MTH 351
Exam 3
Fall 2024

Show all work in a neat and organized fashion. Clearly indicate your answers.
100 points possible. 7 problems at 14 points each, plus 2 free points.

1. You have decided to invest in Bond X, an n-year bond with semi-annual coupons and the following characteristics:

(i) Par value is 1000.
(ii) The ratio of the semi-annual bond rate, r, to the desired semi-annual yield rate, i, is 1.04375.
(iii) The present value of the redemption value is 131.45.

Given $(1+i)^{-n} = 0.3538$, calculate the price of bond X.

2. A 40-year bond is purchased at a discount. The bond pays annual coupons. The amount for accumulation of discount in the 20th coupon is 222.67. The amount for accumulation of discount in the 25th coupon is 366.84.

Calculate the amount of discount in the purchase price of this bond.

3. A 1000 par value bond with 8% semiannual coupons and a maturity date 20 years from now can be called on any coupon date after the 20th coupon, according to the following schedule.

If called on the 21st through 30th coupon date, the redemption value will be 1100.

If called on the 31st through 40th coupon date, the redemption value will be at par.

Find the maximum price that can be paid to guarantee a yield of 7% per annum compounded semiannually.

4. A person's savings earn an effective rate of 15% on which 35% income tax is paid. If the inflation rate is 7% per year, what is the annual after-tax real rate of return?

5. You are given the following term structure of spot interest rates.

Term (in years)	Spot interest rate
1	8.5%
2	9.0%
3	9.5%

Find the current price of a 1000 3-year bond with coupon rate 8% payable annually.

6. You are given the following term structure of spot interest rates.

Term (in years)	Spot interest rate
1	6.00%
2	7.00%
3	7.75%
4	8.25%
5	8.50%

Find the following expected forward rates.

(a) 1-year deferred 2-year forward rate

(b) 3-year deferred 2-year forward rate

7. Find the duration of a perpetuity-immediate with annual payments of X, using an effective annual interest rate of 8.5%.