EGR 110 Due Date: In one week
Engineering Graphics
File: N110MA4

MATLAB Assignment #4

Reading Assignment:
MATLAB Lecture #4
MATLAB Handout

MATLAB Assignment:

1. (33 points) Recall your earlier MATLAB program to calculate the 3 angles in a triangle after prompting the user to enter the three sides. At that time you were not required to check to make sure that the sides were valid. A triangle with sides A, B, and C is valid if all of the following conditions are true:
   - A>0
   - B>0
   - C>0
   - A<B+C
   - B<A+C
   - C<A+B

   Rewrite your MATLAB program such that it will test for valid inputs using a single test. The program should either print out an error message that the inputs are not valid or else print out the values of the three angles in degrees.
   Run the program 7 times, including 6 cases where the triangle is not valid (corresponding to the 6 cases above) and 1 case where the triangle is valid (use on of the examples provided on the earlier assignment). Turn in a printout of the program and a printout showing the 6 test cases. Include plenty of comments in your program.

2. (33 points) Write a MATLAB program to prompt the user to enter a value of x and y corresponding to the (x,y) coordinates of a point in the Cartesian coordinate system. The program should then display one of the following prompts:
   - The point is on the x-axis
   - The point is on the y-axis
   - The point is in the first quadrant
   - The point is in the second quadrant
   - The point is in the third quadrant
   - The point is in the fourth quadrant.

   Test the program for all 6 cases. Turn in a printout of the program and a printout showing the 6 test cases. Include plenty of comments in your program.

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3. (34 points) Write a MATLAB program to find the roots of a second order polynomial equation of the form $ax^2 + bx + c = 0$.
   Recall that the quadratic equation can be used to find the roots as follows:

$$\text{Root1, Root2} = \frac{-b \pm \sqrt{b^2 - 4 \cdot a \cdot c}}{2a}$$

   Also recall that the roots may be real and distinct, repeated, or complex as described below.

Real, distinct roots $(b^2 > 4 \cdot a \cdot c)$:

$$\text{Root1} = \frac{-b + \sqrt{b^2 - 4 \cdot a \cdot c}}{2a} \qquad \text{Root2} = \frac{-b - \sqrt{b^2 - 4 \cdot a \cdot c}}{2a}$$

Repeated roots $(b^2 = 4 \cdot a \cdot c)$:

$$\text{Root1} = \text{Root 2} = \frac{-b}{2a}$$

Complex roots $(b^2 < 4 \cdot a \cdot c)$:

$$\text{Root1} = \frac{-b}{2a} + \left(\frac{\sqrt{4 \cdot a \cdot c - b^2}}{2a} \right) i \qquad \text{Root2} = \frac{-b}{2a} - \left(\frac{\sqrt{4 \cdot a \cdot c - b^2}}{2a} \right) i$$

   Specifically, the program should:

- Display a brief description of the program and the form for the quadratic equation.
- Prompt the user to enter values for a, b, and c.
- Test to see if the roots are real & distinct, repeated, or complex. Display the type of roots and the value of the roots as shown in the three examples below. Display an error message if A, B, or C are equal to zero.
- Run the program for the three examples below and one case where A, B, or C are equal to zero.
- Turn in a printout of the program and a printout showing the 3 example cases. Include plenty of comments in your program.
- Note that there is a function called **roots** in MATLAB which can be used to find roots of polynomials. You cannot use this function or any similar function in this assignment.

Example 1: $x^2 + 30x + 200 = 0$
Program Output:
Roots are real and distinct
Root 1 = -10
Root 2 = -20

Example 2: $2x^2 + 24x + 72 = 0$
Program Output:
Roots are repeated
Root 1 = Root 2 = -6

Example 3: $x^2 + 8x + 25 = 0$
Program Output:
Roots are complex
Root 1 = -4 + 3i
Root 2 = -4 - 3i