Assignment 2

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SFU SCHOOL OF MECHATRONIC SYSTEMS ENGINEERING

MSE300
Assignment 2
Summer 2021

Problem 1 (3 pts)
A local newspaper headline blared, "Shawn Smith Signed for $30 Million." A reading of the article revealed that on April 1. 2009. Shawn Smith, the former record-breaking centre from Hockey University. signed a $30 million package with the Edmonton Ice Knights. The terms of the contract were $3 million immediately, $2.4 million per year for the first five years (with the first payment after one year), and $3 million per year for the next five years (with the first payment at year 6). If Shawn's interest rate is 8% per year, what would his contract be worth at the time he signs it?

Problem 2 (8 pts)
What equal annual payment series is required to repay the following present amounts?
a) $10,000 in 5 years at 5% interest compounded annually
b) $5,500 in 4 years at 9.7% interest compounded annually
c) $8,500 in 3 years al 2.5% interest compounded annually
d) $30,000 in 20 years at 8.5% interest compounded annually

Problem 3 (8 pts)
What is the present worth of the following series of payments?
a) $800 at the end of each year for 12 years at 5.8% compounded annually
b) $2,500 at the end of each year for 10 years at 8.5% compounded annually
c) $900 at the end of each year for 5 years at 7.25% compounded annually
d) $5,500 at the end of each year for 8 years at 8.75% compounded annually

Problem 4 (6 pts)
From the interest tables in Appendix A, determine the values of the following factors by interpolation and compare your results with those obtained from evaluating the A/P and P/A interest formulas:
a) The capital recovery factor for 38 periods at 6.25% interest
b) The equal payment series present-worth factor for 85 periods at 9.25% interest

Problem 5 (6 pts)
What is the amount of 10 equal annual deposits that can provide five annual withdrawals when a first withdrawal of $5,000 is made at the end of year 11 and subsequent withdrawals increase at the rate of 8% per year over the previous year's withdrawal if
a) The interest rate is 9% compounded annually?
b) The interest rate is 6% compounded annually?

Problem 6 (9 pts)
By using only those factors given in interest tables, find the values of the factors that follow, which are not given in your tables. Show the relationship between the factors by using factor notation and calculate the value of the fac tor. Then compare the solution you obtained by using the factor formulas with a direct calculation of the factor values.
Example: (F/P, 8%, 38) = (F/P, 8%, 30)(F/P, 8%, 8) = 18.6253

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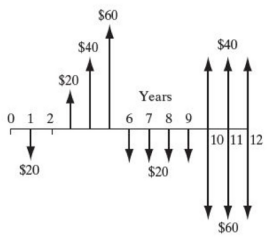
(a) (P/F, 8%, 67)
(b) (A/P, 8%, 42)
(c) (P/A, 8%, 135)

Problem 7 (3 pts)
Solve for the present worth of this cash flow using at most three interest factors at 10% interest compounded annually.



Problem 8 (3 pts)
Find the value of X so that the two cash flows shown in the

Problem 1

$P = 3000000 + \frac{2400000}{(1+0.08)^1} + \frac{2400000}{(1+0.08)^2} + \frac{2400000}{(1+0.08)^3} + \frac{2400000}{(1+0.08)^4} + \frac{2400000}{(1+0.08)^5} + \frac{3000000}{(1+0.08)^6} + \frac{3000000}{(1+0.08)^7} + \frac{3000000}{(1+0.08)^8} + \frac{3000000}{(1+0.08)^9} + \frac{3000000}{(1+0.08)^{10}}$

$P = \$20864282.71$

Problem 2

a) $E = Pi\frac{(1+i)^n}{((1+i)^n-1)}$ $= 10000 \cdot 0.05 \frac{(1+0.05)^5}{((1+0.05)^5-1)}$ $= \$2309.75$

b) $E = Pi\frac{(1+i)^n}{((1+i)^n-1)}$ $= 5500 \cdot 0.097 \frac{(1+0.097)^4}{((1+0.097)^4-1)}$ $= \$1723.83$

c) $E = 8500 \cdot 0.025 \frac{(1+0.025)^3}{((1+0.025)^3-1)}$ $= \$2976.17$

d) $E = 30000 \cdot 0.085 \frac{(1+0.085)^{20}}{((1+0.085)^{20}-1)}$ $= \$3170.13$

Problem 3

a) $P = 800\left(\frac{(1+0.058)^{12}-1}{0.058(1+0.058)^{12}}\right)$ $= \$6781.23$

b) $2500\left(\frac{(1+0.085)^{10}-1}{0.085(1+0.085)^{10}}\right)$ $= \$16903.37$

