Expt. No. 1a GENERATION OF SEQUENCES

AIM:

To write a program to generate different waveforms using MATLAB

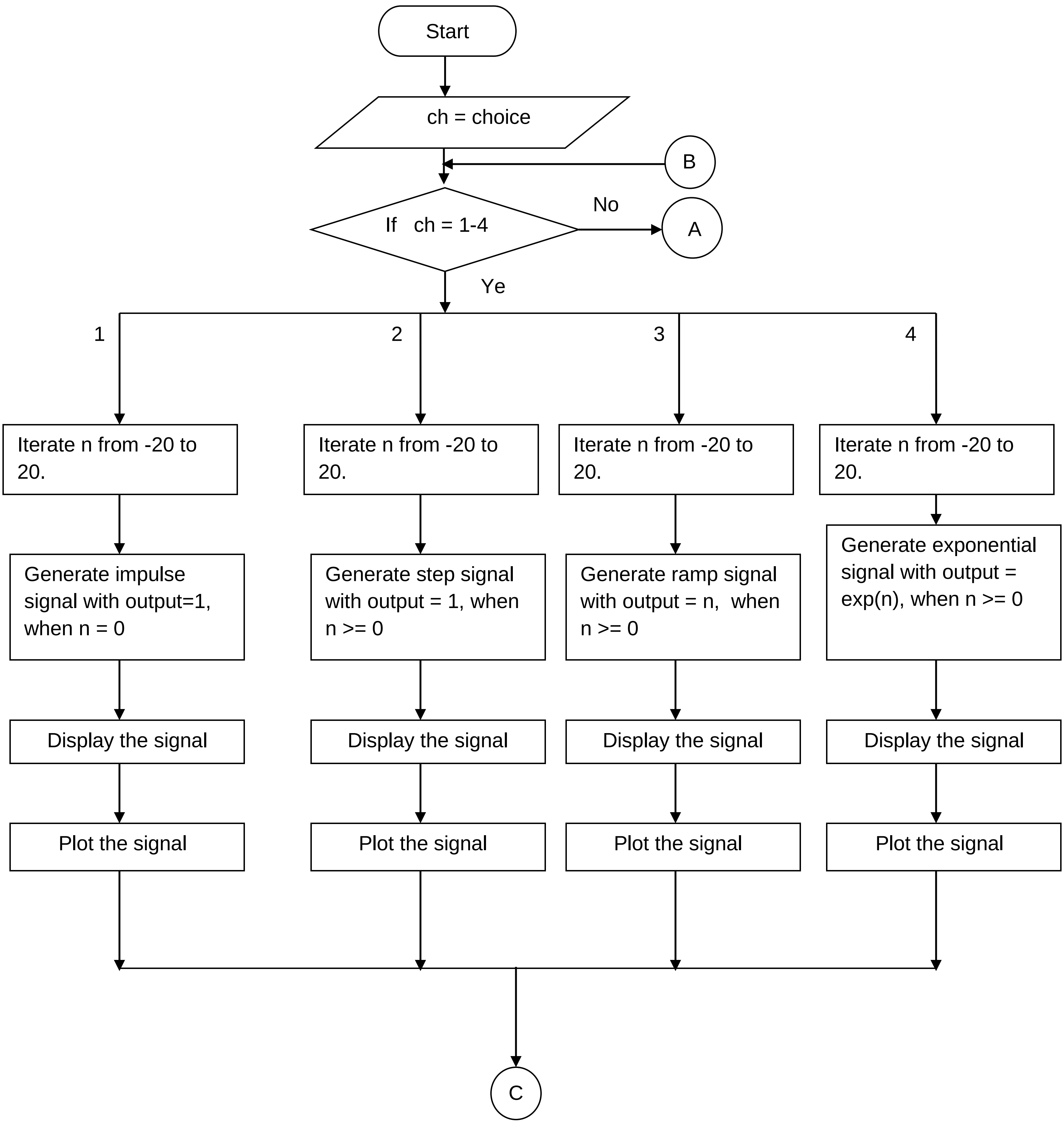
SOFTWARE REQUIRED:

