

MAP 4170  
Test 4

Name: \_\_\_\_\_  
Date: December 1, 2020

Show sufficient work and clearly mark your answers. Each problem is worth 10 points.

1. Calculate the present value of a 20-year annuity immediate with annual payments of 1000 using the real rate of return, given a nominal interest rate of 9% compounded annually and an inflation rate of 3% annual effective.
  - (A) 11,470
  - (B) 11,635
  - (C) 11,975
  - (D) 12,160
  - (E) 12,310
  
2. An investment account has a beginning of year balance on January 1 of 100,000. There is one deposit of 20,000 during the year. Immediately before the deposit, the balance in the account is 95,000. At the end of the year, the time weighted rate of return for the year is 14% and the dollar weighted rate of return for the year is 17%. Determine the month of the deposit.
  - (A) March
  - (B) April
  - (C) June
  - (D) August
  - (E) September

3. A 2-year accreting swap has notional amounts of 10,000 during Year 1 and 20,000 during Year 2. The 1-year spot rate is 3.5%, and the 2-year spot rate is 3.8%. Determine the swap rate.

(A) 3.9%

(B) 4.0%

(C) 4.1%

(D) 4.2%

(E) 4.3%

4. You are given that both the 1-year and 2-year spot rates are 2%, and the 3-year spot rate is 3%. Determine the annual yield on 3-year 5% annual coupon bonds that is consistent with this term structure of interest rates.

(A) 2.89%

(B) 2.91%

(C) 2.93%

(D) 2.95%

(E) 2.97%

5. For each value of  $k$ ,  $1 \leq k \leq 5$ , the annual effective yield rate on  $k$ -year zero coupon bonds is  $i_k = 0.035 + 0.005k$ . Determine the corresponding forward rate from the end of year 2 to the end of year 4; i.e.  $f_{[2,4]}$ .
- (A) 4.2%
  - (B) 6.5%
  - (C) 8.8%
  - (D) 11.1%
  - (E) 13.4%
6. The price of a bond is 1000 and the Macaulay duration of the bond is 21.4 when using a 7% annual effective yield rate. If the interest rate is changed to 6.5%, let  $C$  denote the approximate price of the bond using the first order Macaulay approximation, and let  $D$  denote the approximate price of the bond using the first order Modified approximation. Determine the difference  $C - D$ .
- (A) -10.77
  - (B) - 5.43
  - (C) 0
  - (D) 5.43
  - (E) 10.77

7. Determine the Macaulay duration of a 20-year 1000 face value bond, redeemable at par, with 8% annual coupons, using a 6% annual effective interest rate.

(A) 10.5

(B) 11.0

(C) 11.5

(D) 12.0

(E) 12.5

8. Liabilities of 1000 due at the end of 1 year, and 3570 due at the end of 2 years, are to be exactly matched using a 1-year zero coupon bond redeemable at 100 and a 2-year 1000 face value 5% annual coupon bond, redeemable at par. Determine the number of the 1-year zero coupon bond needed.

(A) 6.7

(B) 7.1

(C) 7.5

(D) 7.9

(E) 8.3

9. A CFO wants to immunize her company's liabilities with assets using a 4% annual effective interest rate. There's a liability of 100,000 due at the end of 3 years, and another liability of 250,000 due at the end of 5 years. She will use 2-year and 10-year zero coupon, 1000 face-value bonds. Determine the number of 10-year zero coupon bonds she will need to purchase.

(A) 130

(B) 135

(C) 140

(D) 145

(E) 150

10. A payment of 1000 is due at the end of 2 years, and another payment of 2000 is due at the end of 5 years. Determine the Macaulay convexity of this set of payments, using an annual effective interest rate of 5%.

(A) 16.5

(B) 16.9

(C) 17.3

(D) 17.7

(E) 18.1