

## Questions Bank

### Computational Mathematics I

**Mixing MATLAB built-in functions to do the following by one line statement in command window**

Q1:- From the n by m matrix find the minimum positive number

Let

```
a=[6 -1 7 3;5 2 8 -4;9 -5 -2 0]
```

```
>>a =
```

```
     6     -1     7     3
     5     2     8    -4
     9    -5    -2     0
```

```
>>minpsitive=min(min(a(a>0)))
```

```
minpsitive =
```

```
2
```

Q2:- Find the number of negative prime elements in n by m matrix

```
>>numberofnegativeprime=length(a(isprime(abs(a))&a<0))
```

```
numberofnegativeprime =
```

```
2
```

Q3:- Find the number of odd elements in each column from n by m matrix

```
>>numberofoddineachcolumn=sum(rem(abs(a),2))
```

```
numberofoddineachcolumn =
```

```
2 2 1 1
```

Q4:- Find the minimum number of upper triangle of n by n matrix

```
>>b=[2 0 -1;4 1 7;5 6 3]
```

```
b =
```

```
2 0 -1
4 1 7
5 6 3
```

```
>> min(min(tril(NaN*ones(3))+triu(b,1)))
```

```
ans =
```

```
-1
```

Q5:-Create the following n by m matrix

$$a = \begin{pmatrix} e^1 & n & n & & n & n \\ m & e^2 & n & \dots & n & n \\ m & m & e^3 & & n & n \\ & \vdots & & \ddots & & \vdots \\ m & m & m & \dots & e^n & n \end{pmatrix}$$

```
>>n=4;m=6;
```

```
>>m*tril(ones(n,m),-1)+[diag(exp(1:n)) zeros(n,m-n)]+
+n*triu(ones(n,m),1)
```

```
>>ans =
```

```
2.7183 4.0000 4.0000 4.0000 4.0000
4.0000
```

```

        6.0000    7.3891    4.0000    4.0000    4.0000
4.0000
        6.0000    6.0000    20.0855    4.0000    4.0000
4.0000
        6.0000    6.0000    6.0000    54.5982    4.0000
4.0000

```

Q6:- Find the location (sub) of maximum element in n by m matrix

```
>> [i j]=find(a==max(max(a)))
```

```
i =
```

```
    3
```

```
j =
```

```
    1
```

Q7:- Find the sum of integer elements in n by m matrix

```
>> sum(a(fix(a)==a))
```

Q8:- Replace the diagonal elements in square matrix by ones

```
>> b=[1 2 3;4 5 6;7 8 9]
```

```
b =
```

```

    1    2    3
    4    5    6
    7    8    9

```

```
>> tril(b,-1)+eye(3)+triu(b,1)
```

```
ans =
```

```

    1    2    3
    4    1    6
    7    8    1

```

Q9:-Create the following n by m matrix

$$a = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 2 & 3 & 0 \\ 0 & 4 & 5 & 6 & 0 \\ 0 & 7 & 8 & 9 & 0 \end{pmatrix}$$

```
>> [ones(1,5); [zeros(3,1) reshape(1:9,3,3)
zeros(3,1)]]
```

```
ans =
```

```
    1    1    1    1    1
    0    1    4    7    0
    0    2    5    8    0
    0    3    6    9    0
```

Q10:- Let

$$a = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \quad b = (0 \ 0 \ 0) \quad c = \begin{pmatrix} -1 & -1 \\ -1 & -1 \end{pmatrix}$$

```
1->> [a b'; c c]
```

```
ans =
```

```
    1    4    7    0
    2    5    8    0
    3    6    9    0
   -1   -1   -1   -1
   -1   -1   -1   -1
```

```
2->> [[a;b] [c;c]]
```

```
ans =
```

```
    1    4    7   -1   -1
    2    5    8   -1   -1
    3    6    9   -1   -1
    0    0    0   -1   -1
```

```
3- >> [a(:, [3 1]) b' a(:,2)]
```

```
ans =
```

```
    7    1    0    4
    8    2    0    5
```

```
9      3      0      6
```

```
4- >> [a [c c c;b b]]
```

```
ans =
```

```
1      4      7     -1     -1     -1     -1     -1     -1
2      5      8     -1     -1     -1     -1     -1     -1
3      6      9      0      0      0      0      0      0
```

```
5- >> a(2:3,2:3)=c
```

```
a =
```

```
1      4      7
2     -1     -1
3     -1     -1
```

```
6- >> a(:,1)=b'
```

```
a =
```

```
0      4      7
0     -1     -1
0     -1     -1
```

Q11:-From n by m matrix A replace the element in corners by 0.

```
>>A([1 size(A,1)],[1 size(A,2)])=0
```

Q12:- Let u and v be vectors of coefficients of two polynomials then find the sum of polynomials

```
[zeros(1,length(v)-length(u))
u]+[zeros(1,length(u)-length(v)) v]
```

- Q1) Write a script or function to remove all repeat elements in the input row array.
- Q2) Write a script or function to find the number of repeat for each elements of input matrix.
- Q3) Write a script or function to input two matrices then find out the same rows between them if exist.
- Q4) Write a script or function to check increasing and decreasing of the sequence.
- Q5) Rectangle plane with width W and length L divided to n by m square and each square contain a greeters circle then find the area that covered by circles.

