(4) $x(n) = \{3, 6, 4, 2, 3, 5, 0, 9\}$

a) FFT je grupa algoritama koji se koriste za brzo računanje DFT-a. Temelji se na dekompoziciji DFT_N u niz parcijalnih DFT-a, odnosno periodičnosti i simetričnosti kompleksne eksponencijale.

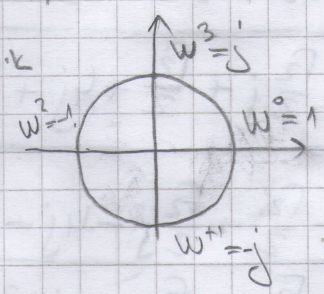
b) $L=2,\ M=4,\ N=8$

$x(0,0)=3 \quad x(0,1)=4 \quad x(0,2)=3 \quad x(0,3)=0$

$x(1,0)=6 \quad x(1,1)=2 \quad x(1,2)=5 \quad x(1,3)=9$

3	4	3	0
6	2	5	9

$DFT_4: X[k] = \sum_{n=0}^{3} x(n) W_4^{n \cdot k}$



$X_1[k] = 3 \cdot W_4^0 + 4 \cdot W_4^{1 \cdot k} + 3 \cdot W_4^{2 \cdot k}$

$X_2[k] = 6 W_4^0 + 2 W_4^{1 \cdot k} + 5 W_4^{2 \cdot k} + 9 W_4^{3 \cdot k}$

$X_1[0] = 3+4+3 = 10$

$X_1[1] = -4j$

$X_1[2] = 2$

$X_1[3] = 4j$

$X_2[0] = 22$

$X_2[1] = 1+7j$

$X_2[2] = 0$

$X_2[3] = 1-7j$

10	$-4j$	2	$4j$	$\cdot W_8^{e \cdot g} =$
22	$1+7j$	0	$1-7j$	

10	$-4j$	2	$4j$	$\xrightarrow{DFT_2}$
22	$4\sqrt{2}+3\sqrt{2}j$	0	$-4\sqrt{2}+3\sqrt{2}j$	

$10+22$	$-4j+4\sqrt{2}+3\sqrt{2}j$	2	$4j-4\sqrt{2}+3\sqrt{2}j$
$10-22$	$-4j-4\sqrt{2}-3\sqrt{2}j$	2	$4j+4\sqrt{2}-3\sqrt{2}j$

$x[0]=32 \quad x[1]=4\sqrt{2}+j(3\sqrt{2}-4) \quad x[2]=2 \quad x[3]=-4\sqrt{2}+j(3\sqrt{2}+4)$

$x[4]=-12 \quad x[5]=-4\sqrt{2}-j(3\sqrt{2}+4) \quad x[6]=2 \quad x[7]=4\sqrt{2}-j(3\sqrt{2}-4)$

c) $L=4$, $M=2$

$x(0,0)=3 \quad x(1,0)=3$

$x(0,1)=6 \quad x(1,1)=5$

$x(0,2)=4 \quad x(1,2)=0$

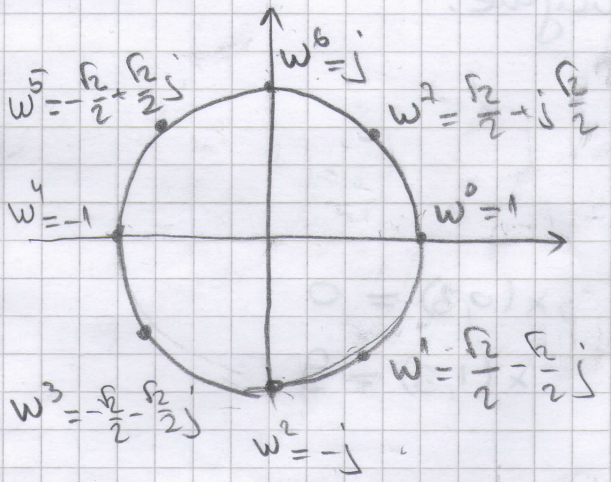
$x(0,3)=2 \quad x(1,3)=9$

3	3
6	5
4	0
2	9

$\xrightarrow{DFT_2}$

6	0
11	1
4	4
11	-7

$\cdot W_8^{q \cdot r}$



6	0
11	$\frac{\sqrt{2}}{2}-\frac{\sqrt{2}}{2}j$
4	$-4j$
11	$+\frac{7\sqrt{2}}{2}+\frac{7\sqrt{2}}{2}j$

$\downarrow DFT_4$

$k=0$	$6+11+4+11=32$	$0+\frac{\sqrt{2}}{2}-\frac{\sqrt{2}}{2}j-4j+\frac{7\sqrt{2}}{2}+\frac{7\sqrt{2}}{2}j=4\sqrt{2}+j(3\sqrt{2}-4)$
$k=1$	$6-11j-4+11j=2$	$0-\frac{\sqrt{2}}{2}j+\frac{\sqrt{2}}{2}+4j+\frac{7\sqrt{2}}{2}j-\frac{7\sqrt{2}}{2}=-4\sqrt{2}+j(3\sqrt{2}+4)$
$k=2$	$6-11+4-11=-12$	$0-\frac{\sqrt{2}}{2}+\frac{\sqrt{2}}{2}j-4j-\frac{7\sqrt{2}}{2}-\frac{7\sqrt{2}}{2}j=-4\sqrt{2}-j(3\sqrt{2}+4)$
$k=3$	$6+11j-4-11j=2$	$0+\frac{\sqrt{2}}{2}j+\frac{\sqrt{2}}{2}+4j-\frac{7\sqrt{2}}{2}j+\frac{7\sqrt{2}}{2}=4\sqrt{2}-j(3\sqrt{2}-4)$

$X(0)=32 \quad X(1)=4\sqrt{2}+j(3\sqrt{2}-4)$

$X(2)=2 \quad X(3)=-4\sqrt{2}+j(3\sqrt{2}+4)$

$X(4)=-12 \quad X(5)=-4\sqrt{2}-j(3\sqrt{2}+4)$

$X(6)=2 \quad X(7)=4\sqrt{2}-j(3\sqrt{2}-4)$