Homework 9 - Due 28 October 2011

Math 1140 Financial Mathematics

Collaboration Policy: You are encouraged to collaborate with your fellow students on this homework. You must turn in individual solutions and you are not allowed to use any written, typed, or recorded artifact from the meeting with your classmates. You are allowed to use any resources **except for the Appendix D in the textbook (the solutions to the odd-numbered exercises)**.

Pledge: On my honor, I pledge that I have neither given nor received unauthorized aid on this assignment.

Name(use block letters):

Signature:

For full credit you must show your work and your calculations for all the problems. I am not asking for the presentation of silly arithmetic!

Problem 1

Find the present value of an ordinary annuity that lasts five years and pays $\$3,000$ at the end of each month, using a nominal interest rate of 3% convertible monthly. Then repeat the problem using an annual effective discount rate of 3%. Which is higher? Why?

Problem 2

Mrs Williams finds that she has two options for investing $\$32,000.02$ for fifteen years.
Option 1: Deposit the $\$32,000.02$ into a fund earning a nominal rate of discount $d(4)$ convertible quarterly.
Option 2: Buy an ordinary annuity with 15 equal payments, the annuity payments computed using an annual effective rate 7%, and then, when she gets an annuity payment, she invests it immediately into a fund earning an annual effective rate of 5%.
Mrs Williams calculates that the second option produces an accumulated value that is $\$1,500$ more than the accumulated value yielded by the first option.
Calculate $d(4)$.

Problem 3

April received an inheritance from her grandmother in the form of an annuity. The annuity pays $\$3,000$ on Jan 1 from 1966 trough 1984. Find the value of this annuity on Jan 1, 1966 using an annual effective interest rate of 5%.

Problem 4

Suppose the interest rate is 3% per month. Find the value one month before the first payment of an annuity-due paying $200 at the beginnig of each month for five years.

Problem 5

Steve Wong wishes to save for his retirement by depositing $\$1,200$ at the beginning of each year for thirty years. Exactly one year after his last deposit he wishes to begin making annual equal withdrawals until he has made twenty withdrawals and exhausted the savings. Find the amount of each withdrawal if the effective rate is 5% during the first thirty years but only 4% after that.

Problem 6

Alice owned an annuity which had equal payments for twelve consecutive years, the first of these being in exactly twelve years. She sold it, and the selling price of $\$21,092.04$ was based on an yield rate for the investor of 7.8%. What is the amount of the equal payments?

Problem 7

Catfish Hunter's 1974 baseball contract with Oakland Athletics called for half of his $\$100,000$ salary to be paid to a life insurance company of his choice for the purchase of a deferred annuity. More precisely, there were to be semi-monthly contributions in Hunter's name to the Jefferson Insurance Company with the first payment on April 16 and the final payment on September 30. We suppose that the first eleven of these were to be for $\$4,166.67$, and the final payment was to be for four cents less.

a) Using an annual effective interest rate of 6% (a rate that figures in a six-year personal loan of $\$120,000$ that Oakland's owner Charley Finley had made to Hunter in 1969 and then promtly recalled), find the value of the specified payments to the insurance company at the scheduled time of the last payment. (Hunter wished to have such an annuity in lieu of immediate salary for tax reasons. Finley claimed he was fullfiling the contract with Hunter when he offered Hunter a $\$50,000$ check at the end of the season. Finley's default on his contractual obligation led to Hunter's historic free agency. The New York Yankees signed Hunter to a five-year $\$3,750,000$.)

b) Suppose that the contracted payments had been made to the insurance company from April 16, 1974 trough September 30, 1974, and that they accumulated at an annual interest rate of 6%. Further suppose that Hunter had drawn equal Jan first salary for twenty years beginning on Jan 1, 1980, the first January after his retirement. Find the amount of the annual salary payments.

Problem Bonus 1

Tracy receives payments of $\$X$ at the end of each year for n years. The present value of her annuity is \$493. Gary receives payments of $\$3X$ at the end of each year for $2n$ years. The present value of his annuity is $\$2,748$. Both present values are calculated using the same effective interest rate, i. Calculate $(1+i)^{-n}$.

Problem (Bonus 2)

Sigmund and Karl each borrowed an identical amount from Ludwig at a nominal rate of discount of 5.4% convertible quarterly.
Sigmund repays his loan by making payments of $\$2,000$ at the end of each year for six years.
Karl makes payments of $\$3,200$ at four equally spaced times T, $2T$, $3T$, and $4T$.
Find T.

Problem (Bonus 3)

Starting on his 25th birthday and continuing trough his 60th birthday, Fred deposits $\$7,500$ each year on his birthday into a retirement fund earning an annual effective rate of 5%. Immediately after the last deposit, the accumulated value of the fund is transferred to a fund earning an annual effective rate of j. Five years later, a twenty-five year annuity-due paying $\$5,800$ each month is purchased with the funds. The purchase price of the annuity was determined using an annual effective rate of interest of 4%. Find j.

Problem (Bonus 4)

When computed using an effective interest rate of i, it is known that the present value of $\$2,000$ at the end of each year for $2n$ years plus an additional $\$1,000$ at the end of each of the first n years is $\$52,800$. Using this same interest rate, the present value of an n year deferred annuity-immediate paying $\$4,000$ per year for n years is $\$27,400$. Find n.