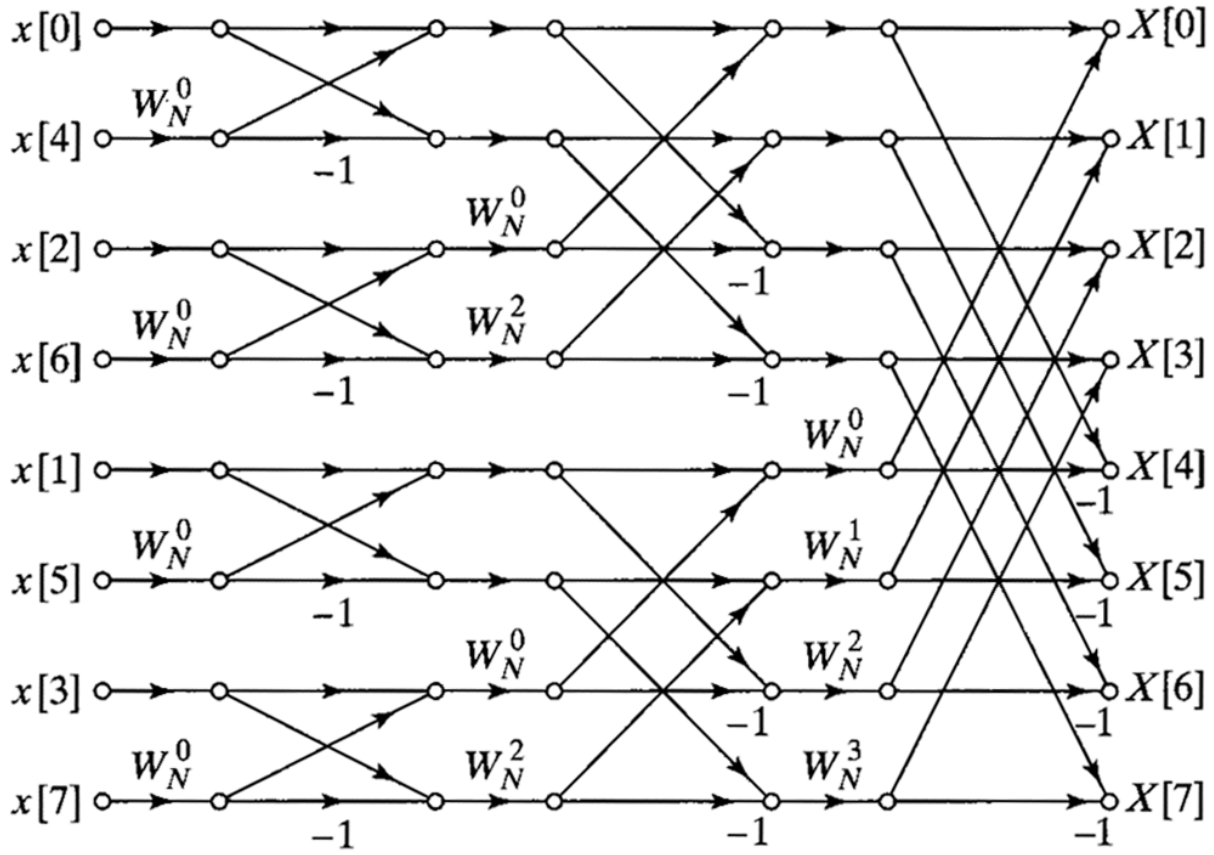
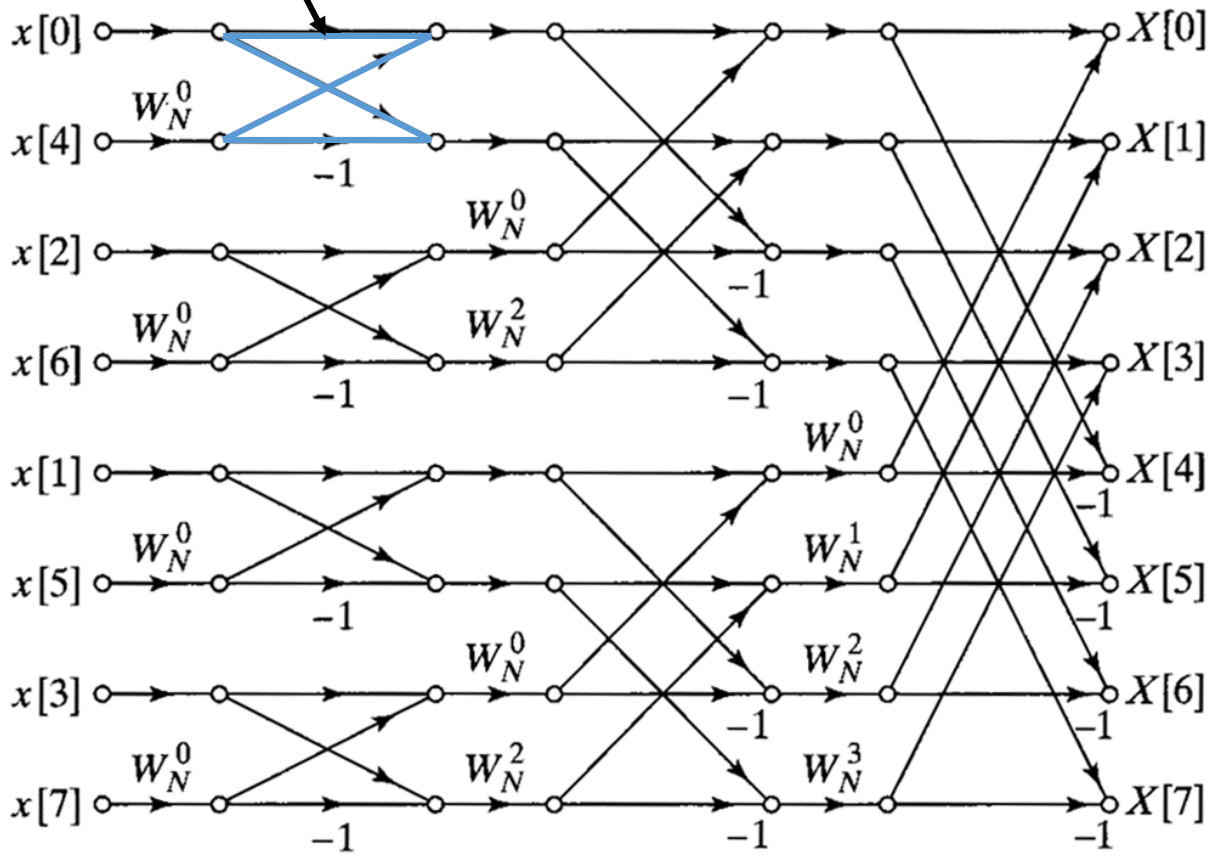
ECE111 Final Projects Notes