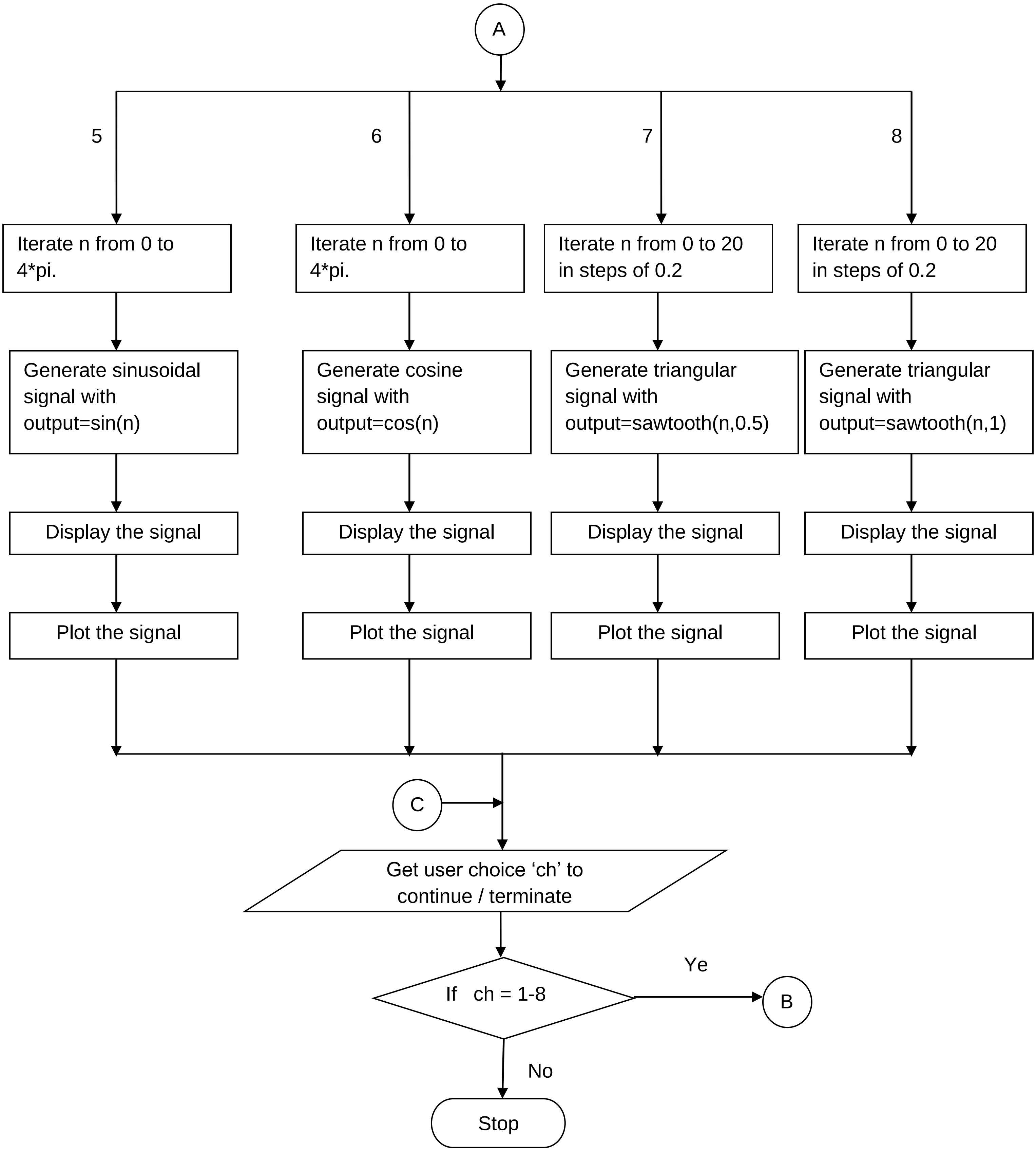
MATLAB Software

ALGORITHM:

1. Clear command window.
2. Get the choice from user to select the waveform to be generated.
3. Use switch case to execute the code for different waveforms.
4. Generate
   i) Unit impulse: Iterate n from -20 to 20. Generate output=1 when n = 0.
   ii) Unit step: Iterate n from -20 to 20. Generate output=1 when n >= 0.
   iii) Ramp: Iterate n from -20 to 20. Generate output=n when n >= 0.
   iv) Exponential: Iterate n from -20 to 20. Generate output=exp(n) when n >= 0.
   v) Sine: Iterate n from 0 to 4*pi. Generate output = sin(n)
   vi) Cosine: Iterate n from 0 to 4*pi. Generate output = cos(n)
   vii) Triangular: Iterate n from 0 to 20 in steps of 0.2.
   Generate output=sawtooth(n,0.5)
   viii) Sawtooth: Iterate n from 0 to 20 in steps of 0.2.
   Generate output=sawtooth(n,1)
5. Plot the signal.
6. Get the input from user if another waveform needs to be generated.
7. If yes, jump to Step 4, else terminate the program.

FLOWCHART:


Start
ch = choice
B
If ch = 1-4
No
A
Ye
1
2
3
4
Iterate n from -20 to 20.
Iterate n from -20 to 20.
Iterate n from -20 to 20.
Iterate n from -20 to 20.
Generate impulse signal with output=1, when n = 0
Generate step signal with output = 1, when n >= 0
Generate ramp signal with output = n, when n >= 0
Generate exponential signal with output = exp(n), when n >= 0
Display the signal
Display the signal
Display the signal
Display the signal
Plot the signal
Plot the signal
Plot the signal
Plot the signal
C



