In [5]:
```
from IPython.display import Latex

code = get_latext_string("InversFourier.txt")

Latex(f"""{code}""")
```

Out[5]: *if f0, f1, f2, ..., fm are the frequencies of Sine wave which are used to reconstruct the signal*

$$x(n) = \sum_{i=0}^{i=M-1} A_i * sin(2 * \pi * f_i * n/N * \phi_i)$$

Using DFT we have proved that

$$X(f_i) = \frac{NA_i * e^{j\phi_i}}{2j} \ \& \ X(N - f_i) = \frac{NA_i * e^{-j\phi i}}{2j}$$

We want to reconstruct x(n) to do so multiply $X(f_i)$ *by* $e^{2j\pi * fi*n/N}$

$$X(f_i) * e^{2j\pi * fi*n/N} = \frac{NA_i * e^{2j\pi * fi*n/N + j\phi_i}}{2j}$$

$$X(N - f_i) * e^{2j\pi*(N-f_i)*n/N} = \frac{NA_i * e^{2j\pi*(N-fi)*n/N - j\phi_i}}{2j}$$

$$=> \frac{NA_i * e^{-j\phi_i} * [e^{2j\pi*N*n/N} * e^{-2j\pi*fi*n/N}]}{2j}$$

$$=> \frac{NA_i * e^{-j\phi_i} * [e^{2j\pi*n} * e^{-2j\pi*fi*n/N}]}{2j}$$

$$e^{2j*\pi*n} == 1 \forall n \epsilon \mathbb{Z}$$

$$=> \frac{NA_i * e^{-j\phi_i} * [e^{-2j\pi*fi*n/N}]}{2j}$$

lets Add $X(f_i) * e^{2j\pi*fi*n/N}$ *and* $X(N - f_i) * e^{2j\pi*(N-f_i)*n/N}$

$$=> X(f_i) * e^{2j\pi*fi*n/N} + X(N - f_i) * e^{2j\pi*(N-f_i)*n/N} = NA_i * \frac{e^{2j*\pi*n*f_i/N + j\phi_i} - e^{-2j*\pi*f_i*n/N - j*\phi_i}}{2j}$$

let $x = 2 * \pi * f_i * n/N + \phi_i$

$$=> X(f_i) * e^{2j\pi*fi*n/N} + X(N - f_i) * e^{2j\pi*(N-f_i)*n/N} = NA_i * \frac{e^{jx} - e^{-jx}}{2j}$$

$$\frac{e^{j\theta} - e^{-j\theta}}{2j} = sin(\theta)$$

$$=> X(f_i) * e^{2j\pi*fi*n/N} + X(N - f_i) * e^{2j\pi*(N-f_i)*n/N} = NA_i * sin(x)$$

$$=> X(f_i) * e^{2j\pi*fi*n/N} + X(N - f_i) * e^{2j\pi*(N-f_i)*n/N} = NA_i * sin(2 * \pi * n * f_i/N + \phi_i)$$

so inverse discret fourier transform can be expressed as

$$x(n) = \frac{1}{N} * \sum_{k=0}^{N-1} X(k) * e^{2j*\pi*k*n/N}$$