**Demonstration of Code Correctness**

**Please find the test cases written in the file attached as Test\_Case\_HW\_8.m. Matrix A is only generated for comparing results and is not used anywhere directly in the functions. Functions are only using the nzA, ir and ic arrays.**

**All test variables have the suffix (\_t) like variablename\_t in the test case file.**

**Pasting the output below for the executed test cases.**

**For N = 2 and x = ones(N^2,1)**

A =  
  
 4 -1 -1 0  
 -1 4 0 -1  
 -1 0 4 -1  
 0 -1 -1 4  
  
  
nzA =  
  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
  
  
ir =  
  
 1  
 4  
 7  
 10  
 13  
  
  
ic =  
  
 1  
 2  
 3  
 1  
 2  
 4  
 1  
 3  
 4  
 2  
 3  
 4  
  
  
x =  
  
 1  
 1  
 1  
 1  
  
  
y =  
  
 2  
 2  
 2  
 2  
  
Test Case 1 - Validate the values of nzA - Passed!  
Test Case 2 - Validate the values of ic - Passed!  
Test Case 3 - Validate the values of ir - Passed!  
Test Case 4 - Validate the values of y - Passed!

**For N = 2 and x = [1;3;2;0]**

A =  
  
 4 -1 -1 0  
 -1 4 0 -1  
 -1 0 4 -1  
 0 -1 -1 4  
  
  
nzA =  
  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
  
  
ir =  
  
 1  
 4  
 7  
 10  
 13  
  
  
ic =  
  
 1  
 2  
 3  
 1  
 2  
 4  
 1  
 3  
 4  
 2  
 3  
 4  
  
  
x =  
  
 1  
 3  
 2  
 0  
  
  
y =  
  
 -1  
 11  
 7  
 -5  
  
Test Case 1 - Validate the values of nzA - Passed!  
Test Case 2 - Validate the values of ic - Passed!  
Test Case 3 - Validate the values of ir - Passed!  
Test Case 4 - Validate the values of y - Passed!

**For N = 4 and x = ones(N^2,1)**

A =  
  
 4 -1 0 0 -1 0 0 0 0 0 0 0 0 0 0 0  
 -1 4 -1 0 0 -1 0 0 0 0 0 0 0 0 0 0  
 0 -1 4 -1 0 0 -1 0 0 0 0 0 0 0 0 0  
 0 0 -1 4 0 0 0 -1 0 0 0 0 0 0 0 0  
 -1 0 0 0 4 -1 0 0 -1 0 0 0 0 0 0 0  
 0 -1 0 0 -1 4 -1 0 0 -1 0 0 0 0 0 0  
 0 0 -1 0 0 -1 4 -1 0 0 -1 0 0 0 0 0  
 0 0 0 -1 0 0 -1 4 0 0 0 -1 0 0 0 0  
 0 0 0 0 -1 0 0 0 4 -1 0 0 -1 0 0 0  
 0 0 0 0 0 -1 0 0 -1 4 -1 0 0 -1 0 0  
 0 0 0 0 0 0 -1 0 0 -1 4 -1 0 0 -1 0  
 0 0 0 0 0 0 0 -1 0 0 -1 4 0 0 0 -1  
 0 0 0 0 0 0 0 0 -1 0 0 0 4 -1 0 0  
 0 0 0 0 0 0 0 0 0 -1 0 0 -1 4 -1 0  
 0 0 0 0 0 0 0 0 0 0 -1 0 0 -1 4 -1  
 0 0 0 0 0 0 0 0 0 0 0 -1 0 0 -1 4  
  
  
nzA =  
  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
  
  
ir =  
  
 1  
 4  
 8  
 12  
 15  
 19  
 24  
 29  
 33  
 37  
 42  
 47  
 51  
 54  
 58  
 62  
 65  
  
  
ic =  
  
 1  
 2  
 5  
 1  
 2  
 3  
 6  
 2  
 3  
 4  
 7  
 3  
 4  
 8  
 1  
 5  
 6  
 9  
 2  
 5  
 6  
 7  
 10  
 3  
 6  
 7  
 8  
 11  
 4  
 7  
 8  
 12  
 5  
 9  
 10  
 13  
 6  
 9  
 10  
 11  
 14  
 7  
 10  
 11  
 12  
 15  
 8  
 11  
 12  
 16  
 9  
 13  
 14  
 10  
 13  
 14  
 15  
 11  
 14  
 15  
 16  
 12  
 15  
 16  
  
  
x =  
  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
 1  
  
  
y =

2  
 1  
 1  
 2  
 1  
 0  
 0  
 1  
 1  
 0  
 0  
 1  
 2  
 1  
 1  
 2  
  
Test Case 1 - Validate the values of nzA - Passed!  
Test Case 2 - Validate the values of ic - Passed!  
Test Case 3 - Validate the values of ir - Passed!  
Test Case 4 - Validate the values of y - Passed!

**For N = 3 and x = randi(9,N^2,1) – A random vector with the range 0-9**

A =  
  
 4 -1 0 -1 0 0 0 0 0  
 -1 4 -1 0 -1 0 0 0 0  
 0 -1 4 0 0 -1 0 0 0  
 -1 0 0 4 -1 0 -1 0 0  
 0 -1 0 -1 4 -1 0 -1 0  
 0 0 -1 0 -1 4 0 0 -1  
 0 0 0 -1 0 0 4 -1 0  
 0 0 0 0 -1 0 -1 4 -1  
 0 0 0 0 0 -1 0 -1 4  
  
  
nzA =  
  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
 -1  
 -1  
 -1  
 4  
  
  
ir =  
  
 1  
 4  
 8  
 11  
 15  
 20  
 24  
 27  
 31  
 34  
  
  
ic =  
  
 1  
 2  
 4  
 1  
 2  
 3  
 5  
 2  
 3  
 6  
 1  
 4  
 5  
 7  
 2  
 4  
 5  
 6  
 8  
 3  
 5  
 6  
 9  
 4  
 7  
 8  
 5  
 7  
 8  
 9  
 6  
 8  
 9  
  
  
x =  
  
 9  
 2  
 9  
 9  
 5  
 8  
 2  
 4  
 9  
  
  
y =  
  
 25  
 -15  
 26  
 20  
 -3  
 9  
 -5  
 0  
 24  
  
Test Case 1 - Validate the values of nzA - Passed!  
Test Case 2 - Validate the values of ic - Passed!  
Test Case 3 - Validate the values of ir - Passed!  
Test Case 4 - Validate the values of y - Passed!