Student name:

Student number:

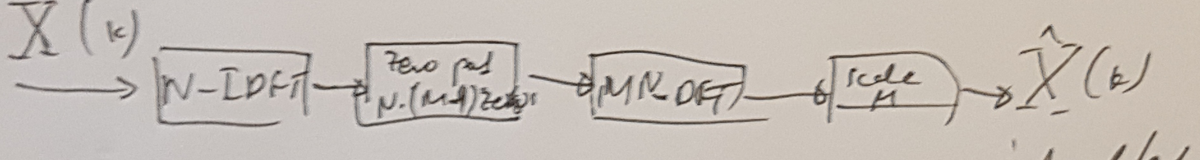
b) What is the minimum length N of the N-DFT, X(k), k=0,1,2,…N-1 we should calculate? What is the approximate range of values of k of the N-DFT corresponding to the two frequencies F1 and F2? (3 points)

Since $L \approx 2 \cdot 10^6$ we should also have $N \geq 2 \cdot 10^6$
So as to achieve the same spectral resolution.

Then $f_1 = \frac{k_1}{N} \Rightarrow F_1 = \frac{k_1}{N} \cdot F_s$

$f_2 = \frac{k_2}{N} \Rightarrow F_2 = \frac{k_2}{N} F_s$.

c) To improve the decision process, we zoom on the region of the N-DFT containing the two frequencies in order to examine it in more detail. Given that X(f), $0 \leq f \leq 2\pi$ is the DTFT and X(k), k=0,1,…n-1 is the N-DFT of x(n), n=0,1,..,L-1, we would like to interpolate X(k) by a factor of M . Describe all steps of a digital interpolation procedure to achieve this by clearly identifying all corresponding operations and parameters. As M increases does our confidence in estimating the true ΔF increases as well? Please explain. (3 points)



As M increases our confidence in estimating the true ΔF will increase as well since the visual resolution will increase as well. However, the chance of finding ΔF exactly becomes less as M increases in general.