

Assignment 2: Coding. Due Monday 1/29

1. **Matlab.** Complete the quadratic equation solver `yournameQuadEqn.m`. See the comments at the top for specific directions, but the main idea is to avoid loss of significance by re-writing one of roots

$$r_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}, \quad r_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}.$$

- The formula for the root r_1 has potential loss of significance when $b > 0$ and $b^2 > 4ac$; The second root r_2 is best left as is.
- The formula for the root r_2 has potential loss of significance when $b < 0$ and $b^2 > 4ac$. The first r_1 is best left as is.

2. **Write a C program for estimating adding numbers in a 2D grid.** See the file `yournameGridSum.c` to get started. This program will exhibit the effect of cumulative rounding error (caused by adding a lot small values.) Consider an $N \times N$ grid (we'll use $N = 5000$) dividing up the unit square into smaller squares. Therefore each subsquare has width $w = 1/N$. Let (x_i, y_j) denote the midpoint of the square in column i , row j . Note that

$$x_i = (i - 0.5) * w$$

Your job is to compute the double sum

$$S = 3w^2 \sum_{j=1}^N \sum_{i=1}^N (x_i)^2 + (y_j)^2$$

For N large, the value of S should approach 2. You will compute S in two different ways:

I. Summing up the numbers 1 by 1 in a nested for loop.

PSEUDOCODE

```
Initialize:   width=1/N; sum1=0;

for loop: row=1 to N
    for loop: col=1 to N
        x = (col - 0.5)*width
        y = (row - 0.5)*width
        sum1 = sum1 + (x*x + y*y)
    end of inner loop
end of outer loop

finalResult1= 3*width*width*sum1
```

II. Sum all the number in a row, then add to overall sum.

PSEUDOCODE

```
Initialize:   sum2=0;

for loop: row=1 to N
    rowSum=0;
    y= (row - 0.5)*width
    for loop: col=1 to N
        x = (col - 0.5)*width
        rowSum = rowSum + (x*x + y*y)
    end of inner loop
    sum2=sum2+ rowSum
end of outer loop

finalResult2= 3*width*width*sum2
```