Contents


```
clearvars;
close all
clc;
```

Linear Algebra Q1

```
disp('Linear Algebra')
for l=1:5
fprintf('Q%gV%g\n',1,l)
m = ceil(3*rand)+1;  %   Matrix size
ro = 5; %   Required options
ca = [];        %   Correct
noa = "None of the Above";
disp('Question-1');
fprintf('Given that A is a singular matrix of order %gx%g. Whcih of the following may be Eigen values of A?\n',m,m)
ABC = Alpha_Gen(ro); %   Generates string of first n Alphabets
for i=1:ro-1
    mo = ceil(m*rand)+1;    %    maximum order of matrix
    rc=ceil(2*rand);
    if rc == 1
        B = round(m*rand(1,mo))+1j*round(m*rand(1,mo));
    else
        B = round(m*rand(1,mo));
    end
        fprintf('%s. %s\n',ABC(i), InLine_disp(B))
    if prod(B)==0 && length(B)==m
        ca(end+1)=i;  %    Correct answers in 1st row and indices in 2nd row
        expl{i}=sprintf('No. of Eigen values is same as No. of rows and columns and product of Eigen values %s is zero. So the matrix is Singular.\n',InLine_disp(B)
    elseif length(B)==m && prod(B)~=0
        expl{i}=sprintf('No. of Eigen values is same as No. of rows and columns but product of Eigen values %s is %g.\n',InLine_disp(B),prod(B));
    elseif length(B)~=m && prod(B)==0
        expl{i}=sprintf('Product of  the Eigen values %s is zero but No. of Eigen values %g is not same as No. of rows and columns of the matrix %g.\n',InLine_disp(
    elseif length(B)~=m && prod(B)~=0
        expl{i}=sprintf('Not the No. of Eigen values %s is same as No. of rows and columns nor product of Eigen values %g is equal to zero.\n',InLine_disp(B),prod(B
    end
end
fprintf('%s. %s\n',ABC(ro),noa)
disp('Solution-1')
fprintf('Answer:')
if isempty(ca)
    fprintf('  %s  ',ABC(end))
else
    for u = 1:length(ca)
    fprintf('  %s  ',ABC(ca(u)))
    end
end
fprintf(['\nFor %gx%g matrix there must be %g Eigen values. \n' , ...
    'Product of the Eigen values is equal to its determinant.\n',...
    'Determinant of a Singular matrix is zero.\n'],m,m,m);
for z=1:length(expl)
    disp(expl{z})
end
clearvars
end
```

```
Linear Algebra
Q1V1
Question-1
Given that A is a singular matrix of order 3x3. Whcih of the following may be Eigen values of A?
A. [  3,  1,  0,  0 ]
B. [  3+3i,  2 ]
C. [  2,  2 ]
D. [  1+3i,  1 ]
E. None of the Above
Solution-1
Answer:  E
For 3x3 matrix there must be 3 Eigen values.
Product of the Eigen values is equal to its determinant.
Determinant of a Singular matrix is zero.
Product of  the Eigen values [  3,  1,  0,  0 ] is zero but No. of Eigen values 4 is not same as No. of rows and columns of the matrix 3.

Not the No. of Eigen values [  3+3i,  2 ] is same as No. of rows and columns nor product of Eigen values 6 is equal to zero.

Not the No. of Eigen values [  2,  2 ] is same as No. of rows and columns nor product of Eigen values 4 is equal to zero.
```

Not the No. of Eigen values [1+3i, 1] is same as No. of rows and columns nor product of Eigen values 1 is equal to zero.

Q1V2
Question-1
Given that A is a singular matrix of order 2x2. Whcih of the following may be Eigen values of A?
A. [1, 0]
B. [1, 2+1i, 1]
C. [1+1i, 1]
D. [1, 1]
E. None of the Above
Solution-1
Answer: A
For 2x2 matrix there must be 2 Eigen values.
Product of the Eigen values is equal to its determinant.
Determinant of a Singular matrix is zero.
No. of Eigen values is same as No. of rows and columns and product of Eigen values [1, 0] is zero. So the matrix is Singular.