NOTE: Pls include the 9th one which is the random signal

PROGRAM:

```
%WAVEFORM GENERATOR
clc
clear all
close all
disp('Program for Waveform generation');
opt=1;

while(opt==1)
    disp('Which waveform you want to generate?');
    disp('1.Impulse,2.Step,3.Ramp,4.Exponential,5.Sine,6.Cosine,7.Triangle,8.Sawtooth,
    9.Random Signal');
    k=input('ENTER YOUR CHOICE:');
    switch k

%IMPULSE WAVEFORM
  case 1
  n = [-20:1:20];
  for k=1:1:length(n)
          if(n(k)==0)
            x(k)=1;
          else
            x(k)=0;
          end
   end
% disp(x);

   subplot(5,2,1)
   stem(n,x);
   xlabel('n -->');
   ylabel('amplitude');
   title('UNIT IMPULSE SIGNAL');


%STEP WAVEFORM
case 2
n =[-20:1:20];
for k=1:1:length(n)
            if(n(k)>=0)
              x(k)=1;
            else
              x(k)=0;
            end
end
% disp(x);
subplot(5,2,2)
stem(n,x);
xlabel('n -->');
ylabel('amplitude');
title('UNIT STEP SIGNAL');

%RAMP WAVEFORM
case 3
n = [-20:1:20];
for k=1:1:length(n)
             if(n(k)>=0)
                   x(k)=n(k);
             else
```

```
            x(k)=0;
          end
  end
% disp(x);
 subplot(5,2,3)
 stem(n,x);
 xlabel('n -->');
 ylabel('amplitude');
 title('RAMP SIGNAL');


 %EXPONENTIAL WAVEFORM
 case 4
 n = [-20:1:20];
 for k=1:1:length(n)
          if(n(k)>=0)
            x(k)=exp(n(k));
          else
            x(k)=0;
          end
 end
% disp(x);
 subplot(5,2,4)
 stem(n,x);
 xlabel('n -->');
 ylabel('amplitude');
 title('EXPONENTIAL SIGNAL');


 %SINE WAVEFORM
 case 5
 n = [0:(pi/32):(4*pi)];
 x = sin(n);
% disp(x);
 subplot(5,2,5)
 stem(n,x);
 xlabel('n -->');
 ylabel('amplitude');
 title('SINE SIGNAL');


%COSINE WAVEFORM
case 6
n = [0:(pi/32):(4*pi)];
x = cos(n);
% disp(x);
subplot(5,2,6)
stem(n,x);
xlabel('n -->');
ylabel('amplitude');
title('COSINE SIGNAL');


%TRIANGULAR WAVEFORM
 case 7
 n = [0:0.2:20];
 x =sawtooth(n,0.5);
% disp(x);
```

```
subplot(5,2,7)
stem(n,x);
xlabel('n -->');
ylabel('amplitude');
title('TRIANGULAR SIGNAL');


%SAWTOOTH WAVEFORM
case 8
n = [0:0.2:20];
x=sawtooth(n,1);
% disp(x);
subplot(5,2,8)
stem(n,x);
xlabel('n -->');
ylabel('amplitude');
title('SAWTOOTH SIGNAL');


%RANDOM SIGNAL
case 9
r=10
x=rand(r,1)
% disp(x);
subplot(5,2,[9 10])
stem(x,'k')
xlabel('r->')
ylabel('X->')
title('RANDOM SIGNAL’)

      otherwise
         disp('INVALID CHOICE');
   end
   disp('Do you want to continue?');
   opt=input('If YES, press 1:');
end
```

RESULT:

Thus, the program to generate different waveforms using MATLAB is executed and the outputs are verified.

Expt. No. 2. AUTO CORRELATION and CROSS CORRELATION

Expt. No. 2a. AUTO CORRELATION

AIM:

To write a program to obtain auto correlation of the given sequence using MATLAB.

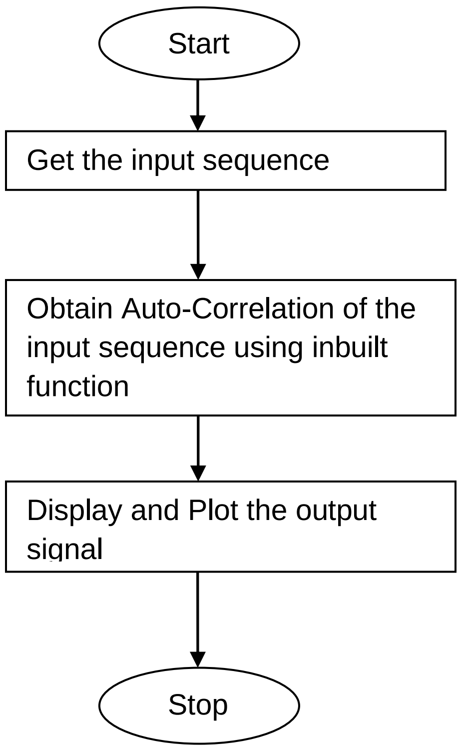
SOFTWARE REQUIRED:

MATLAB Software

ALGORITHM:

1. Start the program.
2. Give the input sequence.
3. Obtain the autocorrelation of the input sequence using the built in function, xcorr(x,x).
4. Display and plot the output.
5. Terminate the program.

FLOWCHART:



PROGRAM:

```
clc
clear all
close all
x=input('enter the input sequence x')
c=xcorr(x,x)              %correlation using the function 'xcorr'
subplot(2,1,1)
stem(x)
xlabel('n')
ylabel('x(n)')
title('input x')
disp('auto correlated sequence')
disp(c)
subplot(2,1,2)
stem(c)
```

```
xlabel('n')
ylabel('c(n)')
title('auto correlated sequence')
```

RESULT:

Thus, the program to find the auto correlation of the given sequences using MATLAB is executed and the output is verified.

