Computational Problem Set 1

 # 1: Explore the relationship between interest rates and bond prices. Start by creating a coupon bond with a 5 year maturity, paying a 6% coupon semiannually. Also, create a flat yield curve with a 7% rate level.

(a) Start exploring the basic relationship between bond price and interest rates, by pricing your bond with a flat yield curve with rate levels varying between 5% and 9%. Use the shift method of the curve object to perturb your rate level from the 7% base level you first used.

(b) Now, investigate the effect of maturity. While keeping the same coupons, create new bond objects with maturities of 6, 8, 10, 15, and 20 years, and for each bond, carry out the same exercise as in (a). What can you conclude about the yield sensitivity of bond prices, and how matirity effects it?

(c) Now we'll look at the effect of coupons. Again, starting from the bond in (a), leaving maturity constant, try coupon rates of 8%, 10%, 15%, 20%, and 30%. Can you characterize the coupon effect on the yield sensitivity of bonds?

 # 2: In this problem, we'll explore the yield-to-maturity. Create a coupon bond, can be anything, but try a reasonable coupon rate, maybe 6% and a medium maturity, like 5 years. Use the YTM method of the bond object to investigate the behavior of the yield-to-maturity. Start by finding the yield-to-maturity if the bond were trading at par. Compare the result to the coupon rate you specified. Are you surprised by what you find? (Warning: computing the yield-to-maturity involves some root finding, so there will be a bit of numerical error). Now, perturb the price and see how the yield-to-maturity responds. Try both premium and discount bonds. Consider the relationships you are discovering in light of what you have understood from problem #1.

 # 3: Use the curve_factory function to bootstrap the bonds from the example in class and from problem set #1, and confirm that the earlier constructions were correct. Now, explore the relationship between the implied yield curve and the market and contractual characteristics of the bonds. Start by perturbing the bond prices. Try increasing and decreasing all of the bond prices together in increments of 5% of the face value. Then try perturbing only the long maturity bond prices, leaving the short maturity bonds fixed. Do the same holding the long bonds constant. Then, try adjusting the coupons of the bonds in a similar investigation. In all of these experiments, observe the

effect on the rates numerically using the get_rates method, and also plot the yield curve using the plotting methods, to help understand the effect these factors have on the yield curve.