EC3333 Tutorial 8

1. A newly issued bond has a maturity of 10 years and pays a 7% coupon rate (with coupon payments coming once annually). The bond sells at par value.
   a. What are the convexity and the duration of the bond?
   b. Find the actual price of the bond assuming that its yield to maturity immediately increases from 7% to 8% (with maturity still 10 years).
   c. What price would be predicted by the duration rule? What is the percentage error of that rule?
   d. What price would be predicted by the duration-with-convexity rule? What is the percentage error of that rule?

2. Pension funds pay lifetime annuities to recipients. If a firm will remain in business indefinitely, the pension obligation will resemble a perpetuity. Suppose, therefore, that you are managing a pension fund with obligations to make perpetual payments of $2 million per year to beneficiaries. The yield to maturity on all bonds is 16%.
   a. If the duration of 5-year maturity bonds with coupon rates of 12% (paid annually) is 4 years and the duration of 20-year maturity bonds with coupon rates of 6% (paid annually) is 11 years, how much of each of these coupon bonds (in market value) will you want to hold to both fully fund and immunize your obligation?
   b. What will be the par value of your holdings in the 20-year coupon bond?

3. Rank the durations of the following pairs of bonds:
   a. Bond A is a 6% coupon bond, with a 20-year time to maturity selling at par value. Bond B is a 6% coupon bond, with a 20-year maturity time selling below par value.
   b. Bond A is a 20-year noncallable coupon bond with a coupon rate of 6%, selling at par. Bond B is a 20-year callable bond with a coupon rate of 7%, also selling at par.
      (A callable bond is a bond that the issuer may repurchase at a given call price in some specified period prior to the bonds' maturity date. When an issuer calls its bonds, it pays investors the call price (usually the face value of the bonds) together with accrued interest to date and, at that point, stops making interest payments.)

4. An insurance company must make payments to a customer of $10 million in one year and $4 million in five years. The yield curve is flat at 10%.
   a. If it wants to fully fund and immunize its obligation to this customer with a single issue of a zero-coupon bond, what maturity bond must it purchase?
   b. What must be the face value and market value of that zero-coupon bond?