Table of Contents


```
%%Alapti Sai Varun
%%1410110037
%%Discussed :

clc;
clear all;
close all;
```

1 Construct a Cosine transformation matrix C of size N×N, by using the sequence? s?_k [n]=2 cos?(?k(2n+1)/2N),0?n?N-1,0?k?N-1 . Where the first row of the matrix is? s?_0 [n],0?n?N-1 , second row is? s?_1 [n],0?n?N-1, similarly N^th row is? s?_(N-1) [n],0?n?N-1.

```
N=4;

for n=0:1:N-1
    for k=0:1:N-1
        C(n+1,k+1)=2*cos((pi*k*((2*n)+1))/(2*N));
    end
end
```

2nd Verify the condition that CC^T=NI, where I is an Identity matrix. If the condition is satisfied then, C^(-1)=1/N C^T

```
Con= C*C'; % C*C' = NICondition is not satisfied
```

3rd Consider a N= 4 length input sequence x[n] (the example you have done in class) and compute the Cosine transformation coefficients X_DCT [K] using X_DCT [K]=Cx[n]. Then from the obtained coefficients compute the inverse transformation, using x[n]=C^(-1) X[K].

```
I=[1,2,3,4];
CT=C.'*I'; % Calculated Cosine transform of Input matrix
ICT=inv(C.')*CT; %Calculated inverse Cosine transform of cosine
 Tranpose matrix got same input value
```

4 Generate a 2N length sequence y[n]= {?(x[n], 0?n?N-1@x[2N-1-n], N?n?2N-1)?and compute its DFT (using previous lab3 code), and multiply the obtained DFT coefficients with? W?_2N^(k/2) ,0?k?2N-1. Consider the first N coefficients and compare this with the DCT coefficients obtained in question 3, and write your observations.

```
ID=I;
for i=N+1:1:2*N
    ID(1,i)=I(2*N-i+1);
end
for n=0:1:2*N-1
    for k=0:1:2*N-1
        D(n+1,k+1)=exp((2*pi*(-1)*1j*k*n)/(2*N));
    end
end
```

```
DFT=D*ID';
for i=0:1:N-1
    DCT(i+1,1)=DFT(i+1,1)*exp((pi*(-1)*1j*i)/(2*N));
end

%Compared with values got in question3, Both are same.
```

5 Repeat Question 1 and 2 for a normalized basis function

```
B=1/sqrt(2);
B=[B ones(1,N-1)];
for n=0:1:N-1
    for k=0:1:N-1
        C1(n+1,k+1)=sqrt(2/N)*B(k+1)*cos((pi*k*((2*n)+1))/(2*N));
    end
end
```

5-2nd

```
Con1= C1*C1.';
% It satisfies the condition C*CTransport = Identity Matrix.
```

6. Repeat Question 3 with the newly obtained transformation matrix in Question 5.

```
CTN=C1.'*I';  %Calculated Cosine transform of Input matrix
ICTN=inv(C.')*CT; %Calculated inverse Cosine transform of cosine
 Tranpose matrix  and got same input value
```

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