IOE 452/MFG 455
University of Michigan
Winter 2026
Assignment II
Due: January 30, before 11:59 PM
Electronic submissions only
Make sure all the requisite materials are attached!

Q1– RK would like to design a spreadsheet to compute the future value of an **ordinary annuity**. Suppose RK contributes P = \$1,000 at the end of each period for 5 periods, and the annual interest rate is $r = 10\%$.

1. Design a table by hand and then implement it in Excel to track the accumulation of the annuity over time. Your spreadsheet should contain two columns with the following headers: (10 pts.)

Column	Header	Description
A	**Period t**	Period number $t = 0, 1, 2, \cdots, 5$
B	**Beginning-of-Period Balance**	Account balance at the start of period t

2. **RK** would like to design a spreadsheet to analyze an **ordinary annuity**. Suppose RK contributes P = \$1,000 at the end of each period for 5 periods, and the annual interest rate is $r = 10\%$. Create an Excel spreadsheet structure and populate it with the following **three columns:** to determine the future value of the annuity (10 pts.)

Column	Header	Description
A	**Period t**	Period number $t = 0, 1, 2, \cdots, 5$
B	**Beginning Balance B_t**	Account balance at the start of period t
C	**Interest Earned**	Interest earned during period t

3. Determine the future value of the annuity using the formula derived in class for each period in your table. (10 pts.)

4. Now suppose **RK** instead wants to determine the present value of receiving $1,000 at the end of each period for 5 periods, discounted at 10%. Use Excel to populate the following type of Table: (10 pts.)

Period	Cash Flow	Discount Factor	Present Value
1	?	?	?
. . .			
. . .			

Q2–An entity quotes a simple (discretely compounded) interest rate of 10.52% per period. Determine the continuously compounded interest rate that produces the same effective rate of return over the period. Clearly show all steps in your calculation. (10 pts.)

Q3–**RK** plans to purchase a car costing $20,000 at the end of 5 years. To finance this purchase, she deposits equal amounts at the end of each year into an account that earns 5% annual interest.

1. Determine the annual deposit required at the end of years 1 through 5 to accumulate $20,000 by the end of year 5. (10 pts.)

Q4–**RK** takes out a student loan of $10,000 at an annual interest rate of 10%, compounded monthly. The loan is to be fully repaid with equal monthly payments over 10 years.

1. Determine **RK**'s monthly payment. (5 pts.)

2. Calculate the total interest paid over the life of the loan. (5 pts.)

Q5–**RK** took out a mortgage that requires annual payments of $70,000 for the next 8 years. The mortgage carries an annual interest rate of 8%.

1. Determine the present value of **RK**'s payments. (10 pts.)

2. Construct an amortization table in Excel, including the following columns for each year:

   - Remaining loan balance
   - Interest paid
   - Principal repaid

Q6–You hold a 4 year bond with a par value of $100, paying semi–annual coupons.

- Annual coupon rate: 6%

- Annual discount rate: 7%

Answer the following:

1. Calculate the price of the bond and indicate the bond type. (5 pts.)

2. Determine the time path of the bond price, i.e., the bond price at the end of each year until maturity. Plot your results. (10 pts.)

3. Based on part 2, what do you observe about the bond price as it approaches maturity? (5 pts.)

4. Plot the present value of the coupon payments versus time to maturity. (5 pts.)

5. Plot the present value of the principal (face value) versus time to maturity. (5 pts.)

6. Based on parts 4 and 5, what conclusions can you draw about the relative contribution of coupon payments and principal repayment to the bond's price over time? (10 pts.)

Q7–You hold a 4 year bond with a par value of $100, paying semi-annual coupons:

- Annual coupon rate: 6%

- Annual discount rate: 5%

Answer the following:

1. Determine the price of the bond and indicate the bond type. (5 pts.)

2. Determine the time path of the bond price, i.e., the bond price at the end of each year until maturity. Plot your results.

3. Based on part 2, what do you observe about the bond price as it approaches maturity? (5 pts.)

4. Plot the present value of the coupon payments versus time to maturity. (5 pts.)

5. Plot the present value of the principal (face value) versus time to maturity. (5 pts.)

6. Based on parts 4 and 5, what conclusions can you draw about the relative contribution of coupon payments and principal repayment to the bond's price over time? (10 pts.)

Q8– You are given a 7 year bond with the following characteristics:

- Face value: $1,000

- Annual coupon: 3%

- Coupon frequency: **annual**

- Yield to maturity: 4% per year

- Maturity: 7 years

Prepare a spreadsheet to accomplish the following tasks:

1. Prepare a schedule of cash flows for each year. (5 pts.)

2. Determine the price of the bond based on the given yield. (5 pts.)

3. Calculate the **Macaulay duration** of the bond. (5 pts.)

4. Calculate the **modified duration** of the bond. (5 pts.)

5. Suppose the coupon increases to 9% per year. Predict how the duration would change and explain why. (10 pts.)

Q9– Consider two zero-coupon bonds, each with a face value of $1,000:

- **Bond A:** 5-year maturity

- **Bond B:** 10-year maturity

Assume **annual compounding** throughout.

1. Using Excel, graph how the price of each bond changes as the yield to maturity varies from 1% to 15%, in 1% increments.

2. Plot both bonds on the same graph with yield on the horizontal axis and price on the vertical axis. (10 pts.)

3. Calculate the change in price for each bond when the yield increases:

    - from 5% to 6%, and
    - from 10% to 11%.

4. Clearly report both the dollar change and the percentage change in price. (10 pts.)

5. Based on your calculations above, determine which bond is more exposed to interest rate risk.

    Your answer must be supported by quantitative evidence from Parts (1) and (2). (10 pts.)