Q1) Write a script to read a matrix a then change the location of maximum number and minimum number between them.

```
SOL1)  a=input('input the matrix:');
        imax=find(a==max(max(a)));
        imin=find(a==min(min(a)));
        temp=a(imax);or temp=max(max(a));
        a(imax)=a(imin);or a(imax)=min(min(a));
        a(imin)=temp;
        disp(a)
```

H.w2) Write a script to read the number n then find S where  $S = 2 + 2^2 + 2^3 + \dots + 2^n$

```
SOL2)  n=input('n=');
        S=sum(2.^(1:n))
```

Q3) Write a script for students degree and sort them according to passed.

```
SOL3)  a=input('input the matrix of student degree:');
        k=all(a>=50,2);
```

```

suc=a(k,:);
fal=a(~k,:);
stsum=sum(suc,2);
[stsum xi]=sort(stsum,'descend');
suc=suc(xi,:);
sucdeg=[suc stsum]

```

Que4) Write a script to solve a linear system  $aX=b$ .

```

SOL4)  a=input(' a= ');
        b=input(' b= ');
        X=inv(a)*b

```

Q5) Write a script to solve a linear system  $aX=b$  by grammer rule.

```

SOL5)  a=input(' a= ');
        b=input(' b= ');
        X1=det([b a(:,2:3)])/det(a)
        X2=det([a(:,1) b a(:,3)])/det(a)
        X3=det([a(:,1:2) b])/det(a)

```

Que6) Write a script to find  $c = a * b + a^2$  where a and b are a matrix.

SOL6)

```

a=input('a=')
b=input('b=')
if size(a,2)==size(b,1)&size(a)==size(b)
c=a*b+a^2
end

```

Que7) Write a script or function to input the number then check that even integer number or not.

```

SOL7)  a=input('a=')
        If (fix(a/2)==a/2)
        fprintf('the number %g is even',a)
        else

```

```
fprintf('the number %g is odd',a)
end
```

Q8) Write a script to find all roots of polynomial is real or not

```
SOL8) p=input('p=')
r=roots(p);
If(all(r==real(r)))
disp('all roots are real')
else
disp('all roots are not real')
end
```

Q9) Write a program to input x then find

$$y = \begin{cases} \sin(x) & 0 \leq x < 1 \\ e^{|x|} + 2 & x < 0 \\ x^2 + 3 & 1 \leq x < 10 \\ \frac{1}{x} & x \geq 10 \end{cases}$$

Quez10) write a program to input two matrix a, b then find  $c = a * b + |a|I - b^{-1}$

```
SOL10) a=input('a=')
b=input('b=')
if size(a)==size(b)&size(b,1)==size(b,2)
c=a.*b + det(a)*eye(size(a)) - inv(b)
end
```

Quez11) write a program to input matrix  $a_{n \times m}$  then find  $s = \sum_{i=1}^{n*m} f(a_i)$

$$\text{When } f(a_i) = \begin{cases} |a_i| & a_i < 0 \\ 1 & \text{if } a_i \text{ is positive prime number} \\ 0 & \text{other wise} \end{cases}$$

```
SOL11) a=input('a=')
s=0;
for i=1:numel(a)
if a(i)<0
a(i)=abs(a(i));
elseif isprime(abs(a(i)))&a(i)>0
```



```

a(i)=1;
else
a(i)=0;
end
s=s+a(i);
end
disp(s)

```

Q12) write a program to transform the decimal number to binary

SOL12) First Method

```

a=input('a=')
s=0;
while a~=0
s=[rem(a,2) s];
a=fix(a/2);
end
s=s(1:length(s)-1)

```

OR

Secand Method

```

a=input('a=')
b=[];
while a>0
b=[rem(a,2) b];
a=fix(a/2);
end
b

```

Q13) write a program to input the matrix then find out even element and odd element.

SOL13) a=input('the matrix a=')

```

for i=1:prod(size(a))          (by index)
(prod(size(a))=numel(a))
if rem(a(i),2)==0
fprintf('the matrix %g is even\n',a(i))
else
fprintf('the matrix %g is odd\n',a(i))

```

```
end
end
```

Q14) write a program to input the matrix then find the summation of even number and summation of odd number in a.

```
SOL14) a=input('the matrix a=')
        ev=0;od=0;
        for i=1:prod(size(a))           (by index) (prod(size(a))=numel(a))
            if rem(a(i),2)==0
                ev=ev+a(i);
            else
                od=od+a(i);
            end
        end
        ev
        od
```

Q15) write a program to create matrix  $A_{n \times m}$  when  $a_{i,j} = i + j^2$ .

```
SOL15) z=input('the dimation a=')
        a=zeros(z);
        for i=1:size(a,1)
            for j=1:size(a,2)
                a(i,j)=i+j^2;
            end
        end
        a
```