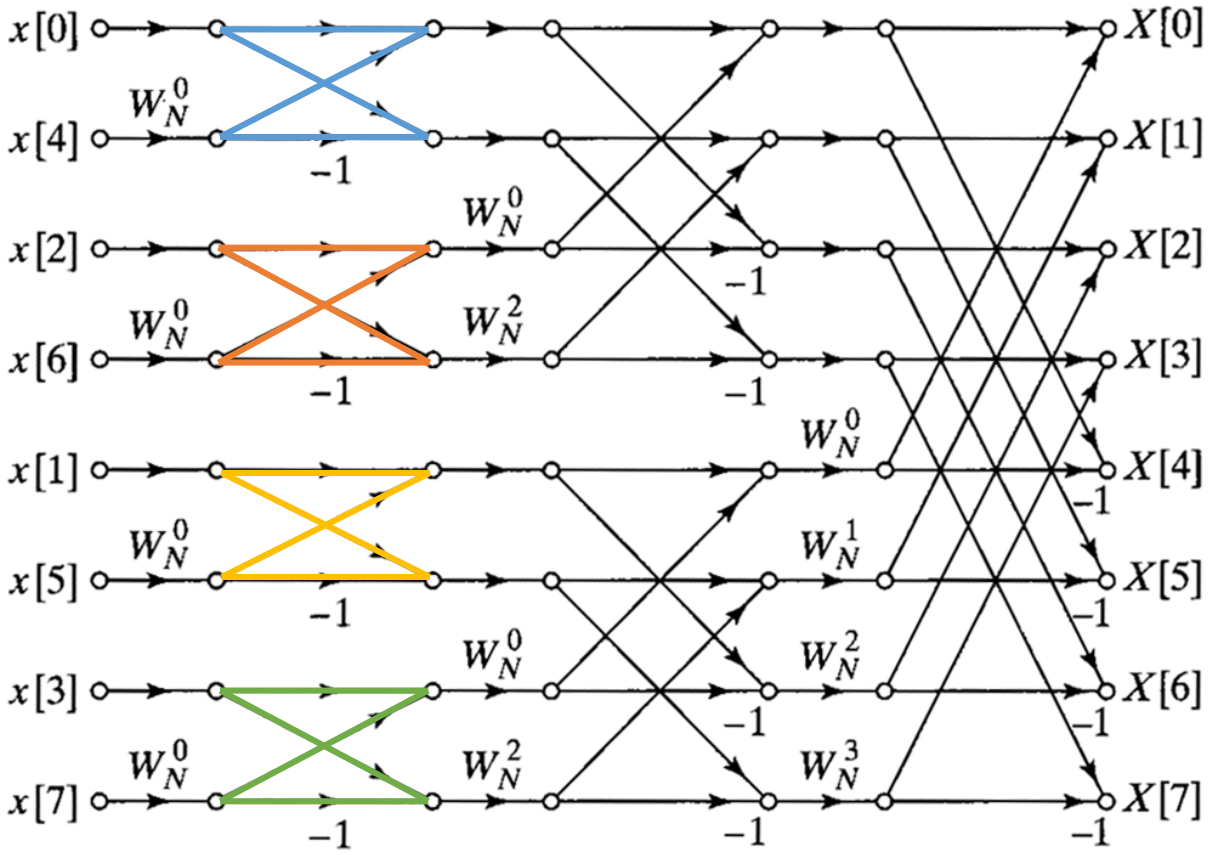
8 Point FFT (This is one possible structure, see slides 35-40 of the lecture for other structures)



