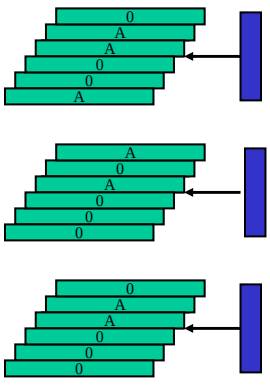
FIR FILTER SCALING

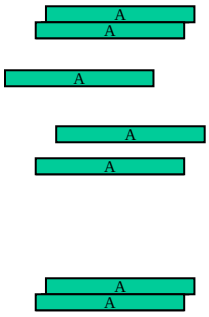
FIR Filter Example

- Use reduction technique and add all terms in a large tree for FIR structures which add delayed products into an output sum



FIR Filter Example

- Remove zeroed terms

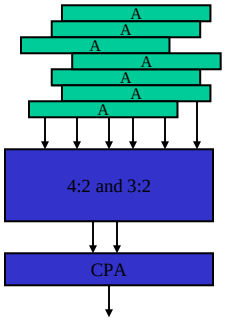


FIR Filter Example

- Add with a single carry-save adder structure similar to how multiplier partial-products are reduced

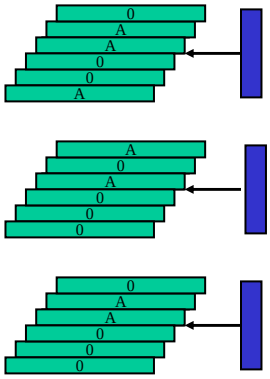
FIR Filter Example

- Complete addition with a carry-propagate adder



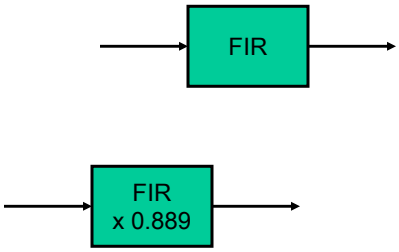
FIR Filter HW Reduction

- If we can scale coefficients all by the same amount
  - Frequency response unchanged
  - Overall gain change
  - May be possible to reduce filter's complexity significantly
  - Must watch
    - Overflow
    - Quantization noise



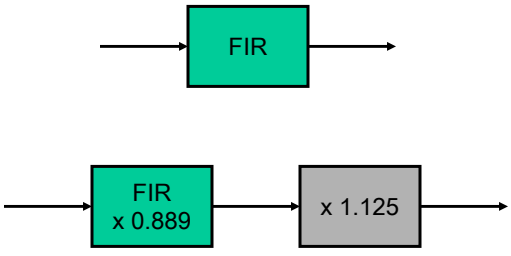
FIR Filter Scaling

- If `coeffs = [9 18 45 18 9]`
  note that `0.889 x coeffs = [8 16 40 16 8]`



FIR Filter Scaling

- Often, scaling of a filter can be accommodated or reversed elsewhere in the signal path



FIR Output Range

- Worst-case inputs: maximum pos/neg samples
  - signs match coeff signs
  - signs opposite coeff signs
- Handling large peak-to-average ratios
  - Calculate full range output (more hardware)
  - Deal with large possible peaks
    - Saturate
    - Overflow (might be risky!)
    - Compression