King Saud University

Department of Mathematics

Tutorial 2 - Semester 461

ACTU 371 – Financial Mathematics

Exercise 1.

(a) You wish to make a deposit now into an account earning 6% annually so that you can make a withdrawal of 300 at the end of each of the next 9 years. How much should you deposit today.

(b) You have an investment account that earns interest at a 5% annual effective rate. You plan to make a level deposit at the beginning of each of the next 9 years so that your balance at the end of 9 years is 12,000. Find the required level deposit.

(c) You have borrowed 20,000 and agree to repay the loan with 5 level payments of 400, with the first payment occurring one year from today. What annual effective interest rate are you paying?

(d) You want to accumulate at least 20,000 in an account earning a 5%annual effective rate. You will make a level deposit of 1,000 at the beginning of each year for n years. What is the value of n? what is the account balance after n years.

(e) Find the level monthly payment for a 30-year mortgage loan of 300,000 at an interest rate of 8% convertible quarterly.

Exercise 2

An annuity-immediate has 5 annual payments of 100, followed by a perpetuity of 200 starting in the 6^{th} year. Find the present value at 8%.

Exercise 3

An annuity-immediate has semi-annual payments of 100 for 10 years. Find its present value at an interest rate of 6% convertible monthly.

Exercise 4

A perpetuity-immediate pays X per year. Brian receives the first n payments, Colleen receives the next n payment and Jeff receives the remaining payments. Brian's share of the present value of the original perpetuity is 40%, and Jeff's share is K.Calculate K.

Exercise 5

A man turns 40 today and wishes to provide supplemental retirement income of 3000 at the beginning of each month starting on his 65^{th} birthday. Starting today, he makes monthly contribution of X to a fund for 25 years. The fund earns a nominal rate of 8% compounded monthly. On his 65^{th} birthday, each 1000 of the fund will provide 9.65 income at the beginning of each month starting immediately and continuing as long as he survives. Calculate X

Exercise 6

For 10,000, Kelley purchases an annuity-immediate that pays 400 quarterly for the next 10 years. Calculate the nominal annual interest rate convertible monthly earned by Kelley's investment.

Exercise 7

A perpetuity-immediate makes quarterly payment. The first 20 payments are 10. Starting with the 21^{st} payments, the remaining payments under this perpetuity are 15. At an interest rate of 6% convertible quarterly, what is the perpetuity's present value.

Exercise 8

John finances his daughter's college education by making deposits into a fund earning interest at an annual effective rate of 8%. For 18 years he deposits X at the beginning of each month. In the 16th through the 19th years, he makes a withdrawal of 25,000 at the beginning of each year. The final withdrawal reduces the fund balance to zero.

Exercise 9

An annuity having n payments of 1 has a present value of X. The first payment is made at the end of three years and the remaining payments are made at seven-year intervals thereafter.

Determine X.

(A) $\dfrac{a_{\overline{7n+3}|} - a_{\overline{3}|}}{s_{\overline{3}|}}$

(B) $\dfrac{a_{\overline{7n+3}|} - a_{\overline{3}|}}{a_{\overline{7}|}}$

(C) $\dfrac{a_{\overline{7n+3}|} - a_{\overline{7}|}}{a_{\overline{3}|}}$

(D) $\dfrac{a_{\overline{7n+3}|} - a_{\overline{7}|}}{a_{\overline{7}|}}$

(E) $\dfrac{a_{\overline{7n+3}|} - a_{\overline{7}|}}{s_{\overline{3}|}}$

Exercise 10

An investor's retirement account pays an annual nominal interest rate of 4.2%, convertible monthly.

On January 1 of year y, the investor's account balance was X. The investor then deposited 100 at the end of every quarter. On May 1 of year $(y + 10)$, the account balance was $1.9X$.

Determine which of the following is an equation of value that can be used to solve for X.

(A) $\dfrac{1.9X}{(1.0105)^{\frac{124}{3}}} + \sum_{k=1}^{42} \dfrac{100}{(1.0105)^{k-1}} = X$

(B) $X + \sum_{k=1}^{42} \dfrac{100}{(1.0035)^{3(k-1)}} = \dfrac{1.9X}{(1.0035)^{124}}$

(C) $X + \sum_{k=1}^{41} \dfrac{100}{(1.0035)^{3k}} = \dfrac{1.9X}{(1.0035)^{124}}$

(D) $X + \sum_{k=1}^{41} \dfrac{100}{(1.0105)^{k-1}} = \dfrac{1.9X}{(1.0105)^{\frac{124}{3}}}$

(E) $X + \sum_{k=1}^{42} \dfrac{100}{(1.0105)^{k-1}} = \dfrac{1.9X}{(1.0105)^{\frac{124}{3}}}$