c) $P = 900\left(\frac{(1+0.0725)^5-1}{0.0725(1+0.0725)^5}\right)$ $= \$3665.61$

d) $5500\left(\frac{(1+0.0875)^8-1}{0.0875(1+0.0875)^8}\right)$ $= \$30726.92$

Problem 4

a) N=38 6.25%

6%: $\frac{38-40}{35-40} = \frac{x-0.065}{0.069-0.065}$ $x = 0.0675$

7%: $\frac{38-40}{35-40} = \frac{x-0.0750}{0.0712-0.0750}$ $x = 0.07388$

6.25%: $\frac{6.25-6}{7-6} = \frac{x-0.0675}{0.0738-0.06755}$ $x = 0.0695875$

$A/P = \frac{0.0625(1+0.0625)^{38}}{((1+0.0625)^{38}-1)}$ $= 0.0694356$

$\left(\frac{0.0695875}{0.0694356}-1\right)\times 100\% = 0.219\%$ error

b) @ n=85: $\frac{9.25-9}{10-9} = \frac{x-11.08}{9.997-11.08}$ $x = 10.80975$

$P/A = \frac{(1+0.0925)^{85}-1}{0.0925(1+0.0925)^{85}}$ $= 10.804994895$

$\left(1-\frac{10.804994895}{10.80975}\right)100\% = 0.0397\%$ error

Problem 5

a) $P = G\left(\frac{1-(1+g)^n(1+i)^{-n}}{i-g}\right)$ $= 5000\left(\frac{1-(1+0.08)^5(1+0.09)^{-5}}{(0.09-0.08)}\right)$ $= 22518.78$

$A = F\left(\frac{i}{(1+i)^n-1}\right) = 22518.78\left(\frac{0.09}{(1+0.09)^{10}-1}\right)$ $A = 1982.19$

b) $P = 5000\left(\frac{1-(1+0.08)^5(1+0.06)^{-5}}{(0.06-0.08)}\right)$ $= 24991.85$

$A = 24991.85\left(\frac{0.06}{(1+0.06)^{10}-1}\right)$ $A = 1858.15$

Problem 6

a) $(P/F, 8\%, 67) = (P/F, 8\%, 60)(P/F, 8\%, 7)$ $= 0.0099 \times 0.5835$ $= 0.005776650$

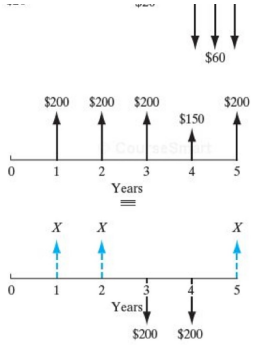
$\frac{P}{F} = \frac{1}{(1+i)^n}$ $= \frac{1}{(1+0.08)^{67}}$ $= 0.005776296$

0.252% error

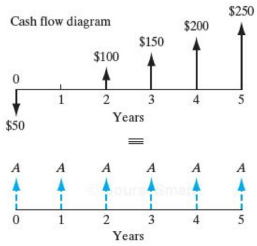
b) $(A/P, 8\%, 42) = \frac{0.08}{1-(P/F, 8\%, 40)(P/F, 8\%, 2)}$

$\frac{0.08}{\quad}$ $A = \frac{i(1+i)^n}{\quad}$

Problem 8 (3 pts)
Find the value of X so that the two cash flows shown in the diagram are equivalent for an interest rate of 8%.



Problem 9 (3 pts) Find the equivalent equal payment series (A) using an A/G factor such that the two cash flows are equivalent at 10% compounded annually.



$= 0.0057696$

b) $(A/P, 8\%, 42) = \dfrac{0.08}{1-(P/F, 8\%, 40)(P/F, 8\%, 2)}$

$= \dfrac{0.08}{1-0.046 \cdot 0.8573}$ $\quad \dfrac{A}{P} = \dfrac{i(1+i)^n}{(1+i)^n-1}$

$= 0.083285$ (0.0022% error) $= \dfrac{0.08(1.08)^{42}}{(1.08)^{42}-1} = 0.0833868$

c) $(P/A, 8\%, 135) = \dfrac{1-(P/F, 8\%, 100)(P/F, 8\%, 35)}{0.08}$ $\quad \dfrac{P}{A} = \dfrac{(1+i)^n-1}{i(1+i)^n}$

$= \dfrac{1-0.0005 \times 0.0676}{0.08}$ $= \dfrac{(1.08)^{135}-1}{0.08(1.08)^{135}}$

$= 12.4996$ (0.00013% error) $= 12.499681567$

Problem 7

$P = 20(P/A, 10\%, 12) - 20(P/G, 10\%, 5)$

$= 20(6.8137) - 20(6.9618)$

$= -0.962$

$= \$0.96$

Problem 8

$200(1+0.08)^{-1} + 200(1+0.08)^{-2} + 200(1+0.08)^{-3} + 150(1+0.08)^{-4} + 200(1+0.08)^{-5}$

$= 761.791$

$X(1+0.08)^{-1} + X(1+0.08)^{-2} - 200(1+0.08)^{-3} - 200(1+0.08)^{-4} + X(1+0.08)^{-5}$

$= 2.481X - 305.8$

$2.481X = 761.796 + 305.8$

$X = 433.28$

Problem 9

$50(P/G, 10\%, 5) + 50(P/A, 10\%, 4)(P/F, 10\%, 1) - 50 = X + X(P/A, 10\%, 3)$

$50(6.8618) + 50(3.1699)(0.9091) - 50 = X + X(2.7903)$

$437.18 = X(1 + 2.7903)$

$X = 91.25$