中国科学技术大学

University of Science and Technology of China

Lab 6

姓名：高茂航

学号：PB22061161

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Lab 6

1 Problem Descriptions

2 Analysis and Algorithms

2.1 Algorithm 1 FFT

$n \leftarrow length[f]$
if $n == 1$
  then return f
end if
$\omega_n \leftarrow e^{i2\pi/n}$
$\omega \leftarrow 1$
$\mathbf{f}^0 \leftarrow (f_0, f_2, \ldots, f_{n-2})$
$\mathbf{f}^1 \leftarrow (f_1, f_3, \ldots, f_{n-1})$
$\mathbf{g}^0 \leftarrow$FFT($\mathbf{f}^0$)
$\mathbf{g}^1 \leftarrow$FFT($\mathbf{f}^1$)
for $k \leftarrow 0$ to $n/2 - 1$**do**
  $\mathbf{g_k} \leftarrow \mathbf{g}_k^0 + \omega \mathbf{g}_k^1$
  $\mathbf{g_{k+n/2}} \leftarrow \mathbf{g}_k^0 - \omega \mathbf{g}_k^1$
  $\omega \leftarrow \omega\omega_n$
end for
return g

2.2 Algorithm 2 IFFT

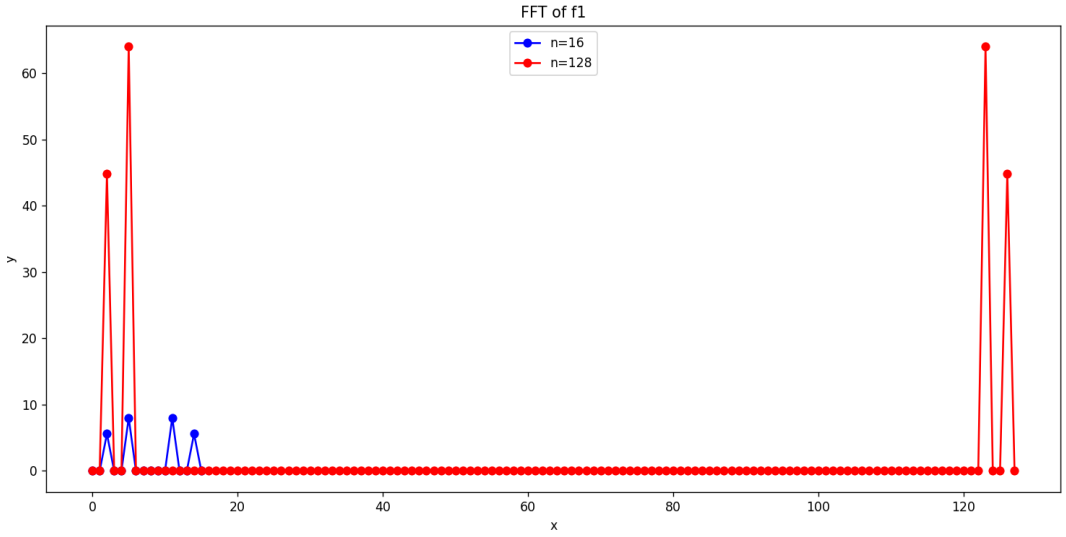
2.2.1 方法 1

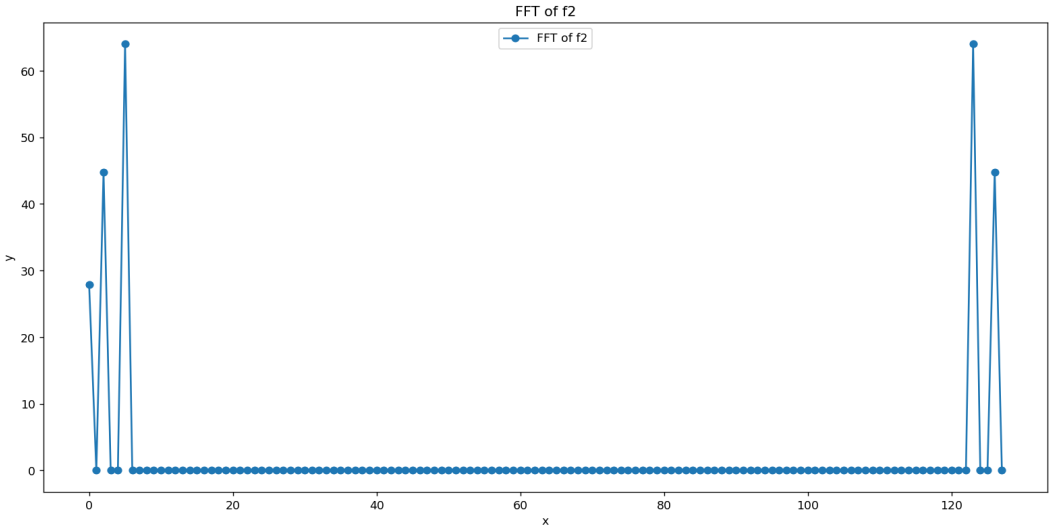
$n \leftarrow length[f]$
if $n == 1$
  then return f
end if
$\omega_n \leftarrow e^{-i2\pi/n}$
$\omega \leftarrow 1$
$\mathbf{f}^0 \leftarrow (f_0, f_2, \ldots, f_{n-2})$
$\mathbf{f}^1 \leftarrow (f_1, f_3, \ldots, f_{n-1})$
$\mathbf{g}^0 \leftarrow$IFFT($\mathbf{f}^0$)
$\mathbf{g}^1 \leftarrow$IFFT($\mathbf{f}^1$)
for $k \leftarrow 0$ to $n/2 - 1$**do**
  $\mathbf{g_k} \leftarrow \mathbf{g}_k^0 + \omega \mathbf{g}_k^1$
  $\mathbf{g_{k+n/2}} \leftarrow \mathbf{g}_k^0 - \omega \mathbf{g}_k^1$
  $\omega \leftarrow \omega\omega_n$
end for
$\mathbf{g} = \mathbf{g}/2$
return g

