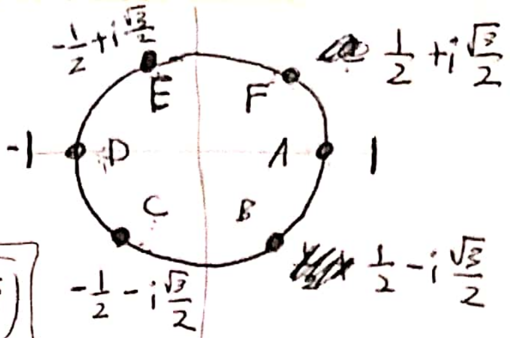
Fourier Analysis

$N=6,$ $\longrightarrow$



Calculating weights,

$A = e^{-i2\pi\left(\frac{0}{6}\right)} = \boxed{1}$

$B = e^{-i2\pi\left(\frac{1}{6}\right)} = \cos\left(\frac{-2\pi}{N}\cdot\frac{1}{6}\right) + i\sin\left(\frac{-2\pi}{N}\cdot\frac{1}{6}\right) = \boxed{\frac{1}{2} + \left(-i\frac{\sqrt{3}}{2}\right)}$

$C = e^{-i2\pi\left(\frac{2}{6}\right)} = \boxed{-\frac{1}{2} + -i\frac{\sqrt{3}}{2}}$

$D = \boxed{-1}$

$F = e^{-i2\pi\left(\frac{5}{6}\right)} = \boxed{\frac{1}{2} + i\frac{\sqrt{3}}{2}}$

$E = \boxed{-\frac{1}{2} + i\frac{\sqrt{3}}{2}}$

10, 40, 20, 90, 5, 30

a) $F_0 = \cancel{10A+40B+20C+90D+5E+30F} = \boxed{10+40+20+90+5+30}$

$F_1 = \boxed{10A + 40B + 20C + 90D + 5E + 30F}$

$F_2 = \cancel{10A+40C+20E+90A+5C+30E} = \boxed{10A + 40C + 20E + 90A + 5C + 30E}$

$F_3 = \boxed{10A + 40D + 20A + 90D + 5A + 30D}$

$F_4 = \boxed{10A + 40E + 20C + 90A + 5E + 30C}$

$F_5 = \boxed{10A + 40F + 20E + 90D + 5C + 30B}$

B) Because frequency is divided into 2 parts, the positive and the negative part. So, the max. frequency cannot exceed $N/2$ (Nyquist Limit).

(Same as above)

c) $F_0 = 10 + 40 + 20 + 90 + 5 + 30$

$F_1 = 10A + 40B + 20C + 90D + 5E + 30F$

$F_2 = 10A + 40C + 20E + 90A + 5C + 30E$

$F_3 = 10A + 40D + 20A + 90D + 5A + 30D$

$F_{-1} = F_5 = 10A + 40F + 20E + 90D + 5C + 30B$

$F_{-2} = F_4 = 10A + 40E + 20C + 90A + 5E + 30C$