ECEN 487
QUIZ 10

NAME:___KEY_____

Consider the design of a generalized linear phase highpass FIR filter using the Parks-McClellan algorithm.

a) Prove that at least one of the two frequency limits (i.e. $\omega = 0$ and $\omega = \pi$) must be an alternation.

Proof:

For a highpass filter there are 4 band edges that can potentially be alternations, at $\omega = 0$, $\omega = \pi$, $\omega = \omega_s$, and $\omega = \omega_p$. An optimal design will have L+2 or L+3 alternations. Eliminating both $\omega = 0$ and $\omega = \pi$ would mean the maximum possible number of remaining alternations would be L-1 (the maximum number of local extrema in the polynomial curve) plus 2 (for $\omega = \omega_s$, and $\omega = \omega_p$), for a total of L+1. By the alternation theorem, this cannot be optimal.

b) In the design process for the above filter you have a candidate Parks-McClellan solution that exactly meets your specified passband ripple level and transition bandwidth requirements, but ripple levels in the stopband is half as high as specified. You don't want to over design, so you decide to rework it to meet spec without so much margin. What will your procedure be?

Redesign Approach:

Reduce the weighting function, $W(\omega)$, in the stopband by a factor of 2 (i.e. divide it by 2). Do not change the passband filter weighting. (Or alternatively, double the passband weighting and leave the stopband weighting unchagned). Then, redesign with a SMALLER filter order M. This may take a few iterations to get the right M.