Expt. No. 2b. CROSS CORRELATION

AIM:

To write a program to obtain cross correlation of the given sequences using MATLAB.

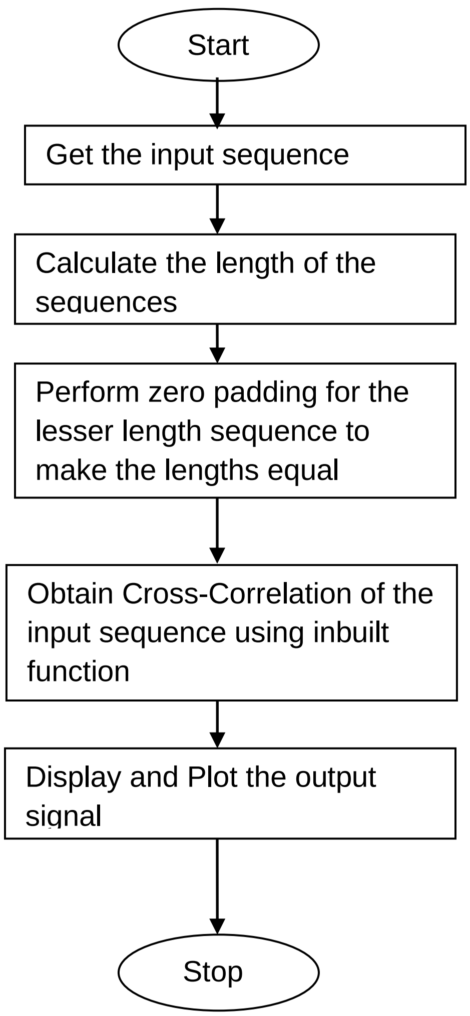
SOFTWARE REQUIRED:

MATLAB Software

ALGORITHM:

1. Start the program.
2. Give the two input sequences.
3. Obtain the autocorrelation of the input sequence using the built in function, xcorr(x,x).
4. Display and plot the output.
5. Terminate the program.

FLOWCHART:



PROGRAM:

```
clc
clear all
close all
x=input('enter the input sequence x')
y=input('enter the input sequence y')
m=length(x)                    %length of x
n=length(y)                    %length of x
if (m-n) ~= 0
   if m>n
```

```
        y=[y zeros(1,(m-n))]      %append m-n number of zeros to the sequence ‘y’
        n=m
    else
        x=[x zeros(1,(n-m))]      %append n-m number of zeros to the sequence ‘x’
        m=n
    end
end
c=xcorr(x,y)                      %correlation using the function ‘xcorr’
subplot(3,1,1)
stem(x)
xlabel('n')
ylabel('x(n)')
title('input x')
subplot(3,1,2)
stem(y)
xlabel('n')
ylabel('y(n)')
title('input y')
disp('cross correlated sequence')
disp(c)
subplot(3,1,3)
stem(c)
xlabel('n')
ylabel('c(n)')
title('cross correlated sequence')
```

RESULT:

Thus, the program to find the cross correlation of the given sequences using MATLAB is executed and the output is verified.

Expt. No. 3a. DFT & IDFT

AIM:

To write a program to find the Discrete Fourier Transform of the given sequence using MATLAB and plot the magnitude and phase response.