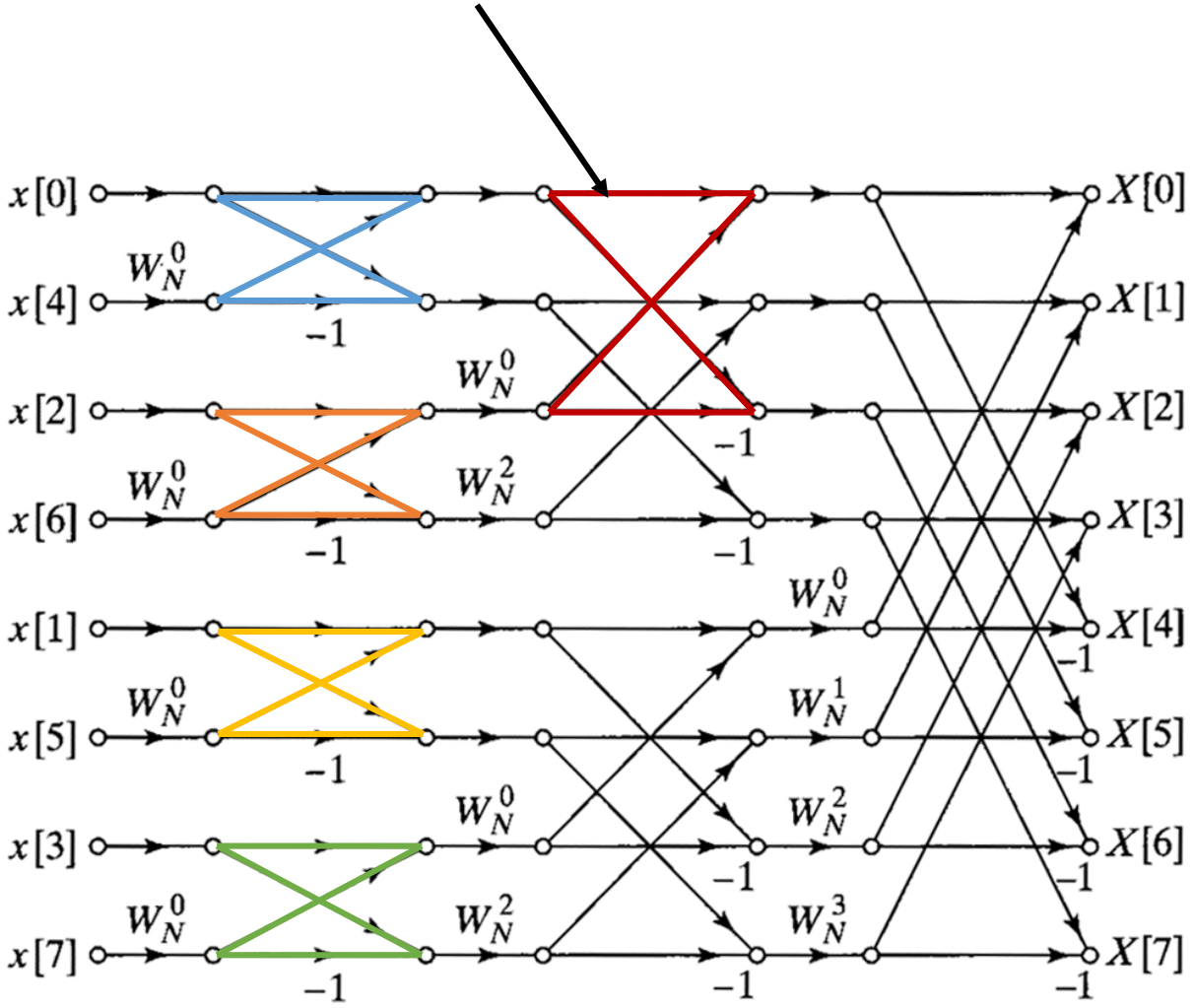
This is one butterfly structure (2 point FFT, see slides 30, 34 of the lecture)



