CS1112 Fall 2012 Project 1 due Thursday 9/6 at 11pm

You must work either on your own or with one partner. If you work with a partner you must first register as a group in CMS and then submit your work as a group. *Adhere to the Code of Academic Integrity.* For a group, "you" below refers to "your group." You may discuss background issues and general strategies with others and seek help from the course staff, but the work that you submit must be your own. In particular, you may discuss general ideas with others but you may not work out the detailed solutions with others. It is not OK for you to see or hear another student's code and it is certainly not OK to copy code from another person or from published/Internet sources. If you feel that you cannot complete the assignment on you own, seek help from the course staff.

Objectives

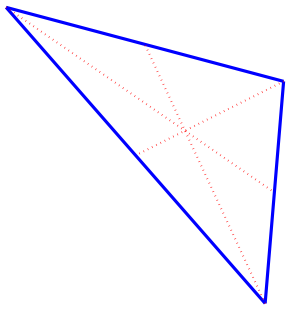
Completing this project will help you learn about MATLAB script, branching, and some MATLAB built-in functions. You will also start to explore MATLAB graphics.

1 Approximating the perimeter of an ellipse

Complete exercise **P1.1.6** in Chapter 1 of *Insight*. Save the script as `ellipseApprox.m`.

Write your answer to the last question of exercise **P1.1.6** as a comment at the end of your program. Note that your program solicits only one value for a and one value for b. Answer the last question by running your program multiple times, with different values for a and b.

2 Centroid of a Triangle



Given a triangle, one can construct the centroid by drawing the three medians of the triangle, which meet at the centroid. A median extends from a vertex to the midpoint of the opposite side. You will modify a given script to draw a random triangle, accept a user's guess (mouse click) of the centroid, and evaluate the user's guess.

(a) Triangle, mouse click, medians

Download the file `randTriangle.m` and run it. A graphics window showing three points connected by two lines will pop up. The message near the top (the title area) says to click in the window. After you click, a black asterisk marks the clicked point and its coordinates are given in the title area.

Read the program to make sure you understand what it does. Don't worry about the early commands to set up the figure window, but here's how the `plot` statement works: `plot(x,y,'bo')` draws a marker at the point (`x`,`y`) with the format "blue circle"; `plot([x1 x2],[y1 y2]),'k:')` draws a line from the point (`x1`,`y1`) to (`x2`,`y2`) with the format "black dotted line." Other formats are explained in the program comments. The statement `[xu,yu]=ginput(1)` accepts one mouse click by the user and stores the x- and y-coordinates of the click in the variables `xu` and `yu`, respectively. A statement `title('hello there')` would display the text 'hello there' as the title of a figure. The `sprintf` statement works just like `fprintf` in formating text, but instead of printing directly to the Command Window, `sprintf` allows the text to be saved under a variable name. Then this text (string) variable can be used in other statements, such as the `title` statement as shown in the program.

Now modify the program:

1. Connect the three points (x_1, y_1), (x_2, y_2), and (x_3, y_3) with solid lines in a color of your choice to draw a triangle. Use the same marker type and color for all three vertices.

2. Change the fixed locations of the second and third points (see the comments in the code) to randomly generated coordinates within the interval (1,9) for both x and y. *Hint*: The statement `v = rand` assigns to variable `v` a random number in the range of 0 to 1. So how do you get a random number within a different range? First, the statement `v = rand` gets you a real number in the range of 0 to 1. Next, scale (think multiply) and shift (think add) the value `v` as necessary to get the range you need.

3. Change the message that solicits a mouse click to "Click on the centroid."

4. *After accepting and drawing the user's mouse click,* draw the three medians using dotted lines in a color different from that of the triangle. Note that the midpoint on a line with endpoints (x_1, y_1) and (x_2, y_2) is
$$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right).$$

5. Compute the centroid and mark it on the figure with a marker type different from the vertex markers. The centroid of a set of three points, (x_1, y_1), (x_2, y_2), and (x_3, y_3), is
$$\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3} \right).$$
In other words, the centroid is the average and x- and y-coordinates.

(b) Is the guess any good?

Replace the final message in the title area of the figure to indicate how good the user's guess is. If the click is really close, say, no more than 0.1 unit distance from the centroid, display the message "Difference is x. Good stuff!" where x is the distance from the centroid shown to two decimal places. If the click is more than 0.1 unit from but within 1 unit distance of the centroid, display the message "Difference is x. Not bad." Otherwise display the message "Difference is x. Way off." Forgot the distance formula? See Appendix B in *Insight*.

3 Quadratic Function

Complete exercise **P1.2.8** in Chapter 1 of *Insight*. Save the file as `minAndMax.m`.

Submit your files `ellipseApprox.m`, `randTriangle.m`, and `minAndMax.m` in CMS.