2.2.2 方法 2

$\mathbf{f}_{\text{temp}} \leftarrow (f_0, f_{n-1}, f_{n-2} \ldots, f_2)$
$\mathbf{g} \leftarrow \text{FFT}(\mathbf{f}_{\text{temp}})$
$\mathbf{g} = \mathbf{g}/n$
return g

3 Results





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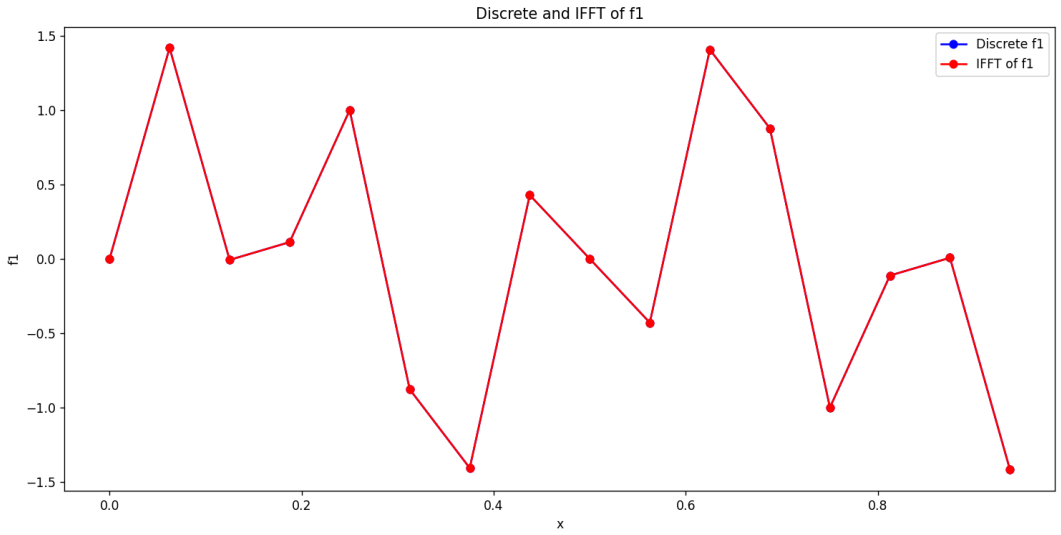