Q16) write a script to read x then find y where  $y = \begin{cases} \sin(x) & x > 0 \\ 2 + e^x & x < 0 \\ 7 & x = 0 \end{cases}$  by switch case?

```
SOL16) x= input('input the number');
        switch true
            case x>0
                y=sin(x)
```

```

case x<0
y=2+exp(x)
otherwise
y=7
end

```

Quez17) write a script to create a matrix  $A_{n \times m}$  where

$$a_{i,j} = \begin{cases} 3^i + j & \text{if } i + j \text{ is prime number} \\ 2^j + i & \text{if } i + j \text{ is even number} \\ 1 & \text{otherwise} \end{cases}$$

Quez18) write a program to read a matrix  $A_{n \times m}$  then find  $p = \prod_{i=1}^{n \times m} f(a_i)$  where

$$f(a_i) = \begin{cases} 3^i + 1 & \text{if } a_i \text{ is prime number} \\ 2^i + 1 & \text{if } a_i \text{ is not prime number} \end{cases}$$

Q19) write a program to create a matrix  $A_{n \times m}$  where

$$a_{i,j} = \begin{cases} 0 & \text{if } i, j \text{ is odd number} \\ 1 & \text{if } i, j \text{ is even number} \\ -1 & \text{otherwise} \end{cases}$$

Quez1) write a program to read a matrix a then find b where

$$b = \begin{cases} a^{-1} & \text{if } |a| > 0 \\ a^2 & \text{if } |a| = 0 \\ a^{-1} * a & \text{if } |a| < 0 \end{cases}$$

Quez2) write a program to read a matrices a and b then find c where

$$c = \begin{cases} a + b & \text{if } a \text{ and } b \text{ have the same size} \\ |a| I + a & \text{otherwise} \end{cases}$$

Quez3) write a program to read the real number x then find y where

$$y = \begin{cases} \ln(x + 1) & x > 0 \\ e^{x^2+1} & x < 0 \text{ and } |x| \text{ is odd} \\ \sqrt{|x - 2|} & x < 0 \text{ and } |x| \text{ is even} \end{cases}$$

Q20) write a program to input the integer number n then find the Fibonacci sequence.

$$f_1 = 1, f_2 = 1 \text{ and } f_n = f_{n-1} + f_{n-2}$$

```
Sol)  n=input('n=');
      f = zeros(1,n);
      f(1) = 1;
      f(2) = 1;
      for j = 3:n
      f(j) = f(j-1) + f(j-2);
      end
      f
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Q1) Write a script to read a matrix a then change the location of maximum number and minimum number between them.

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SOL1)  a=input('input the matrix:')
      imax=find(a==max(max(a)));
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        b=input(' b= ');
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```

SOL5)  a=input(' a= ');
        b=input(' b= ');
        X1=det([b a(:,2:3)])/det(a)
        X2=det([a(:,1) b a(:,3)])/det(a)
        X3=det([a(:,1:2) b])/det(a)

```

Que6) Write a script to find  $c = a * b + a^2$  where a and b are a matrix.

SOL6)

```

a=input('a=')
b=input('b=')
if size(a,2)==size(b,1)&size(a)==size(b)
c=a*b+a^2
end

```

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```

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        else

```

```
fprintf('the number %g is odd',a)
end
```

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```
SOL8) p=input('p=')
r=roots(p);
If(all(r==real(r)))
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else
disp('all roots are not real')
end
```

Q9) Write a program to input x then find

$$y = \begin{cases} \sin(x) & 0 \leq x < 1 \\ e^{|x|} + 2 & x < 0 \\ x^2 + 3 & 1 \leq x < 10 \\ \frac{1}{x} & x \geq 10 \end{cases}$$

Quez10) write a program to input two matrix a, b then find  $c = a * b + |a| I - b^{-1}$

```
SOL10) a=input('a=')
b=input('b=')
if size(a)==size(b)&size(b,1)==size(b,2) & det(b)~=0
c=a.*b + det(a)*eye(size(a)) - inv(b)
end
```

Quez11) write a program to input matrix  $a_{n \times m}$  then find  $s = \sum_{i=1}^{n*m} f(a_i)$

$$\text{When } f(a_i) = \begin{cases} |a_i| & a_i < 0 \\ 1 & \text{if } a_i \text{ is positive prime number} \\ 0 & \text{other wise} \end{cases}$$

```
SOL11) a=input('a=')
s=0;
for i=1:numel(a)
if a(i)<0
```

```

a(i)=abs(a(i));
elseif isprime(abs(a(i)))&a(i)>0
a(i)=1;
else
a(i)=0;
end
s=s+a(i);
end
disp(s)

```

Q13) write a program to input the matrix then find out even element and odd element.

```

SOL13) a=input('the matrix a=')
        for i=1:prod(size(a))           (by index)
(prod(size(a))==numel(a))
        if rem(abs(a(i)),2)==0
        fprintf('the matrix %g is even\n',a(i))
        else
        fprintf('the matrix %g is odd\n',a(i))
        end
        end
        end

