

Math 302: Problem Set 5

Due: October 15, 2009 Notice: Due in 2 weeks

Email me your m-files and results as attachments in ONE email with each m-file having the format `firstname_lastname_prob.m`. Be sure to comment your code so I can follow it.

1. (50 points) Taylor Polynomials
 - (a) (15 points) Write a function named `taylorexp.m` that takes as input a natural number n (check it!) and a number or vector x . If P_n is the n -th Taylor Polynomial for e^x at $a = 0$, (otherwise known as the Maclaurin Polynomial for e^x), the function should return the computed value(s) $P_n(x)$.
 - (b) (5 points) Use your above function to estimate e using $n = 2, 5, 10$. Write down the answers in your comments
 - (c) (10 points) Plot $y = e^x$, P_2 , P_5 , and P_{10} on the same graph for $x \in [-5, 5]$. Make sure that you make a difference between the curves and label them appropriately. Limit the y -values to between 0 and 10. Call this graph `hw51c.jpg`.
 - (d) (10 points) Plot $y = e^x$, P_2 , P_5 , and P_{10} on the same graph for $x \in [-1.5, 1.5]$. Make sure that you make a difference between the curves and label them appropriately. Limit the y -values to between 0 and 10. Call this graph `hw51d.jpg`.
 - (e) (5 points) Based on the graphs, what can you say about what happens to P_n as n gets larger (in relation to $f(x) = e^x$)? Write your answer in the comments.
 - (f) (5 points) Based on the graphs, what would you need to do to use your function to estimate e^x accurately for x far away from 0? Write your answer in the comments.
2. (50 points) We will be growing ferns by random repetition of a few simple matrix/vector transformations. For each step a random number is generated and dependent on the number one of four possible transformations occur. Your new program `drawfern.m` should successively generate a random number and should
 - apply $z = [00; 00.16] * z$ with probability 0.01
 - apply $z = [0.850.04; -0.040.85] * z + [0; 1.6]$ with probability 0.85
 - apply $z = [0.2 - 0.26; 0.230.22] * z + [0; 1.6]$ with probability 0.07
 - apply $z = [-0.150.28; 0.260.24] * z + [0; 0.44]$ with probability 0.07

starting with $z = [0; 0]$. This recursion should occur a user-defined n times. You should accomplish this with a single if clause, although, given that your logic now forks four ways, you will want to make use of some subordinate `elseif` statements. Note: To make your code run faster there should be only 1 `plot` statement.

Grading: 15 pts for plot called `fern.jpg` for $n = 10000$, 20 pts for code, 10 points for correct indentation, 5 pts commenting

Bonus: 5 pts Adapt the code to make a new fern called `fernBonus.jpg`