

MATH 373
Test 1
Spring 2017
February 9, 2017

1. Aaron invests in a fund earning interest based on an accumulation function of $a(t) = 1 + 0.02t^2$ where t is measured from today. Aaron invests 10,000 today and another 20,000 at the end of three years.

Calculate the amount that Aaron will have at the end of 8 years.

2. Alex, Brian, and Zachary enter into a financial agreement. Alex agrees to pay Brian 10,000 today. Alex will also pay 20,000 to Zachary today.

At the end of one year, Brian will pay Zachary 7,000.

At the end of two years, Zachary will pay 20,000 to Alex.

At the end of four years, Zachary will pay 14,000 to Alex. Additionally, at the end of four years, Brian will pay 5,723 to Alex.

Finally, at the end of 5 years, Zachary pays X to Brian.

Over the five year period, the annual effective interest rate paid or received by each party is the same.

Determine X .

3. Madison loans Savannah 100,000 which will be repaid with three payments of P . The payments will be at the end of the first year, the end of the second year, and the end of the third year. Under the loan, Savannah will pay an annual effective interest rate of 8%.

Madison takes each payment of P and reinvests it in the Hemenway Fund. The Hemenway Fund earns an annual effective interest rate of 5%.

Determine Madison's annual effective return when reinvestment is taken into account.

4. Yuqing purchased a Government of Canada Treasury Bill. The Bill matures in 210 days for 100,000 and has a quoted rate of 6.25%.

Calculate the annual interest rate compounded continuously that Yuqing will actually earn on this Treasury Bill.

5. Bell Industries is building a new factory. Bell invests 5,000,000 today to start the new factory. Bell expects to receive the following cash flows at the end of the next four years:

Time	Amount
End of Year 1	X
End of Year 2	3,000,000
End of Year 3	4,000,000
End of Year 4	1,000,000

After four years, the factory will be obsolete and no further cash flows will be generated.

Bell expects this project to generate an internal rate of return of 9%.

Calculate the Net Present Value at an annual effective interest rate of 8%.

6. Porter invests 30,000 into an account on January 1, 2014.

On July 1, 2014, he has 32,000 and withdraws 10,000 for a trip to China.

On September 30, 2014, Porter has 23,000 and withdraws 9000 for a trip to Europe.

On November 30, 2015, Porter has 15,000 and deposits another 13,000.

On July 1, 2016, Porter has 29,000.

Estimate Porter's annual dollar weighted return over the two and one half years using the simple interest approximation that we learned in class.

7. Phillip purchases a US Treasury Bill for 9750. The Bill matures in 75 days for 10,000.

Let QR be the Quoted Rate on this Treasury Bill. Let i be the annual effective interest rate earned by Phillip on this Treasury Bill.

Calculate $i - QR$ accurate to five decimal places.

8. Daniel invests 1000 in a fund earning an annual effective interest rate. At the end of 10 years, Daniel has 3000.

The force of interest that is equivalent to the annual effective interest rate earned by Daniel is A .

The nominal discount rate compounded quarterly that is equivalent to the annual effective interest rate earned by Daniel is B .

Calculate $A - B$ accurate to five decimal places.

9. Jacob makes six year loans where the loan is repaid with a single payment at the end of six years. On these loans, Jacob wants to earn an annual interest rate of 2.2% compounded continuously to compensate for deferred consumption. Additionally, Jacob expects that the annual rate of inflation compounded continuously will be 4.2% over the next six years. However, Jacob is concerned with the inflation risk and wants an annual rate of 0.25% compounded continuously in order to accept this risk.

For these loans, Jacob also expects to be compensated for defaults. Jacob expects a default rate of 2.4%. For loans which default, Jacob expects to recover 35% of the amount owed at time of default.

Jacob makes a six year loan to Austin. The amount Austin borrowed was 55,000.

Determine the amount that Austin will owe at the end of six years.

10. Molly invests in a fund earning interest based on an accumulation function of $a(t) = 1 + ct^3$ where t is measured from today.

Under this accumulation function, $\delta_{10} = \frac{11}{38}$.

Calculate $i_7 - d_7$.

11. Tommy makes a 3 year loan of 100,000 to the US Government. With a loan to the US Government, the risk of default is zero so there is no credit spread.

Tommy will receive an annual interest rate compounded continuously of 3.4% plus the rate of inflation for the next three years. The rate of inflation compounded continuously for the first year is 2.8%. The rate of inflation compounded continuously for the second year is $x\%$. The rate of inflation compounded continuously in the third year is $1.5x\%$.

At that end of three years, the US Government owes 121,835.31.

Calculate x .

12. Faith invests 100,000 into an account on January 1, 2014.

On July 1, 2014, she has 125,000 and withdraws 30,000 to buy a new car.

On August 31, 2014, Faith sells her old car for 10,000 and deposits the money into her account. Prior to making the deposit of 10,000, Faith had 115,000 in her account.

On June 30, 2016, Faith has 135,000.

Calculate Faith's annual time weighted return over the two and one half years ending June 30, 2016.

13. Hyun Woo buys a US Treasury Bill on January 1, 2017 at a quoted rate of 6.5%. The price of the Treasury Bill was 14,440 and it matures in 240 days.

When the Treasury Bill matures, Hyun Woo invests the maturity value of the remaining 125 days of 2017 in Cao Bank at an annual effective discount rate of 7.0%.

At the end of 2017, Hyun Woo withdraws his funds from Cao Bank. He then invests the entire balance in the Roche Fund which pays 8% compounded every three years.

Calculate Hyun Woo's balance at the end of 2020.