```
% Zyad Khan
% Matlab Unit 3 Assignment
% MATH-210: Linear Algebra

% Display name and assignment details
disp('Zyad Khan - MATLAB Unit 3 Assignment')

% Part 1 - Provided Matrix
disp("Part 1 - Provided Matrix")
% Using provided A matrix, decode the message:
 DVIZRTJQXVCWOGUJNKGSDEWMDDY
A = [2 5 3; 12 9 4; 17 22 8];

encodedTextMessage = 'DVIZRTJQXVCWOGUJNKGSDEWMDDY';
encodedMessage = [3 25 9 21 14 9 6 4 3; 21 17 16 2 6 13 18 22 3; 8 19
 23 22 20 10 3 12 24];

P = round(det(A)*inv(A));
a = round(det(A)); num = [1:26]; res = mod(a*num,26);
b = find(abs(res-1)<10^-10);

key = mod(b*P,26);

% Find the key matrix from the example
disp("The mod 26 inverse of the A matrix (or the key matrix) is: ")
disp(key)
decodedMessage = key * encodedMessage;
decodedMessage = mod(decodedMessage, 26);

% Print
fprintf("\nThe encoded message in text is: %s\n", encodedTextMessage)
disp("The encoded message Matrix is: ")
disp(encodedMessage)

fprintf("\nThe decoded message matrix is: \n")
disp(decodedMessage)
fprintf("Translation: Alan Turing Cracked Enigma Code \n")
% This message refers to the person who cracked the German Enigma Code
% during WW2.


% Part 2 - Encode your own message with your own A matrix (mod 26 w/
 an inverse)
fprintf("\nPart 2 - Encode your own message with your own A matrix\n")
message = 'Congrats. You solved the code';
messageMatrix = [2 6 19 14 14 4 7 14; 14 17 18 20 11 3 4  3 ; 13 0 24
 18 21 19 2 4];

% My A Matrix
A = [ 10 17 8 ; 3 22 4; 14 11 3];

% Find Key matrix for my A matrix
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```
P = round(det(A)*inv(A));
a = round(det(A)); num = [1:26]; res = mod(a*num,26);
b = find(abs(res-1)<10^-10);
key = mod(b*P,26);

encodedMessage = mod(A * messageMatrix, 26);
decodedMessage = key * encodedMessage;
decodedMessage = mod(decodedMessage, 26);

% Output
disp("The mod 26 inverse of the A martrix (or the key matrix) is: ")
disp(key)

disp("The encoded message matrix is: ");
disp(encodedMessage)
encodedMessageText = 'ycnlclmdqaicbeqjyqynspuh';
disp("The encoded message matrix in text is:" + encodedMessageText)

disp("The decoded message using this message is (which is the same as
 the message in matrix form): ");
disp(decodedMessage)
disp("Translation: Congrats you solved the code")

% Part 3 - In Class Decoding from Gavin Dalton

fprintf("\nPart 3 - In Class Decoding from Gavin Dalton")
% Using the classmate's A matrix, decode the message:
A = [23 8 1 ; 15 1 7; 12 17 7];

encodedTextMessage = 'DILNMNIROEOCDMRCAQVPUZKBFWM';
encodedMessage = [3 13 8 4 3 2 21 25 5; 8 11 17 14 12 0 15 10 22; 11
 13 14 2 17 16 20 1 12];

P = round(det(A)*inv(A));
a = round(det(A)); num = [1:26]; res = mod(a*num,26);
b = find(abs(res-1)<10^-10);

key = mod(b*P,26);

% Find the key matrix from a classmate
fprintf("The mod 26 inverse of the A matrix (or the key matrix) from a
 classmate is: ")
disp(key)
decodedMessage = key * encodedMessage;
decodedMessage = mod(decodedMessage, 26);

% Print results
fprintf("\nThe encoded message from a classmate in text is: %s\n",
 encodedTextMessage)
disp("The encoded message Matrix from a classmate is: ")
disp(encodedMessage)

fprintf("\nThe decoded message matrix from a classmate is: \n")
disp(decodedMessage)
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```
fprintf("The decoded message in text from a classmate is: The
 Night(njght) Hawk Flies at Midnight\n")
```

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Zyad Khan - MATLAB Unit 3 Assignment
Part 1 - Provided Matrix
The mod 26 inverse of the A matrix (or the key matrix) is:
     2     0     9
    10    19    16
    17     3     2


The encoded message in text is: DVIZRTJQXVCWOGUJNKGSDEWMDDY
The encoded message Matrix is:
     3    25     9    21    14     9     6     4     3
    21    17    16     2     6    13    18    22     3
     8    19    23    22    20    10     3    12    24


The decoded message matrix is:
     0    13    17     6     0     4    13    12    14
    11    19     8     2     2     3     8     0     3
     0    20    13    17    10     4     6     2     4

Translation: Alan Turing Cracked Enigma Code

Part 2 - Encode your own message with your own A matrix
The mod 26 inverse of the A martrix (or the key matrix) is:
    24    25    24
    17    24    18
    25    12    13

The encoded message matrix is:
    24    11    12     0     1     9    24    15
     2     2     3     8     4    24    13    20
    13    11    16     2    16    16    18     7

The encoded message matrix in text is:ycnlclmdqaicbeqjyqynspuh
The decoded message using this message is (which is the same as the
 message in matrix form):
     2     6    19    14    14     4     7    14
    14    17    18    20    11     3     4     3
    13     0    24    18    21    19     2     4

Translation: Congrats you solved the code

Part 3 - In Class Decoding from Gavin DaltonThe mod 26 inverse of the
 A matrix (or the key matrix) from a classmate is:     12    13    15
    25    17    24
    19     7     9


The encoded message from a classmate in text is:
 DILNMNIROEOCDMRCAQVPUZKBFWM
The encoded message Matrix from a classmate is:
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     3    13     8     4     3     2    21    25     5
     8    11    17    14    12     0    15    10    22
    11    13    14     2    17    16    20     1    12


The decoded message matrix from a classmate is:
    19     0     7     0     5     4    19     3     6
     7    18    19    22    11    18    12    13     7
     4    25     7    10     8     0     8     8    19

The decoded message in text from a classmate is: The Night(njght) Hawk
 Flies at Midnight
```

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