

HW6 Function by reference

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```
function Xdft=dftdirect(x)
% Direct computation of the DFT
N=length(x); Q=2*pi/N;
for k=1:N
    S=0;
    for n=1:N
        W(k,n)=exp(-j*Q*(k-1)*(n-1));
        S=S+W(k,n)*x(n);
    end
    Xdft(k)=S;
end

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function x=fftditr2(x)
% DIT Radix-2 FFT Algorithm
N=length(x); nu=log2(N);
x = bitrevorder(x);
for m=1:nu
    L=2^m;
    L2=L/2;
    for ir=1:L2
        W=exp(-1i*2*pi*(ir-1)/L);
        for it=ir:L:N
            ib=it+L2;
            temp=x(ib)*W;
            temp_t=x(it);
            x(it)=temp_t+temp;
            x(ib)=temp_t-temp;
        end
    end
end

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
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function Xdft = fftrecur(x)
% Recursive computation of the DFT using divide & conquer
% N should be a power of 2
N = length(x);
if N ==1
    Xdft = x;
else
    m = N/2;
    XE = fftrecur(x(1:2:N));
    XO = fftrecur(x(2:2:N));
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W = exp(-2*pi*sqrt(-1)/N).^(0:m-1)';
temp = W.*X0;
Xdft = [ XE+temp ; XE-temp ];
end

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
function [y] = filterdf1(b,a,x)
% Implementation of Direct Form I structure (Normal Form)
% with zero initial conditions
% [y] = filterdf1(b,a,x)
M = length(b)-1; N = length(a)-1; K = max(M,N);
a0 = a(1); a = reshape(a,1,N+1)/a0;
b = reshape(b,1,M+1)/a0; a = a(2:end);
Lx = length(x); x = [zeros(K,1);x(:)];
Ly = Lx+K; y = zeros(Ly,1);
for n = K+1:Ly
    sn = b*x(n:-1:n-M);
    y(n) = sn - a*y(n-1:-1:n-N);
end
y = y(K+1:Ly);

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function [y] = filterfirdf(b,x)
% Implementation of FIR Direct Form structure (Normal Form)
% [y] = filterfirdf(b,a,x)
K = length(b)-1; b = reshape(b,1,K+1);
Lx = length(x); x = [zeros(K,1);x(:)];
Ly = Lx+K; y = zeros(1,Ly);
for n = K+1:Ly
    y(n) = b*x(n:-1:n-K);
end
y = y(K+1:Ly);

```