# Homework 1

Ddongwook - Math 19B

Due: Jan 18th, 2024

1. My choice of programming language for this class will be fortran.

2. Exercises 12-16 from Fortran Tutorial by P. Garaud:

   (a) Exercise 12: The code returns a line to the terminal which reads the matrix by going down each column first and then moving to the column to the right. There is also a value returned which is not supposed to be in the printed matrix. It reads -7.822 * $10^{33}$. NOTE: the values which are incorrect are random, on a different run there were two incorrect values and they did not have the same value as the first.

   (b) Exercise 13: The code now returns the matrix in a grid pattern corresponding to the indicies of the array. Hence the (i,j) element of the array prints in the (i,j) cell of the printed grid. There are still incorrect values in the output. Often occuring in the first column of the matrix.

   (c) Exercise 14: I chose to zero all three matrices before any values were entered into a and b. From three different runs of the code, this seems to have corrected the bug which returned incorrect values in the matrix.

   (d) Something extra

   (e) I'm all out of somethings

3. Exercise 8: Let $f(x) = x^2 + x - 2$.

   - Calculate $R_3$ and $L_3$ over [2, 5]. NOTE: $R_3$ and $L_3$ denote the right and left endpoint approximations of the Area under $f(x)$, each made of three rectangles/intervals.
   - Sketch the graph of f and the rectangles that make up each approximation. Is the area under the graph larger or smaller than $R_3$? Than $L_3$ ?

4. Exercise 18: Calculate the approximation for the given function and interval

$$L_6,\ f(x) = 2x^2 - x + 2,\ [1, 4]$$

5. Exercise 22: Calculate the approximation for the given function and interval

$$R_6,\ f(x) = e^x,\ [0, 2]$$

6. Compute the sums using the equations for power sums covered in the textbook (pg. 304)

$$\sum_{i=1}^{10} i^2 - i + 1 \qquad\qquad \sum_{i=1}^{4} i^3 + 4$$

7. Using the power sum equations, compute the sum listed below. HINT: Think about using a composition of sums.

$$\sum_{i=3}^{8} i^2 + i$$

8. Derive the Midpoint Approximation Formula, $M_n$, for a function, $f(x)$, on the interval $[a, b]$ through the process of this problem.

   - Find the base width for each rectangle, $\Delta x$, in terms of $n$.
   - Find the height of the i-th rectangle, $h_i$, in terms of $f$ and $x_i$, where $x_i$ denotes the midpoint of each interval.
   - Find the midpoint of the i-th subinterval, $x_i$, in terms of $i, \Delta x$.
   - Find the area of the i-th rectangle, $A_i$, in terms of $i$, $f$, and $\Delta x$ using the equation for the area of a rectangle.
   - Express the midpoint approximation, $M_n$, as the sum of the areas of all rectangles in the partition in terms of $i, \Delta x$, and $f$.