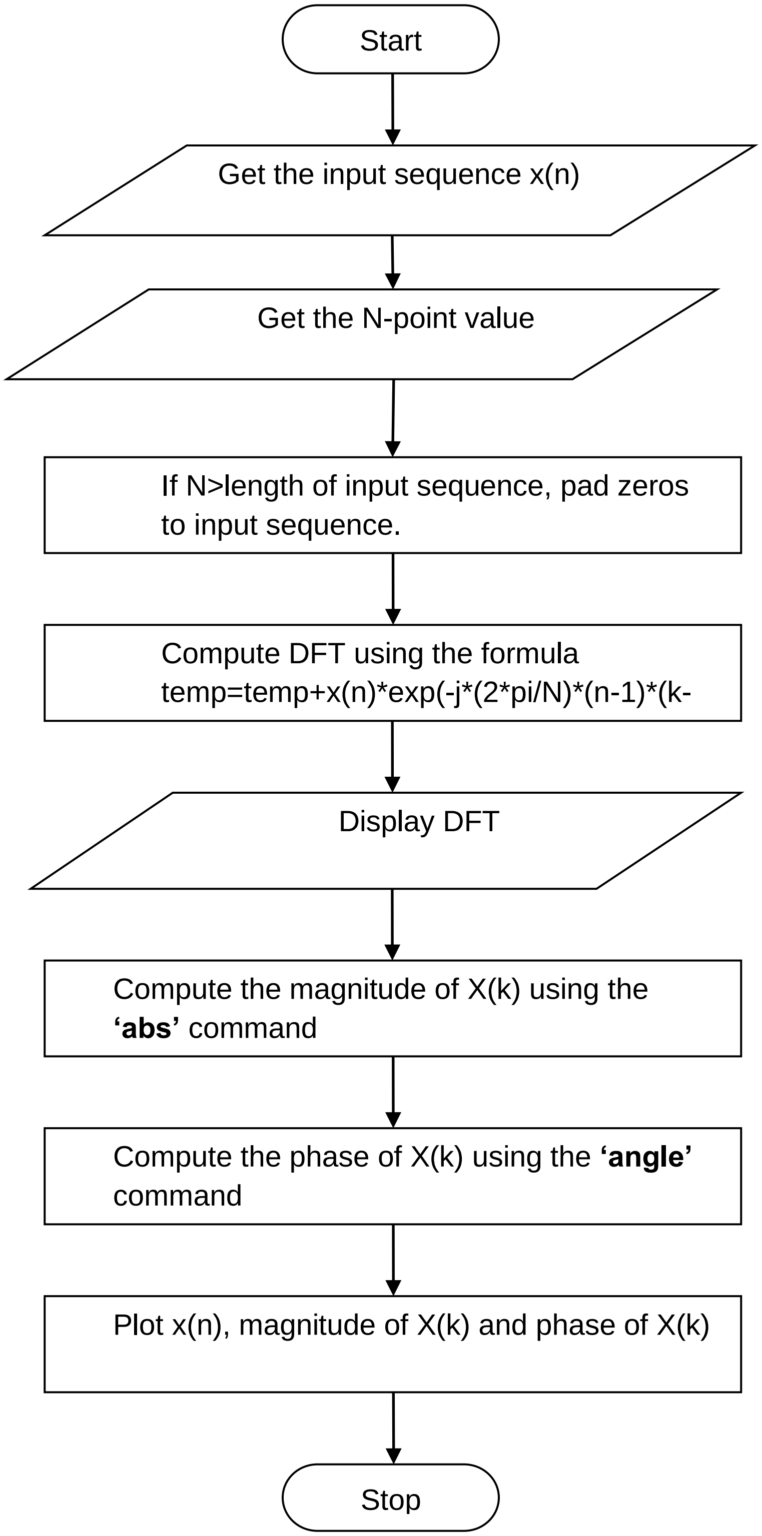
SOFTWARE REQUIRED:

MATLAB Software

ALGORITHM:

1. Clear the command window.
2. Get the input sequence x(n).
3. Get the N-point value.
4. If N>length of input sequence, pad zeros to input sequence.
5. For each value of X(k), compute temp=temp+x(n)*exp(-j*(2*pi/N)*(n-1)*(k-1))
6. Display DFT of the input sequence
7. Compute the magnitude of X(k) using the command
   mag_dft=abs(x_dft)
8. Compute the phase of X(k) using the command
   phase_dft=angle(x_dft)
9. Plot the input sequence, magnitude of X(k), and phase of X(k) in a single window.

FLOWCHART:



PROGRAM:

```
clc;
clear all;
close all;
x=input('enter the sequence');
N=input('enter the length')
if(N>length(x))
   x=[x zeros(1,(N-length(x)))]
end
```

```
for k=1:1:N
    X(k)=0;
for n=1:1:length(x)
    X(k)=X(k)+x(n)*exp(-j*(2*pi/N)*(n-1)*(k-1));
end
 disp(X(k))
end

subplot(3,1,1)
stem(x,'k')
xlabel('n->')
ylabel('amp->')
title('input')
mag_X=abs(X)
subplot(3,1,2)
stem(mag_X,'k')
xlabel('n->')
ylabel('amp->')
title('magnitude response')
phase_X=angle(X)
subplot(3,1,3)
stem(phase_X,'k')
xlabel('n->')
ylabel('amp->')
title('phase response')
for n=1:1:N
    y(n)=0;
    for k=1:1:length(X)
        y(n)=y(n)+(1/N)*X(k)*exp(j*(2*pi/N)*(n-1)*(k-1));
    end
    disp(y(n))
end
```

RESULT:

Thus, the program to find the Discrete Fourier Transform and IDFT of the given sequence using MATLAB is executed and the output is verified.

Expt. No. 3b. FFT and IFFT

AIM:

To write a program to find the FFT of the given sequence using MATLAB and plot the magnitude and phase response.