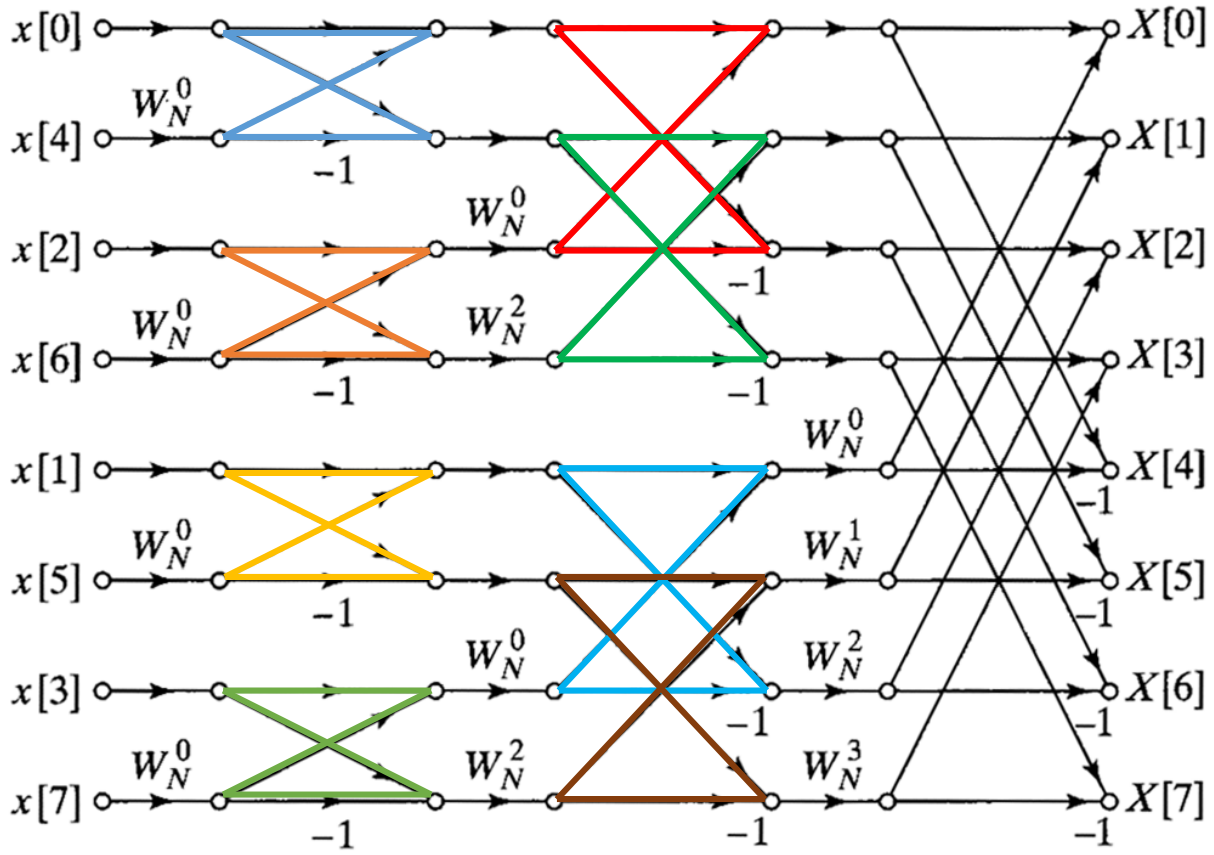
You need to repeat it 4 (=N/2) times at each stage



