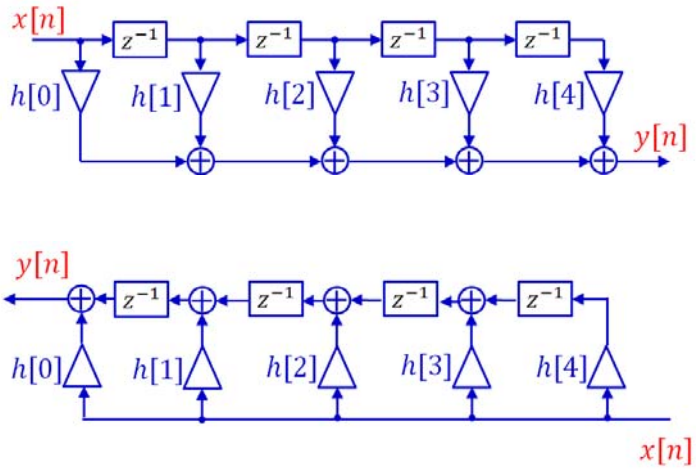
EE332: Final Project:

Design and implement FIR filters with the following filter specifications:

Filters	ω_p	ω_s	δ_p	δ_s
$S1$	0.3π	0.5π	0.0157	0.0066
$S2$	0.042π	0.14π	0.012	0.001

Objective:

1. Implement the direct form design and the transposed direct form design of S2. Compare the two designs in the sense of implementation complexity, power consumption and speed.
   a) Plot the actual frequency responses of your designs to show that they meet the specification.
   b) Using a sequence being an addition of two sinusoid waves, with one frequency in the passband and the other frequency in the stopband, as an input to test the designs. Evaluate the goodness of your design.
2. For S1, do your best to have an implementation that has the minimum device utilities. Observe other performances such as speed and power consumption when you reduce the device utilities. You may consider:
   a) Direct form or transposed direct form
   b) Coefficient Symmetry (component sharing)
   c) Rounding coefficients (wordlength of coefficients)
   d) Using adders to replace multipliers in the design (references 2 and 3 below)



References:

1. Matlab function firpm.m
2. Y. J. Yu and Y. C. Lim, "Design of Linear Phase FIR Filters in Subexpression Space Using Mixed Integer Linear Programming", IEEE Transactions on Circuits and Systems—I: Regular Papers, vol. 54, no. 10, Oct. 2007
3. Some papers cited in the above paper.