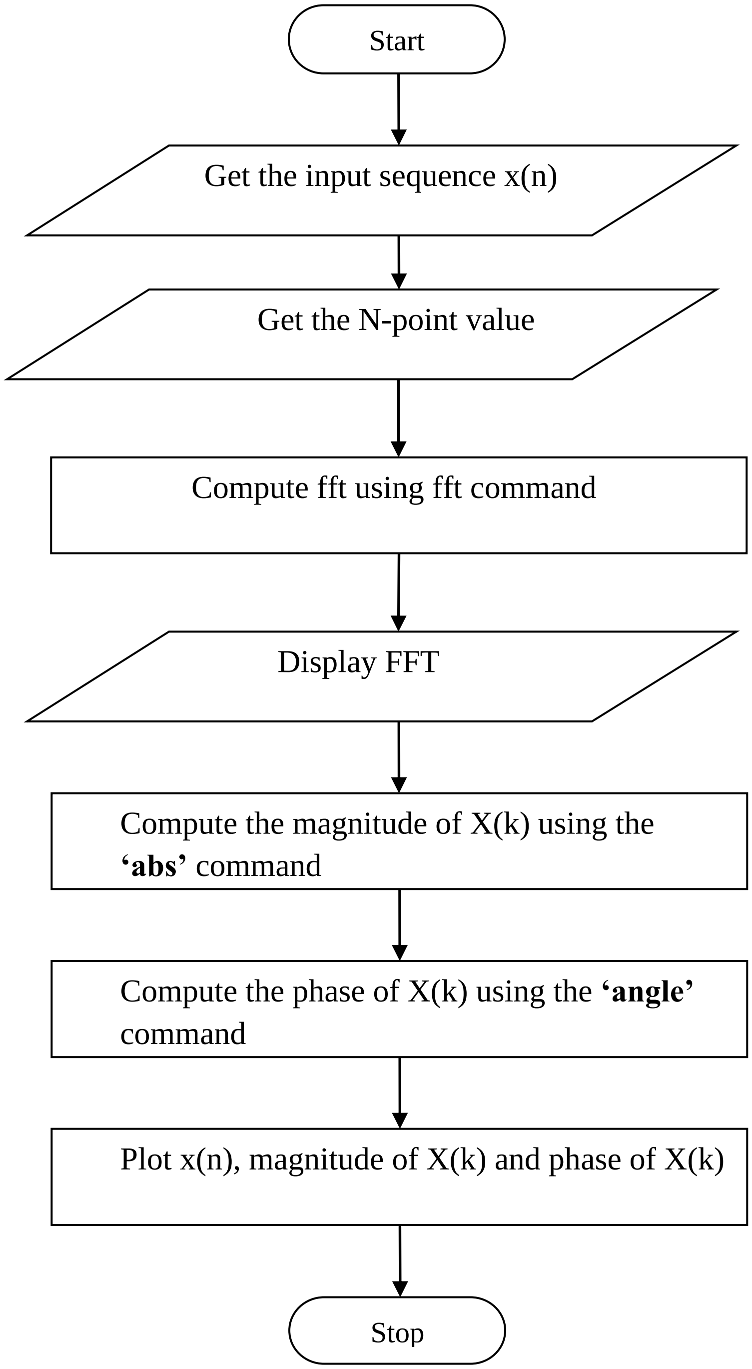
SOFTWARE REQUIRED:

MATLAB Software

ALGORITHM:

1. Clear command window.
2. Get the input sequence x(n).
3. Get the N-point value.
4. Compute FFT using x_fft=fft(x,n).
5. Display FFT of the input sequence
6. Compute the magnitude of X(k) using the command
   mag_fft=abs(x_fft)
7. Compute the phase of X(k) using the command
   phase_fft=angle(x_fft)
8. Plot the input sequence, magnitude of X(k), and phase of X(k) in a single window.

FLOWCHART:



PROGRAM:

```
clc
clear all
close all
x=input('enter the sequence')
N=input('enter the length')
X=fft(x)                    %FFT function
subplot(3,1,1)
stem(x,'k')
xlabel('time->')
ylabel('amp->')
title('input->')
mag_X=abs(X)
subplot(3,1,2)
stem(mag_X,'k')
```

```
xlabel('time->')
ylabel('amp->')
title('phase response->')
phase_X=angle(X)
subplot(3,1,3)
stem(phase_X,'k')
xlabel('time->')
ylabel('amp->')
title('magnitude response->')
y=ifft(X)
```

RESULT:

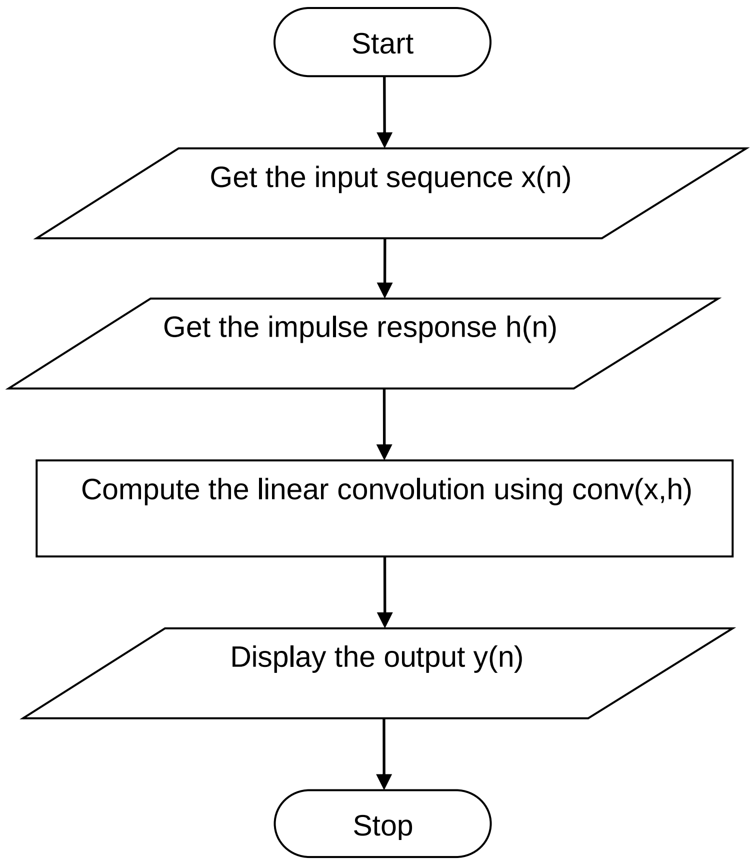
Thus, the program to find the FFT and IFFT of the given sequence using MATLAB is executed and the output is verified.