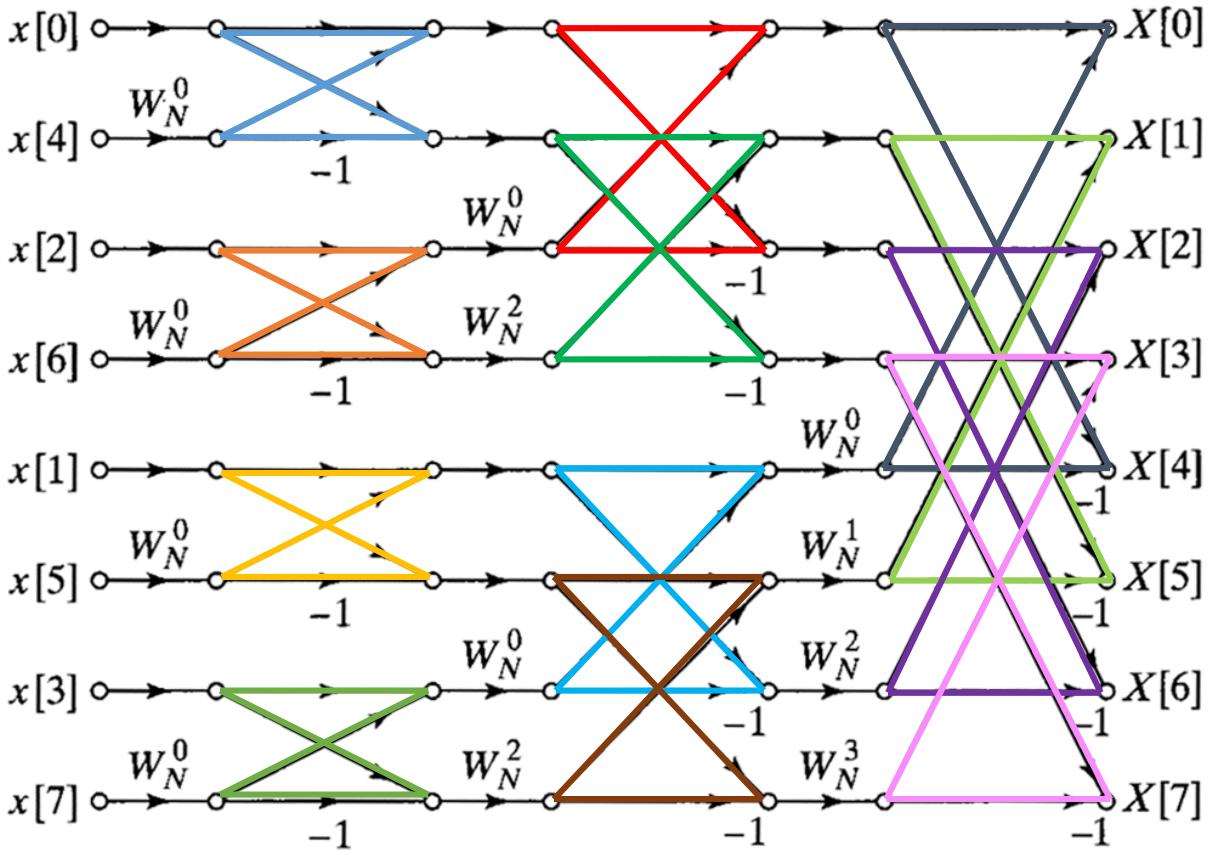
Similarly this is another butterfly structure (2 point FFT)



