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
     -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


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!
```