Not the No. of Eigen values [1, 2+1i, 1] is same as No. of rows and columns nor product of Eigen values 2 is equal to zero.

No. of Eigen values is same as No. of rows and columns but product of Eigen values [1+1i, 1] is 1.

No. of Eigen values is same as No. of rows and columns but product of Eigen values [1, 1] is 1.

Q1V3
Question-1
Given that A is a singular matrix of order 4x4. Whcih of the following may be Eigen values of A?
A. [1, 1]
B. [3, 3, 2, 1, 1]
C. [4+2i, 1+2i, 3+2i, 4+4i]
D. [2, 1, 2, 3]
E. None of the Above
Solution-1
Answer: E
For 4x4 matrix there must be 4 Eigen values.
Product of the Eigen values is equal to its determinant.
Determinant of a Singular matrix is zero.
Not the No. of Eigen values [1, 1] is same as No. of rows and columns nor product of Eigen values 1 is equal to zero.

Not the No. of Eigen values [3, 3, 2, 1, 1] is same as No. of rows and columns nor product of Eigen values 18 is equal to zero.

No. of Eigen values is same as No. of rows and columns but product of Eigen values [4+2i, 1+2i, 3+2i, 4+4i] is -200.

No. of Eigen values is same as No. of rows and columns but product of Eigen values [2, 1, 2, 3] is 12.

Q1V4
Question-1
Given that A is a singular matrix of order 4x4. Whcih of the following may be Eigen values of A?
A. [1+3i, 3, 1+2i]
B. [3, 2, 1, 4, 4]
C. [3, 0, 2, 3]
D. [1, 2]
E. None of the Above
Solution-1
Answer: C
For 4x4 matrix there must be 4 Eigen values.
Product of the Eigen values is equal to its determinant.
Determinant of a Singular matrix is zero.
Not the No. of Eigen values [1+3i, 3, 1+2i] is same as No. of rows and columns nor product of Eigen values -15 is equal to zero.

Not the No. of Eigen values [3, 2, 1, 4, 4] is same as No. of rows and columns nor product of Eigen values 96 is equal to zero.

No. of Eigen values is same as No. of rows and columns and product of Eigen values [3, 0, 2, 3] is zero. So the matrix is Singular.

Not the No. of Eigen values [1, 2] is same as No. of rows and columns nor product of Eigen values 2 is equal to zero.

Q1V5
Question-1
Given that A is a singular matrix of order 2x2. Whcih of the following may be Eigen values of A?
A. [0, 1]
B. [1, 2]
C. [0, 1, 2]
D. [1+1i, 0+1i, 1+1i]
E. None of the Above
Solution-1
Answer: A
For 2x2 matrix there must be 2 Eigen values.
Product of the Eigen values is equal to its determinant.
Determinant of a Singular matrix is zero.
No. of Eigen values is same as No. of rows and columns and product of Eigen values [0, 1] is zero. So the matrix is Singular.

No. of Eigen values is same as No. of rows and columns but product of Eigen values [1, 2] is 2.

Product of the Eigen values [0, 1, 2] is zero but No. of Eigen values 3 is not same as No. of rows and columns of the matrix 2.

Not the No. of Eigen values [1+1i, 0+1i, 1+1i] is same as No. of rows and columns nor product of Eigen values -2 is equal to zero.

