M329F Interest Theory
Fall 2020
University of Texas at Austin
HW 2
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Please, provide your *complete solution* to the following problems:

Problem 2.1. (5 points) Provide your complete solution to **Problem 1.7.8** from the textbook.

Problem 2.2. (6 points) Assume our usual notation. The accumulation of interest in an account is governed by the following:
a nominal interest rate convertible semiannually of 9% for the first 3 years,
a nominal discount rate convertible quarterly of 10% for the following 2 years,
$d = 7\%$ for the next 2 years,
$i = 12\%$ thereafter.

Roger makes an initial deposit of \$100. He makes no subsequent deposits or withdrawals, and liqudates his account after 10 years. Calculate the amount he is able to withdraw at that time.

Problem 2.3. (9 points) *Source: SoA Exam FM, May 1988, Problem #3.*
Two funds, A and B, start with the same amount.

Fund A grows at an annual interest rate $i > 0$ for n years, and at an annual interest rate $j > 0$ for the next n years. Fund B grows at an annual interest rate $k > 0$ for $2n$ years.

Fund A equals 1.5 times fund B after n years. The amount in the two funds are equal after $2n$ years. Which of the following are true?

i. $j < k < i$
ii. $k < \frac{i+j}{2}$
iii. $j = k\left(\frac{2}{3}\right)^{1/n}$

Problem 2.4. (5 points) *Source: SoA Exam FM/2, November 1988, Problem #4.*
John borrows \$1,000 from Jane at an annual effective interest rate i. He agrees to pay back \$1,000 after six years and \$1,366.87 after another six years.

Three years after his first payment, John repays the outstanding balance. What is the amount of John's second payment?

Problem 2.5. (10 points) *Source: SoA Exam FM/2, May 1989, Problem #1.*
Investment X for \$100,000 is invested at a nominal rate of interest j convertible semiannually. After four years, it accumulates to \$214,358.88.

Investment Y for \$100,000 is invested at a nominal rate of interest k convertible quarterly. After two years, it accumulates to \$232,305.73.

Investment Z for \$100,000 is invested at an annual effective rate of interest equal to j in year one and an annual effective rate of discount equal to k in year two. Calculate the value of the investment Z in two years.

Problem 2.6. (5 points) *Source: SoA Exam FM/2, May 2003, Problem #50.*
Jeff deposits 10 into a fund 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 od 6% compounded semiannually thereafter. The accumulated balance in the fund at the end of thirty years is 100. Calculate d.

Problem 2.7. (5 points) *Source: SoA Exam FM/2, May 1998, Problem #2.*
John invests 1000 in a fund which earns interest during the first year at a nominal rate of κ convertible quarterly. During the second year, the fund earns interest at a nominal discount rate of κ convertible quarterly. At the end of the second year, the fund has accumulated to 1173.54. Calculate κ.

Please, provide your *final answer only* for the following problems.

Problem 2.8. (5 pts) Roger makes an initial investment of \$100,000.

In return, he gets cash flows of \$40,000 at the end of each of years 2, 3 and 4. The cash flows can be reinvested at 4.0% per annum effective.

If the rate of interest at which the investment is to be valued is 5.0%, let P denote the net present value of this investment today. Then,

(a) $P < 0$
(b) $0 \leq P < 700$
(c) $700 \leq P < 1400$
(d) $1400 \leq P < 1600$
(e) None of the above.