```

Q14) write a program to input the matrix then find the summation of even number and summation of odd number in a.

```

SOL14) a=input('the matrix a=')
        ev=0;od=0;
        for i=1:prod(size(a))           (by index) (prod(size(a))==numel(a))
        if rem(abs(a(i)),2)==0
        ev=ev+a(i);
        else
        od=od+a(i);
        end
        end
        ev
        od

```

Q15) write a program to create matrix  $A_{n \times m}$  when  $a_{i,j} = i + j^2$ .

```
SOL15) z=input('the dimation a=')
a=zeros(z);
for i=1:size(a,1)
    for j=1:size(a,2)
        a(i,j)=i+j^2;
    end
end
a
```

Q16) write a script to read x then find y where  $y = \begin{cases} \sin(x) & x > 0 \\ 2 + e^x & x < 0 \\ 7 & x = 0 \end{cases}$  by switch case?

```
SOL16) x= input('input the number');
switch true or 1
case x>0
y=sin(x)
case x<0
y=2+exp(x)
otherwise
y=7
end
```

Quez17) write a script to create a matrix  $A_{n \times m}$  where

$$a_{i,j} = \begin{cases} 3^i + j & \text{if } i + j \text{ is prime number} \\ 2^j + i & \text{if } i + j \text{ is even number} \\ 1 & \text{other wise} \end{cases}$$

Quez18) write a program to read a matrix  $A_{n \times m}$  then find  $p = \prod_{i=1}^{n \times m} f(a_i)$  where

$$f(a_i) = \begin{cases} 3^i + 1 & \text{if } a_i \text{ is prime number} \\ 2^i + 1 & \text{if } a_i \text{ is not prime number} \end{cases}$$



Q19) write a program to create a matrix  $A_{n \times m}$  where

$$a_{i,j} = \begin{cases} 0 & \text{if } i,j \text{ is odd number} \\ 1 & \text{if } i,j \text{ is even number} \\ -1 & \text{otherwise} \end{cases}$$

Quez1) write a program to read a matrix a then find b where

$$b = \begin{cases} a^{-1} & \text{if } |a| > 0 \\ a^2 & \text{if } |a| = 0 \\ a^{-1} * a & \text{if } |a| < 0 \end{cases}$$

```
Sol) a=input('a=');
switch true
    case det(a)>0
        b=inv(a)*a
    case det(a)==0
        c=a^2
    otherwise
        d=-inv(a)*a
end
```

Quez2) write a program to read a matrices a and b then find c where

$$c = \begin{cases} a + b & \text{if } a \text{ and } b \text{ have the same size} \\ |a| I + a & \text{otherwise} \end{cases}$$

```
Sol)
a=input('a=')
b=input('b=')
c=0;
if size(a)==size(b)
    c=a+b
elseif size(a,1)==size(a,2)
    d=det(a)*eye(size(a))+a
end
```

Quez3) write a program to read the real number x then find y where

$$y = \begin{cases} \ln(x + 1) & x > 0 \\ e^{x^2+1} & x < 0 \text{ and } |x| \text{ is odd} \\ \sqrt{|x - 2|} & x < 0 \text{ and } |x| \text{ is even} \end{cases}$$

Q20) write a program to input the integer number n then find the Fibonacci sequence.

$$f_1 = 1, f_2 = 1 \text{ and } f_n = f_{n-1} + f_{n-2}$$

```
Sol)  n=input('n=');
      f = zeros(1,n);
      f(1) = 1;
      f(2) = 1;
      for j = 3:n
      f(j) = f(j-1) + f(j-2);
      end
      f
```

Or the summation

```
b=1;a=1;
for j=3:100
c=a+b;
a=b;b=c;
end
disp(c)
```

## While loop

Q) Write a program to transform the decimal number to binary

Sol) First Method

```
a=input('a=')
s=0;
while a~=0
s=[rem(a,2) s];
```

```

a=fix(a/2);
end
s=s(1:length(s)-1)

```

OR

Secand Method

```

a=input('a=')
b=[];
while a>0
b=[rem(a,2) b];
a=fix(a/2);
end
b

```

Q) Write a program to convert the binary number to decimal number?

```

x=input('x=');
s=0;i=0;
while x~=0
    z=(x/10-fix(x/10))*10;
    s=s+z*2^i;
    i=i+1;
    x=fix(x/10);
end
s

```

Q) Write a program to input the integer number then find the number of digit.

```

a=input('a=')
i=0;
while a~=0
    a=fix(a/10);
    i=i+1;
end
i

```

Q) Write a program to read the values of  $x$  and  $y$  then computes the summation,

$$S = y + \frac{y+1}{x+2} + \frac{y+3}{x+4} + \frac{y+6}{x+6} + \frac{y+10}{x+8} + \dots T \quad \text{where } T < 10^3 .$$

Q1) write a program to input the number x then find s where

$$s = \frac{1}{9} + \frac{1}{27} + \frac{1}{81} + \dots + \frac{1}{3^{2(n)}} \text{ until } \frac{1}{3^{2(n)}} \leq 0.001$$

Q2) write a program to find the value of  $s = \frac{5}{x} + \frac{x^2}{6} + \frac{8}{x^3} + \frac{x^4}{11} + \dots + stop$  where the value of last term  $> 23$ , x is positive number.

```
Sol) x=input('x=');
If x~=0
k=5;
i=1;
t=k/x^i;
while t<=23
t=(k/x^i)^((-1)^(i+1));
s=s+t;
k=k+i;
i=i+1;
end
s
end
```

Q3) write a program to input the number x then find s where  $x > 1$  and

$$s = \sum_{n=1}^{\infty} \frac{n}{x^n}$$

```
Ans ) x=input('x=')
n=1; s=0;
while n/x^n > eps
s=s+n/x^n;
n=n+1;
end
s
```

Q3) write a program to input the number then check out is prime or not?