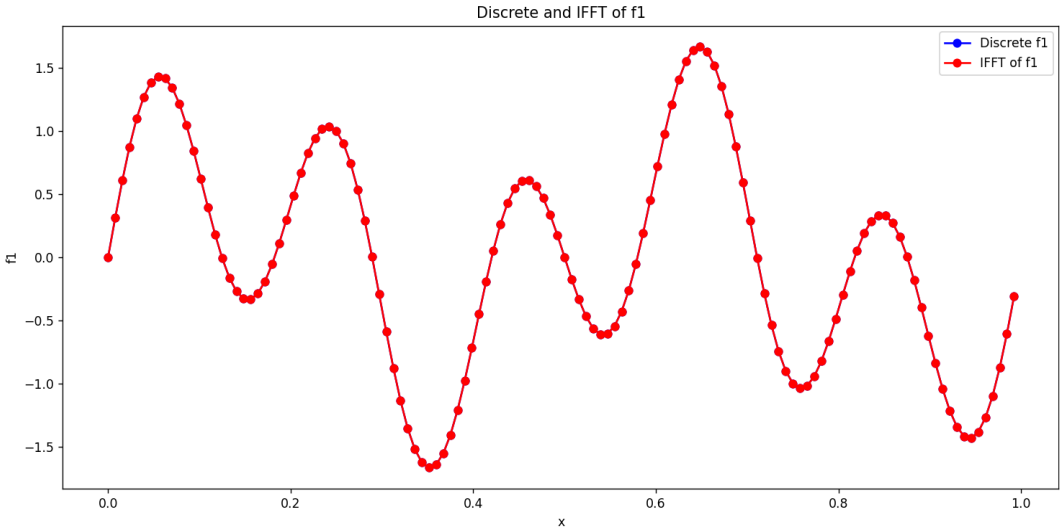
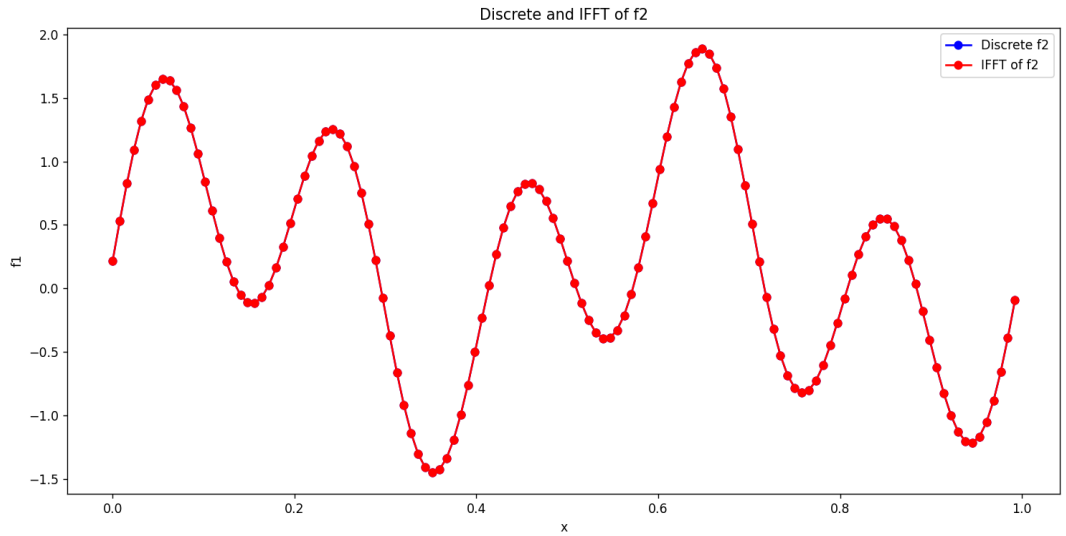
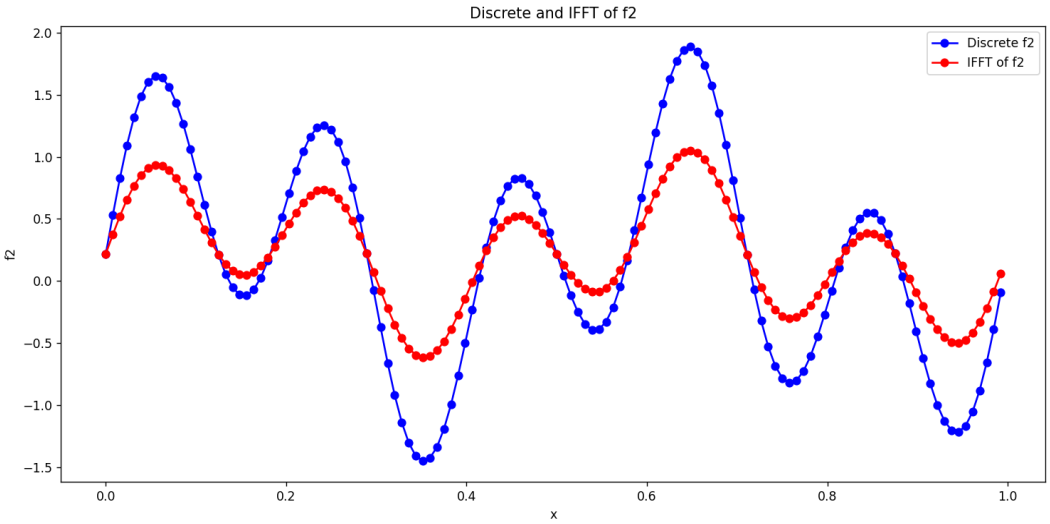

Discrete and IFFT of f1
Discrete f1
IFFT of f1
f1
x


Discrete and IFFT of f1
Discrete f1
IFFT of f1
f1
x


Discrete and IFFT of f2
Discrete f2
IFFT of f2
f1
x



4 Conclusion