Linear Algebra Q2

```
for l=1:5
fprintf('Q%gV%g\n',2,l)
close all;
clearvars -except tn q a
m = ceil(3*rand)+1;  %   Matrix size
ro = 5; %   Required options
ca = [];        %   Correct
noa = "None of the Above";
disp('Question-2');
fprintf('Inverse of A is a matrix of order %gx%g. Whcih of the following may be possibilities of A?\n',m,m)
ABC = Alpha_Gen(ro); %   Generates string of first n Alphabets
for i=1:ro-1
    mo = ceil(m*rand)+1;    %    maximum order of matrix
%     rc=ceil(2*rand);
%     if rc == 1
%         B = round(m*rand(m,mo))+1j*round(m*rand(m,mo));
%     else
        B = round(m*rand(m,mo));
        sz=size(B);
%     end
        fprintf('%s. %s\n',ABC(i), InLine_disp(B))
    if length(B)-sz==0
        ca(end+1)=i;
        expl{i}=sprintf('Order of the matrix %gx%g is same as the rank %g. So it can be the actual matrix.\n',sz(1),sz(2),rank(B));
    elseif length(B)~=rank(B)
        expl{i}=sprintf('Order of the matrix %gx%g is different from the rank %g. So it cannot be A.\n',sz(1),sz(2),rank(B));
    end
end
fprintf('%s. %s\n',ABC(ro),noa)
disp('Solution-2')
fprintf('Answer:')
if isempty(ca)
    fprintf('  %s  ',ABC(end))
else
    for u = 1:length(ca)
    fprintf('  %s  ',ABC(ca(u)))
    end
end
Req=sprintf(['\nActual and Inverse matrix must be of same order i.e. %gx%g. \n' , ...
    'Rank of the matrix must be same as order of matrix.\n'],m,m);
disp(Req)
for z=1:length(expl)
    disp(expl{z})
end
clearvars
end
```

```
Q2V1
Question-2
Inverse of A is a matrix of order 2x2. Whcih of the following may be possibilities of A?
A. [  2,  1 ;  0,  2 ]
B. [  2,  1 ;  1,  1 ]
C. [  1,  1 ;  1,  1 ]
D. [  0,  2 ;  1,  1 ]
E. None of the Above
Solution-2
Answer:  A    B    C    D
Actual and Inverse matrix must be of same order i.e. 2x2.
Rank of the matrix must be same as order of matrix.

Order of the matrix 2x2 is same as the rank 2. So it can be the actual matrix.

Order of the matrix 2x2 is same as the rank 2. So it can be the actual matrix.

Order of the matrix 2x2 is same as the rank 1. So it can be the actual matrix.

Order of the matrix 2x2 is same as the rank 2. So it can be the actual matrix.

Q2V2
Question-2
Inverse of A is a matrix of order 2x2. Whcih of the following may be possibilities of A?
A. [  0,  1 ;  0,  1 ]
B. [  0,  1 ;  1,  1 ]
C. [  0,  1 ;  2,  0 ]
D. [  2,  1,  2 ;  1,  1,  0 ]
E. None of the Above
Solution-2
Answer:  A    B    C
Actual and Inverse matrix must be of same order i.e. 2x2.
Rank of the matrix must be same as order of matrix.

Order of the matrix 2x2 is same as the rank 1. So it can be the actual matrix.

Order of the matrix 2x2 is same as the rank 2. So it can be the actual matrix.

Order of the matrix 2x2 is same as the rank 2. So it can be the actual matrix.

Order of the matrix 2x3 is different from the rank 2. So it cannot be A.
```

```
Q2V3
Question-2
Inverse of A is a matrix of order 4x4. Whcih of the following may be possibilities of A?
A. [  3,  0,  2,  0,  3 ;  2,  3,  3,  2,  4 ;  4,  3,  3,  2,  2 ;  4,  2,  3,  3,  2 ]
B. [  3,  0,  0,  4,  0 ;  3,  3,  0,  1,  0 ;  0,  2,  4,  0,  3 ;  1,  2,  1,  3,  0 ]
C. [  1,  2 ;  1,  2 ;  3,  0 2,  1 ]
D. [  0,  0,  1,  3 ;  1,  2,  1,  1 ;  2,  1,  2,  3 ;  0,  1,  2,  3 ]
E. None of the Above
Solution-2
Answer:  D
Actual and Inverse matrix must be of same order i.e. 4x4.
Rank of the matrix must be same as order of matrix.

Order of the matrix 4x5 is different from the rank 4. So it cannot be A.

Order of the matrix 4x5 is different from the rank 4. So it cannot be A.

Order of the matrix 4x2 is different from the rank 2. So it cannot be A.

Order of the matrix 4x4 is same as the rank 4. So it can be the actual matrix.

Q2V4
Question-2
Inverse of A is a matrix of order 3x3. Whcih of the following may be possibilities of A?
A. [  1,  2,  1,  1 ;  2,  3,  1,  1 ;  2,  0,  1,  1 ]
B. [  0,  3 ;  2,  1 ;  0,  2 ]
C. [  2,  2,  3 ;  1,  2,  3 ;  2,  1,  2 ]
D. [  1,  3,  1 ;  2,  1,  0 ;  2,  2,  0 ]
E. None of the Above
Solution-2
Answer:  C    D
Actual and Inverse matrix must be of same order i.e. 3x3.
Rank of the matrix must be same as order of matrix.

Order of the matrix 3x4 is different from the rank 3. So it cannot be A.

Order of the matrix 3x2 is different from the rank 2. So it cannot be A.

Order of the matrix 3x3 is same as the rank 3. So it can be the actual matrix.

Order of the matrix 3x3 is same as the rank 3. So it can be the actual matrix.

Q2V5
Question-2
Inverse of A is a matrix of order 4x4. Whcih of the following may be possibilities of A?
A. [  1,  4,  1,  2,  3 ;  1,  2,  2,  3,  1 ;  3,  2,  1,  3,  0 ;  2,  1,  4,  1,  2 ]
B. [  0,  4 ;  2,  3 ;  1,  4 0,  4 ]
C. [  4,  0,  1 ;  3,  0,  0 ;  1,  0,  3 ;  4,  1,  4 ]
D. [  3,  4,  4 ;  3,  0,  4 ;  0,  0,  1 ;  3,  1,  1 ]
E. None of the Above
Solution-2
Answer:  E
Actual and Inverse matrix must be of same order i.e. 4x4.
Rank of the matrix must be same as order of matrix.

Order of the matrix 4x5 is different from the rank 4. So it cannot be A.

Order of the matrix 4x2 is different from the rank 2. So it cannot be A.

Order of the matrix 4x3 is different from the rank 3. So it cannot be A.

Order of the matrix 4x3 is different from the rank 3. So it cannot be A.
```