Q4) write a program to input the positive integer  $n$  then find all prime number between 1 and  $n$ ?

Q) Write a program to input an integer number then find all divisor of it.

Quiz) write a program to input  $x$   $y$  and  $n$  then find  $s$  where

$$1) s = \frac{x}{1!} + \frac{2!}{x^2} + \frac{x^3}{3!} + \frac{4!}{x^4} + \frac{x^5}{5!} \dots \text{up to } n \text{ term} .$$

$$2) s = \frac{x}{3!} + \frac{y}{6!} + \frac{x^2}{9!} + \frac{y^2}{12!} + \frac{x^3}{15!} + \dots \text{up to } n \text{ term} .$$

$$3) s = \frac{2}{1!} + \frac{x^2}{2!} + \frac{4}{3!} + \frac{x^4}{4!} + \frac{6}{5!} + \frac{x^6}{6!} + \dots \text{up to } n \text{ term} .$$

$$4) s = \frac{x}{2!} + \frac{x^2}{4!} + \frac{y^4}{6!} + \frac{x^4}{8!} + \frac{x^5}{10!} + \frac{y^7}{12!} + \dots \text{up to } n \text{ term} .$$

# Function

Exam) Write a MATLAB function to find the average of non-zero elements in lower triangle of input matrix (using *if*, *for* statements).

Sol)

```
function av = avlm(a)  
s=0;l=0;  
for i=1:size(a,1)  
    for j=1:size(a,2)
```

```

        if i<j && a(i,j)~=0
            s=s+a(i,j);
            l=l+1;
        end
    end
end

```

H.W) Write a script or function to output all repeat elements in the input row array.

H.W) Write a script or function to remove all repeat elements in the input row array.

```

Sol)  a=input('a=');
      i=1;a=sort(a);
while i<length(a)
    if a(i)==a(i+1)
        a= [ a(1:i)  a(i+2:length(a))];
        continue
    end
    i=i+1;
end
a

```

Exam) Write a Matlab script to find the number of repeat maximum in each row of input n by m dimension matrix then sorting the matrix rows according to number of maximum.

```

Sol)
a=input('a=');
mx=max(a,[],2);
nomx=zeros(size(mx));
for i=1:size(a,1)
    nomx(i)=sum(a(i,:)==mx(i));
    disp(['the no. of max. in row ' num2str(i) ' is
' num2str(nomx(i))]);
end
[s v]=sort(nomx);
b=a(v,:)

```

Exam) Write a Matlab script to find the number of repeat for each element in main diagonal of input square matrix.

```
Sol) a=input('a=');
      b=diag(a);
      c=sort(b);
      for i=length(c):-1:2
          if c(i)==c(i-1)
              c(i)=[];
          end
      end
      n=zeros(size(c));
      for i=1:length(c)
          n(i)=sum(b==c(i));
          disp([num2str(c(i)) ' has ' num2str(n(i)) '
repeat'])
      end
```

- Q1) Write a program to input two strings then find the number of common letters between them.
- Q2) Write a program to draw graph of input function and interval, use string.
- Q3) Write a program to draw surface of input function and region, use string.
- Q4) write a program to find the sum of two binary numbers, use string.
- Q5) write a program to find the multiply of two binary numbers, use string.
- Q6) write a program to find the sum of two hexadecimal numbers, use string.
- Q7) write a program to input string then remove repeated character in it.
- Q8) write a program to input string then separated Caps letters, small letters, digits and symbols.

Q1) Write a program to input the decimal number then converts to the hexadecimal.

```
Sol) a=input('a=') ;
      b= [];
      While (a>0)
          r=rem(a, 16);
          If r>9
              b= [char(r+abs('A')-10) num2str(b)];
          else
              b= [num2str(r) num2str(b)];
          end
          a=fix(a/16);
      end
      b
```

H.W) Write a program to input the hexadecimal number then converts it to the decimal number.

```
Sol) a=input('a=','s');
      s=0;
      for i=1:length(a)
          if a(i)>='A' & a(i)<='G'
              s=s+(abs(a(i))-abs('A')+10)*16^(length(a)-i);
          else
              s=s+str2num(a(i))*16^(length(a)-i);
          end
      end
      s
```



Q) Write a program to input number then finds the sum of even digits in it.

```
x=input('x=');  
y=num2str(x);  
s=0;  
for i=1:length(y)  
    z=str2num(y(i));  
    if mod(z,2)==0  
        s=s+z;  
    end  
end  
disp(['the sum of even digits is ' num2str(s)])
```

Q2) Write a program to input the string then finds all small letters.

```
Sol) a=input('a=','s');  
B=[];  
For i=1:length(a)  
If a(i)>='a' & a(i)<='z'  
b= [b a(i)];  
end  
end  
b
```

Quiz1) Write a program to input the string then removes all space between them.