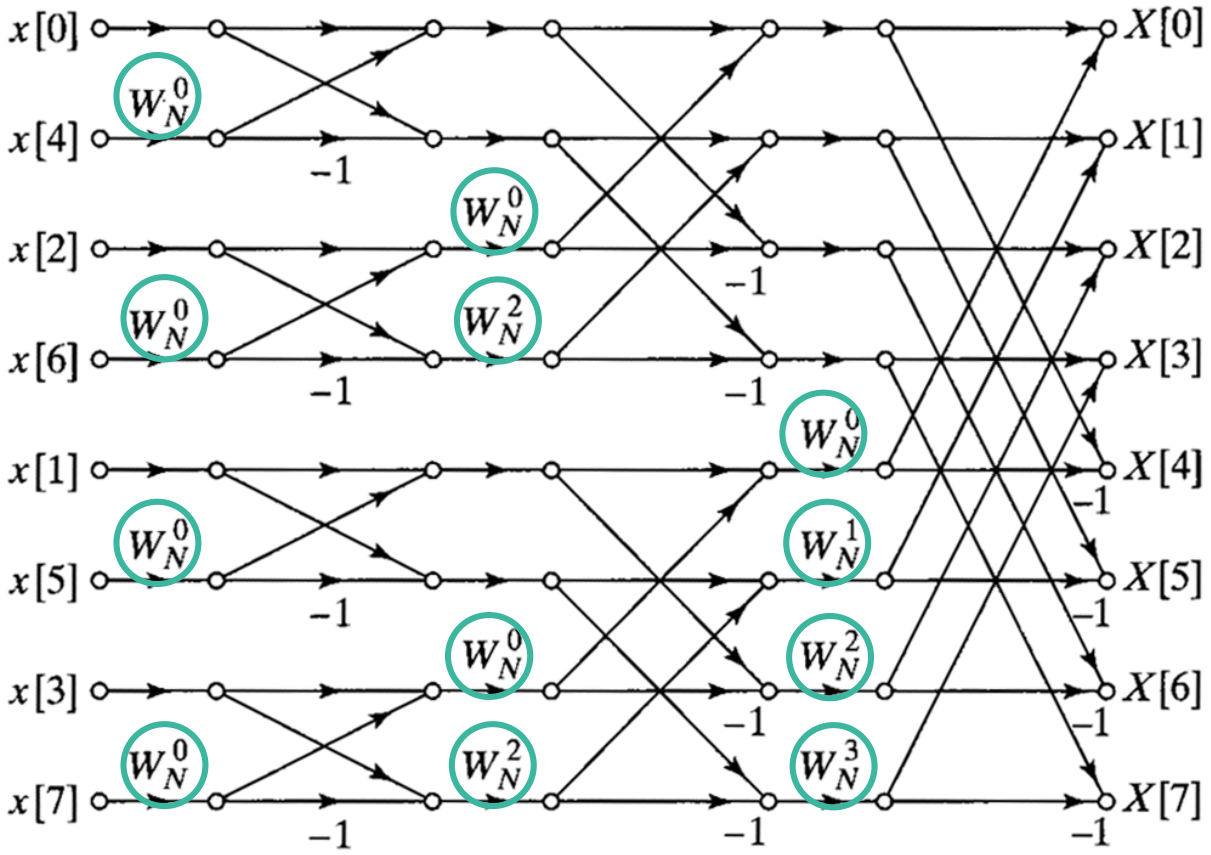
You need to repeat it 4 (=N/2) times at this stage too (with different input/output indices, See slides 35-40 of the lecture)