Expt. No. 4 Linear Convolution and Circular Convolution
Expt. No. 4a Linear Convolution

AIM:
To compute linear convolution of two sequences using in-built function in MATLAB.

ALGORITHM:
1. Clear command window.
2. Get the input sequence x(n).
3. Get the impulse response h(n).
4. Compute the linear convolution using conv(x,h) command.
5. Display the output.
6. Plot the input sequence, impulse response and output sequence in a single window.

FLOWCHART:



PROGRAM:
```
clc
clear all
close all
x=input('enter the input sequence')
h=input('eneter the impulse response')
l=length(x)+length(h)-1
y=conv(x,h)
subplot(3,1,1)
stem(x,'k')
xlabel('time->')
ylabel('amp->')
title('input->')
subplot(3,1,2)
stem(h,'k')
```

```
xlabel('time->')
ylabel('amp->')
title('impulse->')
subplot(3,1,3)
stem(y,'k')
xlabel('time->')
ylabel('amp->')
title('linear convolution->')
```

RESULT:

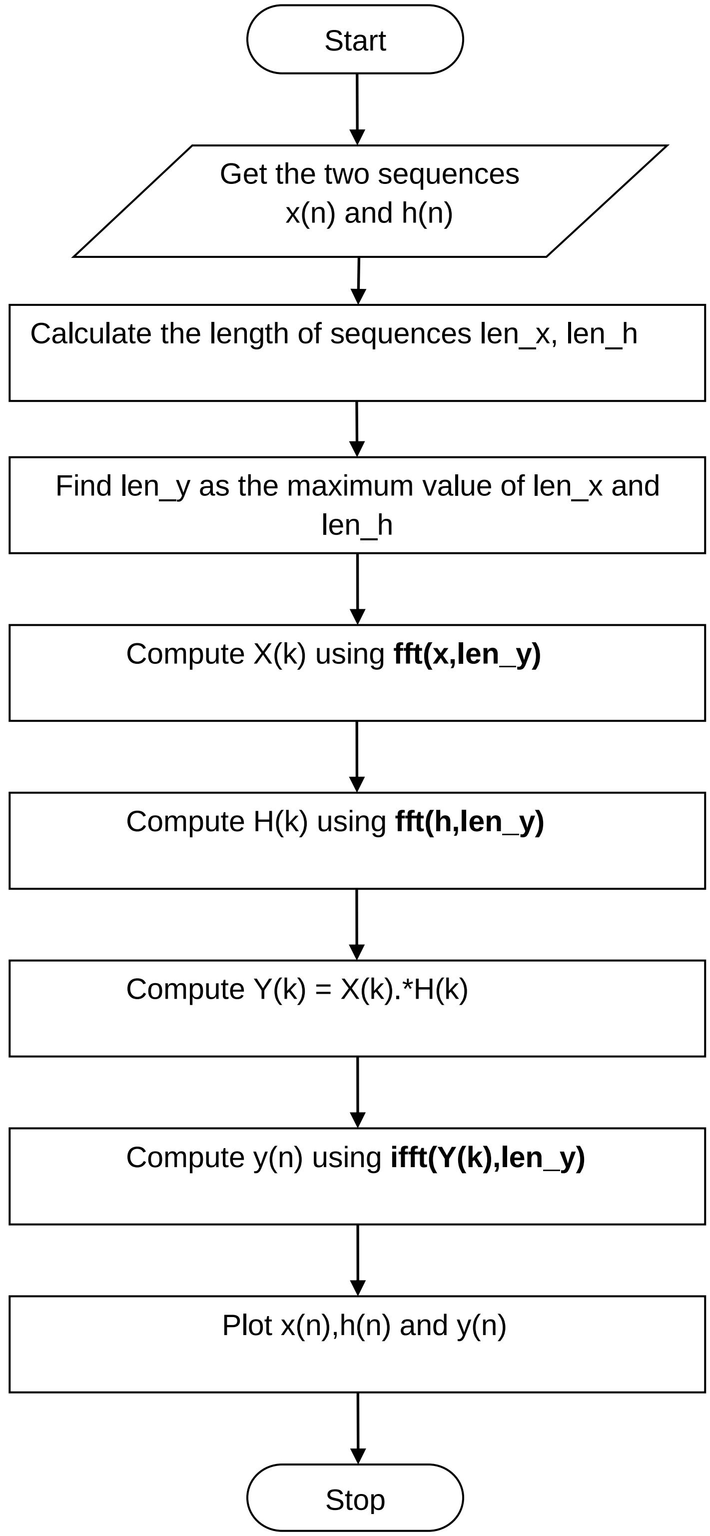
Thus, the program to find the linear convolution of two sequences using in-built function in MATLAB is executed and the output is verified

Expt. No. 4b Circular convolution using FFT

AIM:
To compute circular convolution of two sequences using FFT in MATLAB.

