment 1, using Matlab instead of C++, and using vectors to show the interpolated function values for a range of barycentric coordinates.

Program Details

- First write a Matlab m-file that performs the same as for homework assignment 1. See that assignment (still posted on the course web site) for full details. (You do not need to hand in this initial version of your Matlab script.)
- Then modify the script to ask the user for ***ranges*** of barycentric coordinates, for both λ_1 and λ_2:
  - For λ_1, ask the user for a minimum value, maximum value, and an increment between values (a delta value). Then use the colon operator to generate a vector of values for λ_1.
  - For λ_2, ask the user for a minimum value, maximum value, and the number of values desired. Then use linspace( ) to generate a vector of values for λ_2.
  - With a range of barycentric coordinates, the λ values in the equation:

$$f(r) = \lambda_1 f(r_1) + \lambda_2 f(r_2) + \lambda_3 f(r_3)$$

  - will have to be two-dimensional matrices, with the number of columns equal to the number of values for λ_1 and the number of rows equal to the number of values for λ_2 . Do this as follows:
    - Keep λ_1 as a row vector, and use repmat( ) to copy the row as many times as there are elements in λ_2. (Size( ) or length( ) may be useful functions.)
    - Transpose λ_2 to a column vector, and then use repmat( ) to copy the column as many times as there are elements in (the original) λ_1.
    - The result should be two rectangular matrices, each having as many columns as the original λ_1 and as many rows as the original λ_2. These can be subtracted from 1 to generate λ_3.
- **Input:** Your program should ask the user for the function values at the three vertices of the triangle, and the barycentric coordinate information specified above.
- **Output:** The main result is a table, with column headings corresponding to the values of λ_1 , and row labels corresponding to the values of λ_2 .

Notes:

- Since we have not learned decision-making in Matlab yet, you do not have to check user input, and it is acceptable for function values and barycentric coordinates to have any values.

What to Hand In:

1. Your code, **including a readme file,** should be handed in electronically using Blackboard.
2. The purpose of the readme file is to make it as easy as possible for the grader to understand your program. If the readme file is too terse, then (s)he can't understand your code; If it is overly verbose, then it is extra work to read the readme file. It is up to you to provide the most effective level of documentation.
3. If there are problems that you know your program cannot handle, it is best to document them in the readme file, rather than have the TA wonder what is wrong with your program.
4. Make sure that your name appears at the beginning of each of your files. Your program should also print this information when it runs.
5. You may also hand in a hard-copy printout of your program and readme file at the ***beginning*** of lab on the week of the assigned due date.

Optional Enhancements:

It is course policy that students may go above and beyond what is called for in the base assignment if they wish. These optional enhancements will not raise any student's score above 100 for any given assignment, but they may make up for points lost due to other reasons.

- Generate a surface plot showing the interpolated function value as a function of λ_1 and λ_2.
- Check user input, and restrict λ to a reasonable range, say -1.0 to 2.0, (i.e. within one λ of being interior to the triangle.)
- Change all values of the interpolated function results for which any λ lies outside the range of (-1.0 to 2.0) to NaN, which means "not a number". Then re-plot the data and see how the plot has changed. (If you restrict λ_1 and λ_2 to the limited range to begin with, then you only need to check λ_3.)
- Transfer your plots into a MS Word document, for use as your "readme" documentation.
- Other enhancements that you think of – Check with TA for acceptability.