Probability and Statistics Q3

```
for l=1:5
fprintf('Q%gV%g\n',3,l)
ro = 5; %   Required options
m = ceil(ro*rand)+ro;  %   Matrix size
ca = [];        %   Correct
noa = "None of the Above";
disp('Question-3');
fprintf('Which of the following is a set of deviations of %g observations. Given that one of the observation is mean?\n',m)
ABC = Alpha_Gen(ro); %   Generates string of first n Alphabets
for i=1:ro-1
    mo = ceil(m*rand)+1;    %    maximum order of matrix
        B = round(ro*randn(1,m));
        fprintf('%s. %s\n',ABC(i), InLine_disp(B))
    if nnz(B==0)>=1 && sum(B)==0
        ca(end+1)=i;  %    Correct answers in 1st row and indices in 2nd row
        expl{i}=sprintf('%g element of the set are zero and sum of the set is also zero. So it may be the set of deviation.\n',nnz(B==0));
    elseif nnz(B==0)>=1 && sum(B)~=0
        expl{i}=sprintf('%g element of the set are zero but sum of the set is not zero. So it cannot be the set of deviation.\n',nnz(B==0));
    elseif nnz(B==0)==0 && sum(B)==0
        expl{i}=sprintf('Sum of the set is zero but none of the element of set is zero. So it cannot be the set of deviation.\n');
    elseif nnz(B==0)==0 && sum(B)~=0
        expl{i}=sprintf('Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.\n');
    end
end
```

```
fprintf('%s. %s\n',ABC(ro),noa)
disp('Solution-3')
fprintf('Answer:')
if isempty(ca)
    fprintf('  %s  ',ABC(end))
else
    for u = 1:length(ca)
    fprintf('  %s  ',ABC(ca(u)))
    end
end
fprintf(['\nAt least one element of the set must be zero. \n' , ...
    'Sum of the deviations must be equal to zero.\n']);
for z=1:length(expl)
    disp(expl{z})
end
clearvars
end
```

```
Q3V1
Question-3
Which of the following is a set of deviations of 6 observations. Given that one of the observation is mean?
A. [  -1,  -4,  -6,  -8,  9,  2 ]
B. [  2,  -4,  3,  6,  -8,  2 ]
C. [  -1,  2,  -0,  2,  -6,  2 ]
D. [  -2,  2,  -3,  -2,  2,  -2 ]
E. None of the Above
Solution-3
Answer:  E
At least one element of the set must be zero.
Sum of the deviations must be equal to zero.
Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

1 element of the set are zero but sum of the set is not zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

Q3V2
Question-3
Which of the following is a set of deviations of 6 observations. Given that one of the observation is mean?
A. [  -4,  9,  11,  -0,  -8,  0 ]
B. [  13,  9,  -2,  -6,  -2,  -6 ]
C. [  -2,  -1,  -4,  3,  -5,  4 ]
D. [  1,  -2,  4,  -4,  -4,  -5 ]
E. None of the Above
Solution-3
Answer:  E
At least one element of the set must be zero.
Sum of the deviations must be equal to zero.
2 element of the set are zero but sum of the set is not zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

Q3V3
Question-3
Which of the following is a set of deviations of 7 observations. Given that one of the observation is mean?
A. [  -3,  5,  6,  -2,  10,  4,  9 ]
B. [  -3,  5,  3,  7,  2,  2,  -2 ]
C. [  3,  1,  -0,  3,  -4,  -5,  3 ]
D. [  -9,  -4,  -10,  3,  2,  1,  2 ]
E. None of the Above
Solution-3
Answer:  E
At least one element of the set must be zero.
Sum of the deviations must be equal to zero.
Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

1 element of the set are zero but sum of the set is not zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

Q3V4
Question-3
Which of the following is a set of deviations of 7 observations. Given that one of the observation is mean?
A. [  0,  5,  3,  -0,  6,  -0,  -3 ]
B. [  2,  -5,  -5,  -4,  5,  3,  0 ]
C. [  1,  7,  4,  -3,  -1,  3,  -2 ]
D. [  2,  7,  -1,  -2,  10,  -8,  -4 ]
E. None of the Above
Solution-3
Answer:  E
At least one element of the set must be zero.
Sum of the deviations must be equal to zero.
```

```
3 element of the set are zero but sum of the set is not zero. So it cannot be the set of deviation.

1 element of the set are zero but sum of the set is not zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

Q3V5
Question-3
Which of the following is a set of deviations of 10 observations. Given that one of the observation is mean?
A. [  -6,  4,  4,  7,  4,  2,  -4,  7,  4,  -5 ]
B. [  -4,  -7,  -2,  0,  6,  -1,  1,  2,  -6,  -1 ]
C. [  -4,  -6,  -6,  -2,  -3,  7,  -4,  0,  -2,  8 ]
D. [  -3,  4,  -3,  5,  11,  -2,  -4,  -6,  6,  3 ]
E. None of the Above
Solution-3
Answer:  E
At least one element of the set must be zero.
Sum of the deviations must be equal to zero.
Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.

1 element of the set are zero but sum of the set is not zero. So it cannot be the set of deviation.

1 element of the set are zero but sum of the set is not zero. So it cannot be the set of deviation.

Not a single number in set is zero nor the sum of set is zero. So it cannot be the set of deviation.
```

