M329F Interest Theory
Fall 2020
University of Texas at Austin
HW 3
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Note: You **must** show all your work. Numerical answers without a proper explanation or a clearly written down path to the solution will be assigned zero points.

Please, provide your *complete solution* to the following problems:

Problem 3.1. (5 points) Solve Problem **2.2.1** from the textbook.

Problem 3.2. (5 points) Solve Problem **2.3.1** from the textbook.

Problem 3.3. (5 points) *Source: Problem 2.3.4 from the textbook.*
Shakari opens a savings account with a deposit of \$3,500.

She deposits \$500 six months later and \$800 nine months after opening the account.

The balance in Shakari's account one year after she opened it is \$5,012.

Assume that the account grows by compound interest at a constant annual effective interest rate i. Find i.

Problem 3.4. (5 points) Solve Problem **2.3.6** from the textbook.

Problem 3.5. (5 points) *Source: The SoA exam May 1991, Problem #14.*
You are given that the time-varying force of interest is $\delta_t = \frac{0.2t}{1+0.1t^2}$, for all $t > 0$. Determine i_2.

Problem 3.6. (5 points) *Source: The SoA exam May 2000, Problem #37.*
A customer is offered an investment where interest is calculated using the following time-varying force of interest:

$$\delta_t = \begin{cases} 0.02t & 0 \leq t \leq 3 \\ 0.045 & 3 < t \end{cases}$$

The customer invests \$1,000 at time-0. What nominal rate of interest compounded quarterly is earned over the first four year period?

Problem 3.7. (5 points) *Source: The SoA exam May 2000, Problem #11.*
Joe deposits 10 today and another 30 in five years into a fund paying simple interest of 11% per year. Tina will make the same two deposits, but the 10 will be deposited n years from today, and the 30 will be deposited $2n$ years from today. Tina's deposits earn an annual effective interest rate of 9.15%. At the end of 10 years, the accumulated amount of Tina's deposits equals the accumulated amount of Joe's deposits. Calculate n.

Problem 3.8. (5 points) *Source: The CAS exam May 1994, Problem #1.*
John is 30 years old. He will receive two payments of \$2,500 each. The first payment will be an unknown number of years in the future. The second payment will be five years after the first payment. At an annual effective interest rate of 5%, the present value of the two payments is \$2,607. Determine at what age John will receive the *second* payment.

Problem 3.9. (10 points) *Source: The SoA Sample Problem #31 from the year 2000.*
Jason deposits \$3,960 into a bank account at time-0. The bank credits interest **at the end of every year** at a time-varying force of interest given by $\delta_t = \frac{1}{8+t}$ for $t > 0$. Interest can be reinvested at an annual effective rate of 7%. The total accumulated amount at time-3 is equal to X. Calculate X.