2 Fourier Transform

Dr. Meyer-Baese, ameyerbaese

For a common factor FFT the following 2D DFT is used:

$$X[k_1,k_2] = \sum_{n_2=0}^{N_2-1} W_{N_2}^{n_2k_2}\left(W_N^{n_2k_1}\sum_{n_1=0}^{N_1-1} x[n_1,n_2]W_{N_1}^{n_1k_1}\right)$$

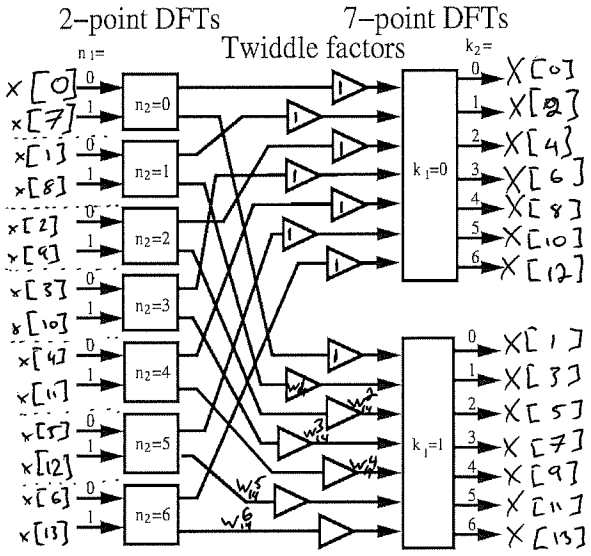
1. **[40 points]** Complete the following table for the index map for a $N = 14$ with $N_1=2$ and $N_2=7$ FFT with:

   $n = 7n_1+n_2$ and $k = k_1+2k_2$

n_1 \ n_2	0	1	2	3	4	5	6
0	0	1	2	3	4	5	6
1	7	8	9	10	11	12	13

k_1 \ k_2	0	1	2	3	4	5	6
0	0	2	4	6	8	10	12
1	1	3	5	7	9	11	13

2. **[60 points]** Complete the SFG (for x[n], X[k], and twiddle factors) for the FFT:



these last twiddle factors are $W_{14}^{n_2k_1}$ ... hard to see my tiny writing but the inputs to the $k_1=1$ DFT have twiddle factors $1, W_{14}, W_{14}^2, W_{14}^3, W_{14}^4, W_{14}^5, W_{14}^6$