**Sol3) First Method**

```
a=input('a=','s');
```

```

i=1; b=length(a);
while(i<b)
if a(i)=' '
a(i)=[];
b=length(a);
else
i=i+1;
end
end
a

```

### Second method

```

a=input('a=','s');
b=[];
for i=1:length(a)
if a(i)~= ' '
b=[b a(i)];
end
end
b

```

Quiz2) Write a program to input the string then finds all prime number between them.

Sol)

```

a=input('a=','s');
b=[];
for i=1:length(a)
    if a(i)<='9' & a(i)>='0' & isprime(str2num(a(i)))

```

```
        b=[b a(i)];
    end
end
b
```

Quiz3) Write a program to input a string then finds the summation of all even numbers between them.

```
Sol)
a=input('a=','s');
s=0;
for i=1:length(a)
    if rem(str2num(a(i)),2)==0 & a(i)>='0' & a(i)<='9'
        s=s+str2num(a(i));
    end
end
s
```

Quiz4) Write a program to input the string then convert all small letters to Capital letter and convert all capital letter to small letter.

```
Sol)
a=input('a=','s');
b=[];
for i=1:length(a)
    if a(i)<='Z' & a(i)>='A'
        b=[b lower(a(i))];
    else
        b=[b upper(a(i))];
    end
end
b
```

H.W) Write a program to input string then separated Capital letters, small letters, digits and symbols.

```

a=input('a=','s')
sc=[];ss=[];sd=[];sb=[];
for i=1:length(a)
    if a(i)>='a' & a(i)<='z'
        ss=[ss a(i)];
    elseif a(i)>='A' & a(i)<='Z'
        sc=[sc a(i)];
        elseif a(i)>='0' & a(i)<='9'
            sd=[sd a(i)];
    else
        sb=[sb a(i)];
    end
end
ss
sc
sd
sb

```

Exam) Write Matlab a function to find the sum of digits in the input string.

Sol)

```

function sd = eq5(st)
sd=0;
    dg=st(st<='9' & st>='0');
    for i=1:length(dg)
        sd=sd+str2num(dg(i));
    end
end

```

Exam) Write Matlab a function to convert small letters to capital in input string.

Sol)

```

function oust = eq5(inst)
for i=1:length(inst)
    if inst(i)>='a' && inst(i)<='z'

```

```
        inst(i)=upper(inst(i));  
end  
oust=inst;  
end
```

**Questions Bank**  
**Computational Mathematics II**

**Exercises**

- 1- Write a program to draw the graph of  $f(x) = \begin{cases} x^2 + 1 & \text{if } x \geq 2 \\ 1 & \text{if } 0 \leq x < 2 \\ |x - 3| & x < 0 \end{cases}$ .
- 2- Write a program to draw the graph of  $f(x) = \ln(x^2 - 4)$  on interval  $[-10, 10]$ .
- 3- Write a program to draw the graph of  $f(x) = \sqrt{x - 2} + \sqrt{1 - x^2}$  on interval  $[-10, 10]$ .
- 4- Write a program to input a polynomial then draw its graph and plot its max. and min. points if exist on his graph.
- 5- Write a program to draw the surface of  $f(x, y) = \ln(x^2 - y^2) + \sqrt{xy - 1}$  on region  $C = \{(x, y) \in \mathbb{R}^2; -2 \leq x \leq 2 \text{ and } -1 \leq y \leq 1\}$
- 6- Write a program to draw the surface of  $f(x, y) = ye^{x^2+y^2}$  on region  $C = \{(x, y) \in \mathbb{R}^2; x^2 + y^2 \leq 4\}$
- 7- Write a program to draw the surface of  $f(x, y) = x \sin(y) + y \cos(x)$  on region  $C = \{(x, y) \in \mathbb{R}^2; 1 \leq x^2 + y^2 \leq 4\}$
- 8- Write a program to draw the surface of  $f(x, y) = x^2 + y^2 - 6$  on region  $C = \{(x, y) \in \mathbb{R}^2; x \in [-4, -2] \cup [2, 4] \text{ and } y \in [-4, -2] \cup [2, 4]\}$
- 9- Write a program to draw the surface of  $f(x, y) = x^2 + y^2 - 6$  on region  $C = \{(x, y) \in \mathbb{R}^2; (x, y) \in \Delta ABC : A = (1, 1), B = (6, 2), C = (3, 5)\}$
- 10- Write a program to draw the surface of  $f(x, y) = x^2 - y^2$  on region  $C = \{(x, y) \in \mathbb{R}^2; -2 \leq x \leq 2 \text{ and } -1 \leq y \leq 1 \text{ and } x^2 + y^2 - xy \geq 1\}$

## Exercises

- 1- Write a program to find the tangent line of polynomial  $p(x)$  at the point  $x_0$  then draw the graph of polynomial and its tangent line.
- 2- Write a program to find all local maximum and minimum points of polynomial  $p(x)$  then draw polynomial and (max., min.) points.
- 3- Write a program to find the area under polynomial  $p(x)$  if its bounded.
- 4- Write a program to find the area under polynomial  $p(x)$  on interval  $[a, b]$ .
- 5- Write a function to add two polynomial  $p(x)$  and  $q(x)$ .
- 6- Write a function to subtract two polynomial  $p(x)$  and  $q(x)$ .
- 7- Write a program to find the area between two polynomials  $p(x)$  and  $q(x)$  if its bounded.

