Homework 2

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Assignment Date: Monday (06/08/2020)

Collection Date: 06/15/2020 Monday 11:59PM by Email

Grade: Total 20 points

Email Address: sbu.ams326d@gmail.com

Please do both problems and each is worth 10 points.

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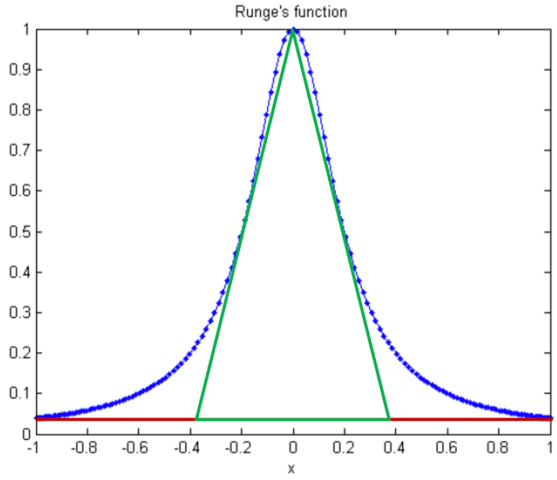
Problem 2.1 (10 Points) The Runge's function $y = \frac{1}{1+25x^2}$ is shown as:



Now, a horizontal line (red line) $y = \frac{1}{1+25}$ is drawn to form a closed area with the Runge curve. Now, I want to yank out, from the enclosed area, a max triangle with one vertex at (0,1), please compute the leftover area. (4 digits such as 1.234 should suffice.)

Problem 2.2 (10 Points)

(1) Write a program to generate two matrices of the dimension $2^{10} \times 2^{10}$. The matrices' elements $x_{ij} \sim U(-1,1)$ are random numbers uniformly distributing in (-1, 1).

(2) Write a program to multiply these two matrices using the naïve algorithm. Estimate how many multiplications and how many additions you have performed.

(3) Write a program to multiply these two matrices using the Strassen algorithm (at least three levels). Estimate how many multiplications and how many additions you have performed.

(4) Repeat the above two steps for matrices of the dimension $2^{12} \times 2^{12}$.

$$\mathbf{2^{10} \times 2^{10} \rightarrow (2 \times 2) \times (2^9 \times 2^9) \rightarrow (2 \times 2)^2 \times (2^8 \times 2^8) \rightarrow (2 \times 2)^3 \times (2^7 \times 2^7)}$$