Stat 274 - Winter 2024
Homework Assignment 3
Due: Thursday, February 1st on Learning Suite at 9:30 am

1. Bruce and Robbie each open up new bank accounts at time 0. Bruce deposits 100 into his bank account, and Robbie deposits 50 into his. Each account earns the same annual effective interest rate. The amount of interest earned in Bruce's account during the 11th year is equal to X. The amount of interest earned in Robbie's account during the 17th year is also equal to X. Calculate X. [38.88]

2. David can receive one of the following two payment streams: (1) 100 at time 0, 200 at time n, and 300 at time $2n$ or (2) 600 at time 10. At an annual effective interest rate of i, the present values of the two streams are equal. Given $v^n = 0.76$, determine i. [0.0350]

3. Jeff deposits 10 into a fund today and 20 fifteen years later. Interest is credited at a nominal discount rate of d compounded quarterly for the first 10 years, and at a nominal interest rate of i compounded semiannually thereafter. If the account balance is less than 90, $i = 0.06$. If the account balance is greater than 90, $i = 0.07$. The accumulated balance in the fund at the end of 30 years is 100. Calculate d. [0.04245]

4. Adam opens an account paying 3% effective annually with an initial deposit (at time 0) of 1000. At time 2, he adds another 1500 to the account. Bridget opens a savings account at time 1 with a deposit of 2000 earning i% annually. At time 5, Adam and Bridget have the same amount in their accounts. Calculate i. [0.08760]

5. You are given the choice of investing in an account which will double your money in 6 years or one which will triple your money in nine years. Which has a better annual interest rate? [0.12246; 0.12983]

6. Assuming compound interest, the effective rate for $[3, 15]$ is one third the effective rate for $[18, 42]$. Find the annual interest rate. [0.05946]

7. Jim received a trust fund on his tenth birthday. When he turned 21, the trust fund was valued at 18750. If the trust fund grew at an annual effective rate of 5.8%, how much was it worth on his 16th birthday? [14,144.02]

8. Suppose $a(t) = 1 + 0.02t + 0.001t^2$:

   - Find d, the effective annual discount rate, as a function of t.
   - Find d_3, the effective discount rate for the third year. [0.023386]
   - Find $d_{[2,6]}$, the effective discount rate from 2 to 6. [0.096886]
   - Given an initial deposit of 25, how much interest is earned from 2 to 6? [2.80]

9. (SOA Study Note FM-09-05-3) Eric deposits 100 into a savings account at time 0, which pays interest at a nominal rate of i, compounded semiannually. Mike deposits 200 into a different savings account at time 0, which pays simple interest at an annual rate of i. Eric and Mike earn the same amount of interest during the last 6 months of the 8th year. Calculate i. [0.09459]

10. 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 book
   - Ask the TA's to write one
   - In your purchased software (Infinite Actuary, Coaching Actuaries, Actex, etc.)