Probability and Statistics Q4

```
for l=1:5
fprintf('Q%gV%g\n',4,l)
format rat
ro = 5; %   Required options
m = ceil(ro*rand)+ro;  %   Matrix size
disp('Question-4');
fprintf('If dice is thrown once what is the probability of getting:\n')
ABC = Alpha_Gen(ro); %   Generates string of first n Alphabets
for i=1:ro
    ds=ceil(3*rand);
    B=ceil(6*rand(1,ds));
    fprintf('%s. %s\n',ABC(i),and_or_disp(B))
    expl{i}=sprintf('Probaility of getting %s is %g/%g.\n',and_or_disp(B),length(B),6);
end
disp('Solution-4')
fprintf(['\nProbability of a single number in dice is 1/6. \n' , ...
    'Probability of more than 1 numbers on dice is the sum of number by 6.\n']);
for z=1:length(expl)
    fprintf('\n%s\n',expl{z})
end
clearvars
end
```

```
Q4V1
Question-4
If dice is thrown once what is the probability of getting:
A.  2 or  1
B.  2
C.  4
D.  6 or  1
E.  2,  5 or  4
Solution-4

Probability of a single number in dice is 1/6.
Probability of more than 1 numbers on dice is the sum of number by 6.

Probaility of getting  2 or  1 is 2/6.


Probaility of getting  2 is 1/6.


Probaility of getting  4 is 1/6.


Probaility of getting  6 or  1 is 2/6.


Probaility of getting  2,  5 or  4 is 3/6.

Q4V2
Question-4
If dice is thrown once what is the probability of getting:
A.  3 or  3
B.  6
C.  4 or  2
D.  6
```

