Math516/Stat541 Fall 2009
Homework assignment 1 Figueroa-Lopez

1. 20.1

2. 20.3

3. Suppose that 6-month, 12-month, 18-month, 24-month, and 30-month zero rates are 4 %, 4.2 %, 4.4 %, 4.6 %, and 4.8 % per annum respectively (rates are measured with continuous compounding). Determine the cash price of a bond with face value of 100, that will mature 30 months and that will pay a coupon of 4 % (per annum) semiannually.

4. The cash prices of six-month and one-year Treasury bills are \$94 and \$89. A 1.5-year bond that will pay coupons of \$4 every six months currently sells for \$ 97.12 (par is \$ 100). (a) Calculate the 6-month, 1 year, and 1.5 year zero rates (also called yields). (b) Describe how to create synthetically a zero-coupon bond maturing in 1.5 years using Treasury bills of maturities 6 months and 1 year and the 1.5-year coupon bond of this problem.

   Note: As in class, these "zero-rates" are simple annual rates.

5. If the term structure of yields is upward slopping, put the following in order of magnitude:

   (a) The five-year zero rate

   (b) The yield on a five-year coupon-bearing bond

   (c) The forward rate corresponding to the period between 5 and 5.25 years in the future.

   Note: All interest rates in this problem are continuously compounding (including the forward rate, the zero-rate, and the yield).

6. The following table gives the prices of bonds.

Principal	Time to mat. (years)	Annual coupon	Bond price
100	0.5	0	98
100	1.0	0	95
100	1.5	6.2	101
100	2.0	8.0	104

   (a) Use the Bootstrap Method to calculate the zero-bond prices and its zero rates (continuously compounding) for maturities of 6 month, 12 months, 18 months, and 24 months.

(b) What are the forward rate for the period from 12 months to 18 months?

(c) What is the yield for the 18-month bond of the table?

(d) Estimate the price and yield of a two-year bond providing a semiannual coupon of 7 % per annum.

Note: The yield of the bond in (c) is defined as in problem 5 but with semi-annual compounding.

7. A forward contract on a zero-coupon bond with par 100 maturing in 1.5 years and with exchange time 1.0 year has a forward price (now) of \$96. (i) Suppose that $p(0, 1.5)/p(0, 1) > \$96$. Devise an arbitrage opportunity using the bonds and forward contrcact. (ii) Solve the same problem if $p(0, 1.5)/p(0, 1) < \$96$.