

92.272 Introduction to Programming with MATLAB
Homework on Programming Structures (Due 3/30)

Please email me a script file containing the commands you used to answer these questions.

1. Write a script file that asks the user to input three real numbers a , b , and c and then calculates and displays the real root(s), if any, of the quadratic $ax^2 + bx + c$. If there are 2 distinct real roots, the output should be "There are two distinct real roots:" followed by the values of the roots. If there is a single real root, the output should be "There is one real root:" followed by the value of the root. If there are no real roots, the output should be "There are no real roots." Test your code on the quadratics $x^2 + 2x + 5$, $x^2 - 5x + 6$, and $x^2 - 6x + 9$.
2. Write a script file that asks the user for a positive integer n greater than 2 and then generates and prints an array of length n containing the first n Fibonacci numbers. The Fibonacci numbers are the numbers 0, 1, 1, 2, 3, 5, 8, 13, ... Each Fibonacci number after the second is the sum of the previous two.

3. (From Gilat, *MATLAB: An Introduction with Applications*)

The Sierpinski triangle can be implemented in MATLAB by plotting points iteratively according to one of the following three rules which are selected randomly with equal probability.

Rule 1: $x_{n+1} = 0.5x_n$, $y_{n+1} = 0.5y_n$

Rule 2: $x_{n+1} = 0.5x_n + 0.25$, $y_{n+1} = 0.5y_n + \frac{\sqrt{3}}{4}$

Rule 3: $x_{n+1} = 0.5x_n + 0.5$, $y_{n+1} = 0.5y_n$

Write a script file that calculates the x and y vectors and then plots y versus x as individual points. (Use `plot(x,y,'^')`) Start with $x_1 = 0$ and $y_1 = 0$. Run the program four times, first with 10 iterations, then 100 iterations, then 1,000 iterations, and finally with 10,000 iterations. (Hints: The command `rule = randi([1 3])` will generate a 1, 2, or 3 with equal probability. You might want to use a `switch - case` structure inside a `for` loop.)

4. Approximate the value of the sum $\sum_{n=1}^{\infty} \frac{-1^{n+1}}{n}$ by computing a partial sum $\sum_{n=1}^N \frac{-1^{n+1}}{n}$. Use a `while` loop that terminates when the difference between two successive approximations is less than 10^{-5} (1.e-5 in MATLAB notation).

Compare the value you obtain with the number $\ln(2)$.