E. 3 or 1
Solution-4

Probability of a single number in dice is 1/6.
Probability of more than 1 numbers on dice is the sum of number by 6.

Probaility of getting 3 or 3 is 2/6.

Probaility of getting 6 is 1/6.

Probaility of getting 4 or 2 is 2/6.

Probaility of getting 6 is 1/6.

Probaility of getting 3 or 1 is 2/6.

Q4V3
Question-4
If dice is thrown once what is the probability of getting:
A. 6
B. 4
C. 5 or 3
D. 2
E. 5, 2 or 5
Solution-4

Probability of a single number in dice is 1/6.
Probability of more than 1 numbers on dice is the sum of number by 6.

Probaility of getting 6 is 1/6.

Probaility of getting 4 is 1/6.

Probaility of getting 5 or 3 is 2/6.

Probaility of getting 2 is 1/6.

Probaility of getting 5, 2 or 5 is 3/6.

Q4V4
Question-4
If dice is thrown once what is the probability of getting:
A. 3
B. 5
C. 5, 5 or 4
D. 5
E. 3, 3 or 1
Solution-4

Probability of a single number in dice is 1/6.
Probability of more than 1 numbers on dice is the sum of number by 6.

Probaility of getting 3 is 1/6.

Probaility of getting 5 is 1/6.

Probaility of getting 5, 5 or 4 is 3/6.

Probaility of getting 5 is 1/6.

Probaility of getting 3, 3 or 1 is 3/6.

Q4V5
Question-4
If dice is thrown once what is the probability of getting:
A. 5
B. 5, 5 or 4
C. 3, 3 or 6
D. 2
E. 5
Solution-4

Probability of a single number in dice is 1/6.
Probability of more than 1 numbers on dice is the sum of number by 6.

Probaility of getting 5 is 1/6.

Probaility of getting 5, 5 or 4 is 3/6.

```
Probaility of getting  3,  3 or  6 is 3/6.

Probaility of getting  2 is 1/6.

Probaility of getting  5 is 1/6.
```