Q1) Write a program to draw the graph of input function.

Q2) Write a program to draw the surface of input function.

Q3) Write a program to check if the input function is odd or even.

Q4) Write a program to find all asymptotic line of input function if exist.

Q5) Write a program to find the area between three line if they are not co-linear and then draw the triangle of intersection.

Q6) Write a program to find out if the input function is onto one or not then find its inverse if exist then draw the graphs.

Q7) Write a program to find all singular point of input equation.

Q8) Write a program to find the equation of line from two points.

Q9) Mixing MATLAB built-in functions to do the following by one-line statement in command window

- a) Find the number of imaginary roots of polynomial.
- b) Find the sum of real roots of polynomial.

- c) Find the maximum coefficient in polynomial.
- d) Find the degree of polynomial.

## Exercises

- Q1) Write a program to find derivative of input function by definition.
  - Q2) Write a program to find the area under function  $f(x)$  on interval  $[a, b]$  by Riemann integral.
  - Q3) Write a program to find tangent line of function  $f(x)$  at  $x_0$  and draw the graphs.
  - Q4) Write a program to find local maximum, Local minimum and Inflection point of function  $f(x)$  then draw its graph.
  - Q5) Write a program to find the area between two input functions.
  - Q6) Write a program to find the area under function  $f(x)$  on interval  $[a, b]$ .
  - Q7) Write a program to find the area under function  $f(x)$  if exist.
  - Q8) Write a program to find local maximum, local minimum and saddle point of function  $f(x, y)$  then draw its graph.
  - Q9) Write a program to find the parametric equation of line in  $R^3$  that pass through the two points and plot of its graph.
  - Q10) Write a program to find the equation of plane pass through the three points and plot of its graph.
  - Q11) Write a program to find the eq. of tangent plane of the surface  $f(x, y, z)$  at the point  $(x_0, y_0, z_0)$ .
- Q1) Mixing MATLAB built-in functions to do the following by one-line statement in command window
- a) Check whether the matrix  $\mathbf{A}_{n \times m}$  is zero matrix or not.
  - b) Check whether the matrix  $\mathbf{A}_{n \times n}$  is identity matrix or not.
  - c) Check whether the matrix  $\mathbf{A}_{n \times n}$  is diagonal matrix or not.



- d) Check whether the matrix  $\mathbf{A}_{n \times n}$  is Symmetric matrices or not.
- e) Check whether the matrix  $\mathbf{A}_{n \times n}$  is Singular matrix or not.
- f) Check whether the matrix  $\mathbf{A}_{n \times n}$  is Hermitian matrix or not.
- g) Check whether the matrix  $\mathbf{A}_{n \times n}$  is Orthogonal matrix or not.
- h) Check whether the matrix  $\mathbf{A}_{n \times n}$  is Idempotent matrix or not.
- i) Check whether the matrix  $\mathbf{A}_{n \times n}$  is Involuntary matrix or not.
- j) Check whether the matrix  $\mathbf{A}_{n \times n}$  is Nilpotent matrix of power  $p$  or not.
- k) Check whether the all eigenvalue of matrix  $\mathbf{A}_{n \times n}$  is real or not.
- l) Check whether two vectors in  $\mathbb{R}^3$  are parallel or not.
- m) Find the angle between two vectors in  $\mathbb{R}^3$ .

Q2) Write a program to input three vectors in  $\mathbb{R}^3$  then find out are independent or not.

Q3) Write a program to solve linear system by using Cramer's rule.

Q4) Write a program input three vectors  $V_1, V_2$  and  $V_3$  in  $\mathbb{R}^3$  then find the area of triangle  $V_1V_2V_3$ .

## Calculus Application

Q) Write a Matlab function to checks that either the input function is even or odd.

```
function k=e(f)
syms x
if subs(f,-x)==f
    k='even';
elseif subs(f,-x)==-f
    k='odd';
else
    k='is not even and not odd';
end
```

end

H.w) Write a program to find the area between two functions.

```
syms x real
f=input('f(x)=');
g=input('g(x)=');
r=solve(f-g);
r=sort(r);
if length(r)>1
    s=0;
    for i=1:length(r)-1
        s=s+abs(int(f-g,x,r(i),r(i+1)));
    end
    s
else
    disp('the area is not bounded')
end
```

Q) Write a program to input the function then find the area under the curve.

```
syms x
f=input('f=');
a=input('a=');
b=input('b=');
c=double(solve(f));
c=c(c>a&c<b);
c=c(real(c)==c);
c=sort([c a b]);
s=0;
for i=1:length(c)-1
    s=s+abs(int(f,x,c(i),c(i+1)));
end
s
```

H.W) Write a program to find the local maximum and local minimum points of input function if exists then

draw the graph of function and view the local maximum and local minimum points on the graph.

