**CS 323 Homework 1**

Theoretical Assignment 1: Suppose we have a decimal number (−28.91)10

1. Convert it to binary number, show the specific procedures, and truncate the result with accuracy to 4 decimal places. (Points: 25)
   1. Firstly, consider about +28.91
      1. Convert 28 to binary, divided by 2, and collect reminders in the reversed order
         1. 2 28 0 2 14 0 2 7 0 2 3 1 2 1 1
         2. (28)10 = (11100)2
      2. Covert 0.91 to binary, multiply by 2, and collect reminders in the same order
         1. 1.82 2 1 1.64 2 1 1.28 2 1 0.56 2 0 1.12 2 1 0.24 2 0 0.48 2 0 0.96 2 0 1.92 2 1 1.84 2 1
         2. (0.91)10 = (0.1110100011…)2
      3. Put them all together and truncate the result with accuracy to 4 decimal places
         1. (28.91)10 = (11100.1110)2
   2. Secondly, consider about -28.91
      1. Take its complement and adds one
         1. The complement = (00011.0001)2
         2. Add one = (00011.0010)2
   3. Finally
      1. (-28.91)10 = (00011.0010)2
2. Convert your binary number back to its corresponding decimal number, show the specific procedures, and evaluate the relative error. (Points: 15)
   1. Take its compliment
      1. The complement = 11100.1110
   2. Convert integral part to decimal, multiply each by 20, 21, 22…, and add them together
      1. 1\*24+1\*23+1\*22+0\*21+0\*20
   3. Convert fractional part to decimal, multiply each by 2-1, 2-2, 2-3…, and add them together
      1. 1\*2-1+1\*2-2+1\*2-3+0\*2-4
   4. Add both integral and fractional part of decimal number.
      1. (11100.1110)2 = 1\*24+1\*23+1\*22+0\*21+0\*20+1\*2-1+1\*2-2+1\*2-3+0\*2-4 = 28.875
      2. Add the negative sign, then (00011.0010)2 = (-28.91)10
   5. Evaluate the relative error
      1. e = |q – q1| / |q| = |-28.91+28.875| / |-28.91| = 1/826
3. Use online calculator1 to present the floating-point representation of (−28.91)10 in a 32-bit computer. Show the specific sign(s) (1-digit), exponent(n) (8- digit), and Mantissa (f) (23-digit). (Points: 10)
   1. Binary Representation: 11000001111001110100011110101110
   2. Sign(s): 1
   3. Exponent(n): 10000011
   4. Mantissa(f): 11001110100011110101110

Theoretical Assignment 2

* + - 1. Find the L1 and L∞ norms of A. (Points: 15)
         1. L1() = ||||1 =  {|2+1+0|, |1+4+3|, |0+0+10|} = max {3, 8, 10} = 10
         2. L∞() = ||||1 =  {|2+1+0|, |1+4+0|, |0+3+10|} = max {3, 5, 13} = 13
      2. Show the details of evaluating eigenvalues of A, the L2 norms of A and A−1. (Point: 25)
         1. L2()=
         2. Using MATLAB ‘()’, we get =
         3. Using MATLAB ‘eig ()’, we get
         4. Therefore, L2 = = = 10.52
         5. L2)=
         6. Using MATLAB ‘()’, we get =
         7. Using MATLAB ‘eig ()’, we get
         8. Therefore, L2 = = = 0.63
      3. Evaluate the condition number of matrix A based on the resulting L2 norms of A and A−1 (Point: 10)
         1. Using MATLAB = 10.52 \* 0.63 = 6.63