Assignment 1: Exercise 1

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Contents

Part a

Define matrix M

```
M = [3 4 -5 1;
     1 2  1 4;
     7 2 -1 5;
     10 -3 2 1];
% Define vector v
v = [2; 1; 3; 4];

% v' * M
vTM = v' * M;
fprintf('v'' * M = \n');
disp(vTM);

% M * v
Mv = M * v;
fprintf('M * v = \n');
disp(Mv);

% M * M'
MMt = M * M';
fprintf('M * M'' = \n');
disp(MMt);

% M' * M
MtM = M' * M;
fprintf('M'' * M = \n');
disp(MtM);

% v' * M * v
vTMv = v' * M * v;
fprintf('v'' * M * v = \n');
disp(vTMv);
```

```
v' * M =
    68     4    -4    25

M * v =
    -1
```

```
    23
    33
    27

M * M' =
    51    10    39     9
    10    22    30    10
    39    30    79    67
     9    10    67   114

M' * M =
   159    -2    -1    52
    -2    33   -26    19
    -1   -26    31    -4
    52    19    -4    43

v' * M * v =
   228

Original A:
    -6    -5     0    10
     7     2     8    -3
     5    -4    12     4
```

Part b

Function that replaces all elements in the input 'matrix' that satisfy -5 <= x <= 5 with 1.

```
function modified = replaceBetween(matrix)
    % Copy the original matrix
    modified = matrix;
    % Create a mask
    mask = (matrix >= -5) & (matrix <= 5);
    % Replace elements that match the condition with 1
    modified(mask) = 1;
end
```

Testing Part b

Example 1

```
A = [-6, -5,  0, 10;
      7,  2,  8, -3;
      5, -4, 12,  4];
fprintf('Original A:\n');
disp(A);
modified_A = replaceBetween(A);
fprintf('Modified A:\n');
disp(modified_A);

% Example 2
B = [-7, -5,  6,  0,  2;
      8,  9, -2, 11,  3;
     10, -4, -6,  5, 12;
```

```
     13,  7, -3, 14, -1;
     15, 16, -8, 17,  4];
fprintf('Original B:\n');
disp(B);
modified_B = replaceBetween(B);
fprintf('Modified B :\n');
disp(modified_B);
```

```
Modified A:
    -6     1     1    10
     7     1     8     1
     1     1    12     1

Original B:
    -7    -5     6     0     2
     8     9    -2    11     3
    10    -4    -6     5    12
    13     7    -3    14    -1
    15    16    -8    17     4

Modified B :
    -7     1     6     1     1
     8     9     1    11     1
    10     1    -6     1    12
    13     7     1    14     1
    15    16    -8    17     1

Original C:
     2     3     4     5
     6     7     8     9
    10    11    12    13
```

Part c

Function that replaces all even integers in the input 'matrix' with 1.

```
function modified = replaceEven(matrix)
    % Copy original matrix
    modified = matrix;
    % Create mask for even integers
    mask = mod(matrix, 2) == 0;
    % Replace even intergers with 1
    modified(mask) = 1;
end
```

Testing Part c

Example 1

```
C = [2,  3,  4,  5;
     6,  7,  8,  9;
    10, 11, 12, 13];
fprintf('Original C:\n');
```

```
disp(C);
modified_C = replaceEven(C);
fprintf('Modified C:\n');
disp(modified_C);

% Example 2
D = [2,  3,  4,  5,  6;
     7,  8,  9, 10, 11;
    12, 13, 14, 15, 16;
    17, 18, 19, 20, 21;
    22, 23, 24, 25, 26];
fprintf('Original D:\n');
disp(D);
modified_D = replaceEven(D);
fprintf('Modified D:\n');
disp(modified_D);
```

```
Modified C:
     1     3     1     5
     1     7     1     9
     1    11     1    13

Original D:
     2     3     4     5     6
     7     8     9    10    11
    12    13    14    15    16
    17    18    19    20    21
    22    23    24    25    26

Modified D:
     1     3     1     5     1
     7     1     9     1    11
     1    13     1    15     1
    17     1    19     1    21
     1    23     1    25     1
```

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