Sol)

```
syms x
f=input('f(x)=');
df=diff(f,x);
d2f=diff(df,x);
xc=double(solve(df));
xc=sort(xc);
n=length(xc);
if n>0
    for i=1:n
        if subs(d2f,xc(i))>0
            disp([num2str(xc(i)) ' is min.'])
        elseif subs(d2f,xc(i))<0
            disp([num2str(xc(i)) ' is max.'])
        else
            disp('test fail')
        end
    end
end
x1=xc(1)-1:0.1:xc(n)+1;
y1=double(subs(f,x1));
plot(x1,y1)
yc=subs(f,xc);
hold on
plot(xc,yc,'or')
```

Q) Write a program to find the critical point and check it which is max., min. or saddle point.

```
syms x y
f=input('f(x,y)=');
fx=diff(f,x);
fxx=diff(fx,x);
fxy=diff(fx,y);
fy=diff(f,y);
```

```

fyy=diff(fy,y);
d=fxx*fyy-(fxy)^2;
[xc,yc]=solve(fx,fy);
xc=double(xc)
yc=double(yc)
for i=1:length(xc)
    if subs(d,[x,y],[xc(i),yc(i)])>0
        if subs(fxx,[x,y],[xc(i),yc(i)]) >0
            disp(['(' num2str(xc(i)) ',' num2str(yc(i))
') is min.'])
        else
            disp(['(' num2str(xc(i)) ',' num2str(yc(i)) ')
is max.'])
        end
    elseif subs(d,[x,y],[xc(i),yc(i)])<0
        disp(['(' num2str(xc(i)) ',' num2str(yc(i)) ')
is saddle.'])
    else
        disp('the method fails')
    end
end
end

```

Q) Write a program to find the Taylor series.

```

syms x
f=input('f(x)=');
x0=input('x0=');
n=input('n=');
s=0;
for i=0:n
    s=s+(subs(diff(f,x,i),x,x0)/factorial(i))*(x-x0)^i;
end
s

```

Q) Write a program to input then find the derivative by definition.

```

syms x h
f=input('input the function f(x)=')
g=simplify((subs(f,x,x+h)-f)/h);

```

```
limit(g,h,0)
```

Q) Write a program to input the function  $f(x)$  and the point  $x_0$  then find the equation tangent line of input function.

```
syms x y
f=input('f(x)= ');
x0=input('x0=');
y0=subs(f,x,x0);
m=diff(f,x);
y=m*(x-x0)+y0
```

Q) Write a program to find the slop and the equation of tangent line of the points  $(x_0, x_1)$  and  $(y_0, y_1)$ .

```
syms x y
x0=input('x0=');
y0=input('y0=');
x1=input('x1=');
y1=input('y1=');
m=(y1-y0)/(x1-x0);
y=simplify(m*(x-x0)+y0)
```

Q) Write a program to find the eq. of tangent plane of the surface  $f(x,y,z)$  at the point  $(x_0, y_0, z_0)$ .

```
syms x y z
f=input('f(x,y,z)= ');
x0=input('x0=');
y0=input('y0=');
z0=input('z0=');
fx=diff(f,x);
fy=diff(f,y);
fz=diff(f,z);
subs(fx,[x y z],[x0 y0 z0])*(x-x0)+subs(fy,[x y z],[x0
y0 z0])*(y-y0)+subs(fz,[x y z],[x0 y0 z0])*(z-z0)
```

Q) Write a program to find the parametric eq. pass through the two points and plot of it.

```
syms t
a=input('a=');
b=input('b=');
v=b-a;
x=a(1)+t*v(1);
y=a(2)+t*v(2);
z=a(3)+t*v(3);
t1=-10:10;
x1=subs(x,t1);
y1=subs(y,t1);
z1=subs(z,t1);
plot3(x1,y1,z1)
```

Q) Write a program to input the polynomial and the discrete set then check that is the polynomial is one to one or not.

```
syms x
f=input('f(x)=');
a=input('input the start range of the function=');
b=input('input the end range of the function=');
c=a:b;
for i=1:length(c)-1
    for j=i+1:length(c)
        if subs(f,x,c(i))==subs(f,x,c(j))&&~c(i)~=c(j)
            disp('the function is not one to one')
            return
        end
    end
end
disp('the function is one to one')
```

Exam) Write a program to input two vectors in  $\mathbb{R}^3$  then if they are not parallel then find the angle between them and plane that contains them.

Sol)

```
v1=input(v1);
v2=input(v1);
if norm(cross(v1,v2))==0
    disp('They are parallel')
else
    th=acosd((dot(v1,v2))/(norm(v1)*norm(v2)))
    n=cross(v1,v2);
    syms x y z
    P=n(1)*(x-v1(1))+n(2)*(y-v1(2))+n(3)*(z-v1(3))
end
```