Optimization Q5

```
for l=1:5
fprintf('Q%gV%g\n',5,l)
a = 500;    %   Lower range
b = 1000;   %   Upper range
r = ceil((b-a).*rand) + a;  %   Area in range of 500 and 1000
ro = 5; %   Required options
m = ceil(ro*rand)+ro;  %   Matrix size
f=-1*[2 2];
A=[2 2;1 -1;1 0;0 1];
b=[r;50];
disp('Question-5');
fprintf('Find the the sides of the rectangle of parameter %gm if one side X is at most 50m longer than Y :\n',r)
ABC = Alpha_Gen(ro); %   Generates string of first n Alphabets
for i=1:ro
    ds=ceil(3*rand);
    X=ceil((a).*rand);
    b(3,1)=X;
    Y=ceil((a).*rand);
    b(4,1)=Y;
    fprintf('%s. X < %g  and Y < %g.',ABC(i),X,Y)
        Op=linprog(f,A,b);
    expl{i}=sprintf('X = %g and Y = %g.',Op(1),Op(2));
end
disp('Solution-5')
for z=1:length(expl)
    fprintf('%s\n',expl{z})
end
clearvars
end
```

```
Q5V1
Question-5
Find the the sides of the rectangle of parameter 534m if one side X is at most 50m longer than Y :
A. X < 183  and Y < 345.
Optimal solution found.

B. X < 451  and Y < 476.
Optimal solution found.

C. X < 4  and Y < 21.
Optimal solution found.

D. X < 223  and Y < 222.
Optimal solution found.

E. X < 470  and Y < 357.
Optimal solution found.

Solution-5
X = 158.5 and Y = 108.5.
X = 158.5 and Y = 108.5.
X = 4 and Y = 21.
X = 158.5 and Y = 108.5.
X = 158.5 and Y = 108.5.
Q5V2
Question-5
Find the the sides of the rectangle of parameter 970m if one side X is at most 50m longer than Y :
A. X < 411  and Y < 144.
Optimal solution found.

B. X < 431  and Y < 276.
Optimal solution found.

C. X < 426  and Y < 174.
Optimal solution found.

D. X < 26  and Y < 68.
Optimal solution found.

E. X < 453  and Y < 386.
Optimal solution found.

Solution-5
X = 194 and Y = 144.
X = 267.5 and Y = 217.5.
```

```
X = 224 and Y = 174.
X = 26 and Y = 68.
X = 267.5 and Y = 217.5.
Q5V3
Question-5
Find the the sides of the rectangle of parameter 853m if one side X is at most 50m longer than Y :
A. X < 378  and Y < 184.
Optimal solution found.

B. X < 111  and Y < 128.
Optimal solution found.

C. X < 158  and Y < 212.
Optimal solution found.

D. X < 177  and Y < 224.
Optimal solution found.

E. X < 365  and Y < 311.
Optimal solution found.

Solution-5
X = 234 and Y = 184.
X = 111 and Y = 128.
X = 158 and Y = 212.
X = 177 and Y = 224.
X = 238.25 and Y = 188.25.
Q5V4
Question-5
Find the the sides of the rectangle of parameter 563m if one side X is at most 50m longer than Y :
A. X < 16  and Y < 101.
Optimal solution found.

B. X < 1  and Y < 319.
Optimal solution found.

C. X < 198  and Y < 132.
Optimal solution found.

D. X < 357  and Y < 98.
Optimal solution found.

E. X < 124  and Y < 468.
Optimal solution found.

Solution-5
X = 16 and Y = 101.
X = 1 and Y = 280.5.
X = 165.75 and Y = 115.75.
X = 148 and Y = 98.
X = 124 and Y = 157.5.
Q5V5
Question-5
Find the the sides of the rectangle of parameter 783m if one side X is at most 50m longer than Y :
A. X < 474  and Y < 240.
Optimal solution found.

B. X < 33  and Y < 194.
Optimal solution found.

C. X < 462  and Y < 468.
Optimal solution found.

D. X < 92  and Y < 197.
Optimal solution found.

E. X < 268  and Y < 226.
Optimal solution found.

Solution-5
X = 220.75 and Y = 170.75.
X = 33 and Y = 194.
X = 220.75 and Y = 170.75.
X = 92 and Y = 197.
X = 220.75 and Y = 170.75.
```