Similarly you have 4 (=N/2) butterfly structure (2 point FFT) at each stage



The multipliers (W_N^K) also changes at each stage



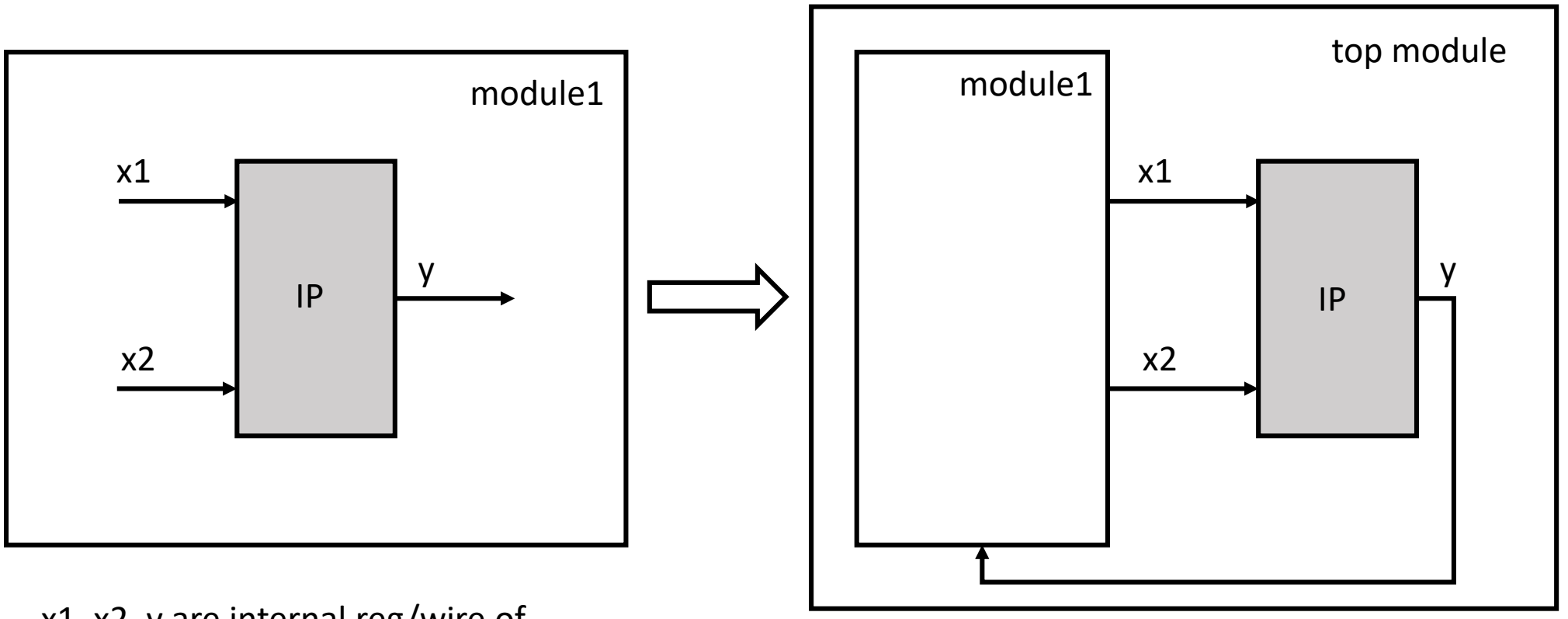
Steps

- First design the butterfly structure (2 point FFT)
- Design one stage by repeating it (N/2) times
- Repeat each stage log(N) times
- At each stage you just need to change the input/output indices of the butterflies structure and the multipliers (W_N^K) (See slides 35-40 of the lecture)

Some more tips

- The filter is symmetric. You can see it by plotting the coefficients. Therefore, you only need to save half of the coefficients.
  For example, if you have 4 coefficients a0, a1, a2, a3, where a0 = a3 and a1 = a2, the output,
  $y(n) = a0\ x(n) + a1\ x(n-1) + a2\ x(n-2) + a3\ x(n-3)$
  $= a0\ (x(n) + x(n-3)) + a1\ (x(n-1) + x(n-2))$
- You do not need to run the FIR and FFT modules simultaneously, therefore you can reuse the same adders and multipliers for each module
- In each module use same name for the inputs and outputs of the adders and multipliers to make the integration easier.

Moving IP cores out of a module



x1, x2, y are internal reg/wire of module1

x1, x2, y are input/output of module1

Sharing IP cores between modules