

# Stat 274 — Winter 2024

## Homework Assignment 1

Due: Thursday, January 18th on Learning Suite at 9:30 am

1. Suppose  $a(t) = 1 + 0.02t + 0.001t^2$ 
  - (a) Find  $i_3$ , the effective interest rate for the third year. [0.023946]
  - (b) Find  $i_{[3,5]}$ , the effective interest rate for the time period from 3 to 5. [0.052385]
  - (c) Given an initial deposit of 25, what will be the accumulated amount at time 5? [28.125]
  - (d) Given an initial deposit of 25, what will be the interest earned in the fifth year? [0.725]
  
2. A loan is made at time 0 at simple interest at an annual rate of 5%.
  - (a) In which year is the effective rate  $1/23$ ? [4]
  - (b) What is the effective rate for the interval  $[4, 6]$ ? [0.0833]
  
3. Assuming simple interest
  - (a) With  $i = 0.03$ , an initial deposit of  $K = 2500$ , and  $A(t) = 3200$ , find  $t$ . [9.33]
  - (b) With an interest rate of 5% and an initial deposit of 3000, find the accumulated value at time 6.5. [3975]
  - (c) How much would you need to deposit now in order to have 10000 in ten years with simple interest credited at a rate of 8% per year? [5555.55]
  - (d) Suppose that an initial deposit of 5000 increases to 8000 in 10 years, find the annual interest rate. [0.06]
  - (e) You deposit 100 at time 0. For the first three years you earn 3% each year, for the next two you earn 4%, and for the final year you earn 6%. How much is in the account after the end of the six years? (Note that for simple interest the principal

will be the same (100) for each period.) [123]

- (f) You deposit 100 at time 0. Accounts earn 2% per year under 125, 3% per year between 125 and 200 and then 4% per year above 200. When will the account have a balance of 225? [43.75]
4. Rework the previous problem assuming compound interest. [8.35; 4119.57; 4631.93; 0.04812; 125.28; 30.172]
5. Suppose that  $a(t) = \alpha + \beta t + \gamma t^2$ , find the values of  $\alpha$ ,  $\beta$ , and  $\gamma$  given that  $i_1 = 0.05$  and  $i_{[0,2]} = 0.12$ . [ $\alpha = 1$ ;  $\beta = 0.04$ ;  $\gamma = 0.01$ ]
6. Under annually compounding interest with a positive interest rate, the effective interest rate for  $[8,14]$  is 2.1 times the effective interest rate for  $[3,6]$ . Find the annual interest rate  $i$ . [3.23%]
7. Account A has 100 dollars at time 0 and grows at a simple interest rate of 0.05. Account B has  $x$  dollars at time 0 and grows at a compound interest rate of 0.03. At time  $t = 9$ , accounts A and B are equal. Solve for  $x$ . [111.13]
8. Richard has 1500 dollars. He wants to have 2500 dollars in 10 years. His bank will pay him simple interest  $i$  for 5 years, after which it will pay him compound interest  $i$  for 5 more years. Solve for  $i$ . You may use software to solve the final equation (e.g. Wolfram Alpha). [0.0550203]
9. Find and work 5 more practice problems. These will be graded, so be sure to include them in your submitted assignment. You can find them:
- In the online practice problems
  - In the study manuals in the library
  - In the book
  - Ask the TA's to write one
  - In your purchased software (Infinite Actuary, Coaching Actuaries, Actex, etc.)