Optimization Q6

```
for l=1:5
fprintf('Q%gV%g\n',6,l)
format shortG
m = ceil(3*rand)+1;  %   Matrix size
ro = 5; %   Required options
ca = [];        %   Correct
sm=20;
noa = "None of the Above";
disp('Question-6');
fprintf('Given that the sum of the diagonal elemens of Hessian matrix is 20 - determinant. For the following \ndeterminants determine whether the function has minim
ABC = Alpha_Gen(ro); %   Generates string of first n Alphabets
for i=1:ro
```

```
    dt=ceil(10*randn);
    fprintf('%s. %g\n',ABC(i),dt)
    if dt<0 && (sm-dt)>=0
        expl{i}=sprintf('As sum is 20 - (%g) = %g > 0 so either 2 Eigen values are positive or 2 negative but as determinant is \nnegative so all Eigen values are n
    elseif dt>0 && (sm-dt)>=0
        expl{i}=sprintf('As sum is 20 - (%g) = %g > 0 so either 2 Eigen values are positive or 2 negative but as determinant is \npositive so all Eigen values are p
    elseif (sm-dt)<0
        expl{i}=sprintf('As sum is 20 - (%g) = %g < 0 so we cannot conclude anything from negative sum.',dt,sm-dt);
    end
end
disp('Solution-6')
for i=1:length(expl)
    disp(expl{i})
end
clearvars
end


function B = InLine_disp(A)
n=size(A);
t='';
for i = 1:n(1)
    for j=1:n(2)
        if ~isreal(A(i,j))
            if imag(A(i,j))>0
                t = [t,sprintf(' %g+%gi',real(A(i,j)),imag(A(i,j)))];
            else
                t = [t,sprintf(' %g-%gi',real(A(i,j)),imag(A(i,j)))];
            end
        else
         t = [t,sprintf(' %g',A(i,j))];
        end
    if j == n(2)
        t=[t,''];
    else
      t = [t,', '];
    end
    end
    if i == n(1)
        break
    elseif i<=n
        t = [t , sprintf(' ; ')];
    end
end
B = sprintf('[ %s ]',t);
end


function B = and_or_disp(A)
n=length(A);
t='';
for i = 1:n
    t = [t,sprintf(' %g',A(i))];
    if i<n-1
        t=[t,', '];
        elseif i==n-1
        t = [t , sprintf(' or ')];
    elseif i == n
        break
    end
end
B = sprintf('%s',t);
end

function A = Alpha_Gen(n)
if n > 26
    n = 26;
elseif n <= 0
    n = 1;
end
A = string(num2cell(char(((1:n) + 64))));
end
```

```
Q6V1
Question-6
Given that the sum of the diagonal elemens of Hessian matrix is 20 - determinant. For the following
determinants determine whether the function has minima or maxima at that point:
A. 4
B. -5
C. 5
D. 12
E. 18
Solution-6
As sum is 20 - (4) = 16 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is
positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (-5) = 25 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is
negative so all Eigen values are negative which means that at this point function has maxima.
As sum is 20 - (5) = 15 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is
positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (12) = 8 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is
```

positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (18) = 2 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
Q6V2
Question-6
Given that the sum of the diagonal elemens of Hessian matrix is 20 - determinant. For the following determinants determine whether the function has minima or maxima at that point:
A. 25
B. 19
C. -8
D. 17
E. 5
Solution-6
As sum is 20 - (25) = -5 < 0 so we cannot conclude anything from negative sum.
As sum is 20 - (19) = 1 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (-8) = 28 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is negative so all Eigen values are negative which means that at this point function has maxima.
As sum is 20 - (17) = 3 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (5) = 15 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
Q6V3
Question-6
Given that the sum of the diagonal elemens of Hessian matrix is 20 - determinant. For the following determinants determine whether the function has minima or maxima at that point:
A. 13
B. 10
C. 6
D. 2
E. -10
Solution-6
As sum is 20 - (13) = 7 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (10) = 10 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (6) = 14 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (2) = 18 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (-10) = 30 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is negative so all Eigen values are negative which means that at this point function has maxima.
Q6V4
Question-6
Given that the sum of the diagonal elemens of Hessian matrix is 20 - determinant. For the following determinants determine whether the function has minima or maxima at that point:
A. 13
B. 18
C. 5
D. -4
E. 12
Solution-6
As sum is 20 - (13) = 7 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (18) = 2 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (5) = 15 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (-4) = 24 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is negative so all Eigen values are negative which means that at this point function has maxima.
As sum is 20 - (12) = 8 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
Q6V5
Question-6
Given that the sum of the diagonal elemens of Hessian matrix is 20 - determinant. For the following determinants determine whether the function has minima or maxima at that point:
A. 5
B. -7
C. 1
D. 7
E. 10
Solution-6
As sum is 20 - (5) = 15 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (-7) = 27 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is negative so all Eigen values are negative which means that at this point function has maxima.
As sum is 20 - (1) = 19 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (7) = 13 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.
As sum is 20 - (10) = 10 > 0 so either 2 Eigen values are positive or 2 negative but as determinant is positive so all Eigen values are positive which means that at this point function has minima.