ALGORITHM:
1. Clear command window.
2. Get the two sequences x(n) and h(n) from user.
3. Calculate the length of sequences len_x, len_h and find the maximum value.
4. Compute X(k) using **fft** command by specifying fft length as maximum length of x and h.
5. Compute H(k) using **fft** command by specifying fft length as maximum length of x and h.
6. Multiply the two fft sequences element by element and store in y_fft .
7. Calculate inverse FFT of y_fft using **ifft** command and store it in y.
8. Display the output.
9. Plot the two input sequences and the output sequence.

FLOWCHART:



PROGRAM:

```
clc
clear all
close all
x=input('enter then input sequence')
h=input('enter the impulse response')
l1=length(x)
l2=length(h)
l3=max(l1,l2)
X=fft(x)
```

```
H=fft(h)
for i=1:1:l3
    Y(i)=X(i)*H(i);
end
y=ifft(Y)
subplot(3,1,1)
stem(x,'k')
xlabel('n->')
ylabel('amp->')
title('input')
subplot(3,1,2)
stem(h,'k')
xlabel('n->')
ylabel('amp->')
title('impulse response')
subplot(3,1,3)
stem(y,'k')
xlabel('n->')
ylabel('amp->')
title('circular convolution using fft')
```

RESULT:

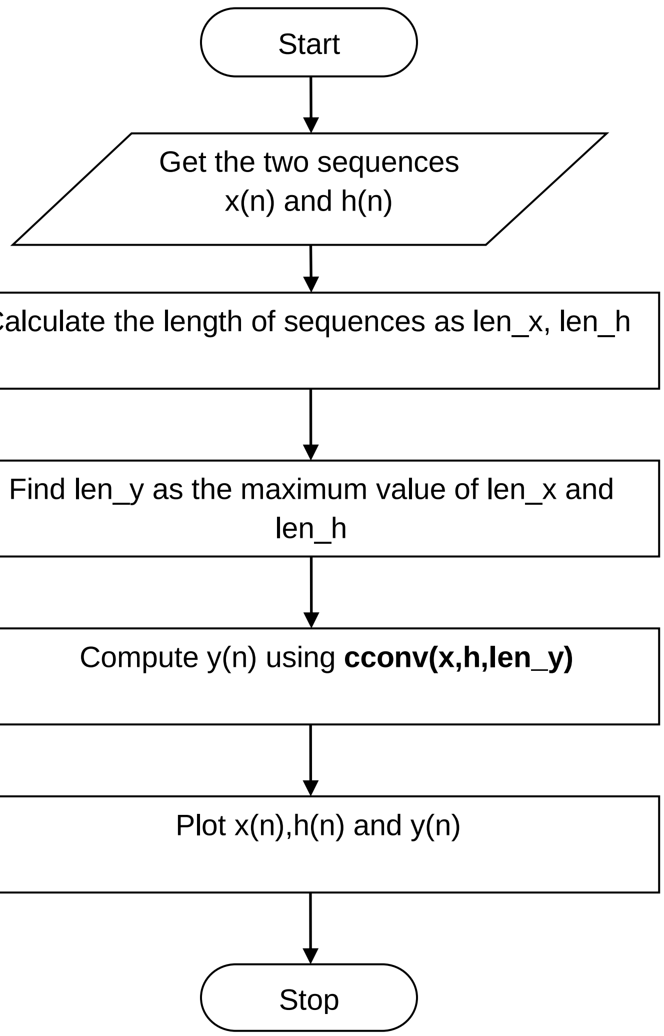
Thus, the program to find the circular convolution of two sequences using FFT in MATLAB is executed and the output is verified

Expt. No. 4c Circular Convolution using in-built function

AIM:
To compute the circular convolution of two sequences using in-built function in MATLAB.

ALGORITHM:
1. Clear command window.
2. Get the two sequences x(n) and h(n) from user.
3. Calculate the length of sequences len_x, len_h and find the maximum value.
4. Perform the circular convolution using ‘cconv’ function by specifying output length as maximum length of x and h.
5. Display the output.
6. Plot the two input sequences and the output sequence.

FLOWCHART:



PROGRAM:

```
clc
clear all
close all
x=input('enter the input sequence')
i=input('enter the impulse response')
l1=length(x)
l2=length(i)
l3=max(l1,l2)
```

```
y=cconv(x,i,l3)
subplot(3,1,1)
stem(x,'k')
xlabel('n->')
ylabel('amp->')
title('input')
subplot(3,1,2)
stem(i,'k')
xlabel('n->')
ylabel('amp->')
title('impulse response')
subplot(3,1,3)
stem(y,'k')
xlabel('n->')
ylabel('amp->')
title('circular convolution')
```

RESULT:

Thus, the program to find the circular convolution of two sequences using using in-built function in MATLAB is executed and the output is verified