```
x = [0,7,0,69,0,7,0,-7,0,-69,0,-7];
distinctVals = dftdistinct(x)
ourDft = dftall(x)'
inbuiltDft = fft(x)'
ourIdft = idftall(ourDft)'
inbuiltIdft = ifft(inbuiltDft)


subplot(5,1,1)
plot(x)
title('Main period of Odd Signal mod 12')
subplot(5,1,2)
plot(abs(ourDft))
title('DFT Using Odd Ramanujan Sums')
subplot(5,1,3)
plot(abs(inbuiltDft))
title('DFT Using Typical FFT Algo - Inbuilt')
subplot(5,1,4)
plot(abs(ourIdft))
title('IDFT Using Odd Ramanujan Sums')
subplot(5,1,5)
plot(abs(inbuiltIdft))
title('IDFT Using Typical IFFT Algo - Inbuilt')

function x = idftall(X)
    x = [];
    r = length(X);
    for n=0:r-1
        val = 0;
        for d=2:r
            if mod(r,d)==0 && mod(d,4)==0
                val = val + X((r/d)+1)*cd(d,n+(d/4));
            end
        end
        x = [x,-1j*val/r];
    end
end


function X = dftall(x)
    X = [];
    r = length(x);
    for n=0:r-1
        val = 0;
        for d=2:r
            if mod(r,d)==0 && mod(d,4)==0
                val = val + x((r/d)+1)*cd(d,n+(d/4));
            end
        end
        X = [X,1j*val];
    end
end
```

```
function Xdis = dftdistinct(x)
    Xdis = [];
    Xdis(1,1) = 0;
    Xdis(1,2) = 0;
    i = 1;
    r = length(x);
    %tau = ndistinct(r);
    %count = 0;
    for D=2:r
        %if count<tau
            if mod(r,D)==0 %ie. D divides r
                val = 0;
                for d=2:r
                    if mod(r,d)==0 && mod(d,4)==0
                        val = val + x((r/d)+1)*cd(d,((r/D)+(d/4)));
                    end
                end
                %if ismember(val,Xdis(:,2))==0
                    i = i+1;
                    Xdis(i,1) = r/D;
                    Xdis(i,2) = 1j*val;
                    %count = count+1;
                %end
            end
        %end
    end
end


function tau = ndistinct(r)
%This function outputs the number of distinct nonzero values that xr(n)
%can take
%ndistinct = (m1+1)(m2+1)...(mk+1) where mi's are the powers of the
%prime factors of r/4
    primearr = factor(r/4)';
    marr = groupcounts(primearr);
    tau = marr(1)+1;
    if length(marr)>1
        for i=2:length(marr)
            tau = tau*(marr(i)+1);
        end
    end
end


function sum = cd(d, x)
%Outputs cd(n+(d/4)) - the odd ramanujan sum
    sum = 0;
    for U=0:d-1
        if gcd(U,d)==1
            Wd = W(d);
            sum = sum + Wd^(-x*U);
```

```
        end
    end
end


function out = W(d)
%Outputs Wd
    out = exp(2*pi*1j/d);
end
```

```
distinctVals =

   1.0e+02 *

   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0600 + 0.0000i  -0.0000 + 0.0000i
   0.0400 + 0.0000i  -0.0000 - 0.0000i
   0.0300 + 0.0000i   0.0000 + 1.1000i
   0.0200 + 0.0000i   0.0000 + 0.0000i
   0.0100 + 0.0000i   0.0000 - 1.5200i


ourDft =

   1.0e+02 *

   0.0000 + 0.0000i
   0.0000 + 1.5200i
   0.0000 - 0.0000i
   0.0000 - 1.1000i
  -0.0000 + 0.0000i
   0.0000 + 1.5200i
  -0.0000 - 0.0000i
  -0.0000 - 1.5200i
  -0.0000 + 0.0000i
  -0.0000 + 1.1000i
   0.0000 - 0.0000i
  -0.0000 - 1.5200i


inbuiltDft =

   1.0e+02 *

   0.0000 + 0.0000i
   0.0000 + 1.5200i
   0.0000 + 0.0000i
   0.0000 - 1.1000i
   0.0000 + 0.0000i
   0.0000 + 1.5200i
   0.0000 + 0.0000i
   0.0000 - 1.5200i
   0.0000 + 0.0000i
```

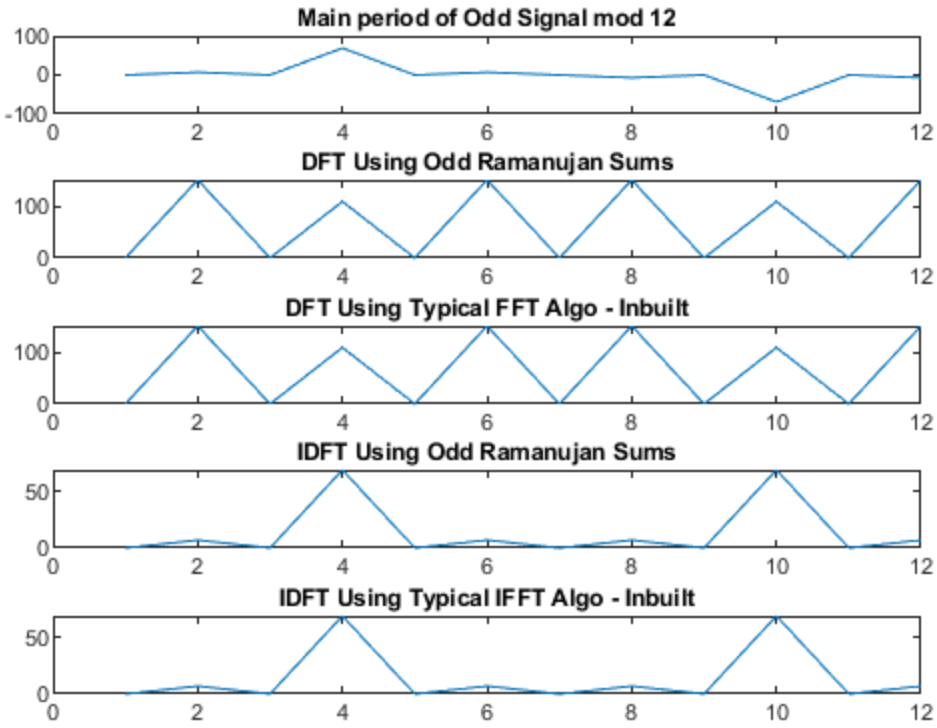
```
   0.0000 + 1.1000i
   0.0000 + 0.0000i
   0.0000 - 1.5200i


ourIdft =

  -0.0000 + 0.0000i
  -7.0000 + 0.0000i
  -0.0000 + 0.0000i
 -69.0000 + 0.0000i
   0.0000 - 0.0000i
  -7.0000 + 0.0000i
   0.0000 - 0.0000i
   7.0000 - 0.0000i
   0.0000 - 0.0000i
  69.0000 - 0.0000i
  -0.0000 + 0.0000i
   7.0000 - 0.0000i


inbuiltIdft =

     0
    -7
     0
   -69
     0
    -7
     0
     7
     0
    69
     0
     7
```



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