**ENGR301 Engineering Management Principles and Economics**

**Cash Flow Analysis**

**Questions:**

These questions are taken from chapter 9 of the course text.

3.4 How much should you invest today at 12% interest to accumulate $1,000,000 in 30 years?

3.9 How much is accumulated over two years in each of the following savings plans?

(a) $40 at the end of each month form 24months at 12% compounded monthly.

(b) $30 at the end of the first month, $31 at the end of the second month, and so forth, increasing by $1 per month, at 12% compounded monthly.

3.18 A 7%, 20-year municipal bond has a$10,000 face value. I want to receive at least 10% compounded semiannually on this investment. How much should I pay for the bond?

3.25 Yoko has just bought a new computer ($2000), a printer ($350), and a scanner ($210). She wants to take the monthly payment option. There is a monthly interest of 3% on her purchase.

(a) If Yoko pays $100 per month, how long does it take to complete her payments?

(b) If Yoko wants to finish paying in 24 months, how much will her monthly payment be?

3.27 Seema is looking at an investment in upgrading an inspection line at her plant. The initial cost would be $140,000 with a salvage value of $37,000 after five years. Use the capital recovery formula to determine how much money must be saved every year to justify the investment at an interest rate of 14%.

3.30 A new software package is expected to improve productivity at Grand Insurance. However, because of training and implementation costs, savings are not expected to occur until the third year of operation. At that time, savings of $10,000 are expected, increasing by $1000 per year for the following five years. After this time (eight years from implementation), the software will be abandoned with no scrap value. How much is the software worth today, at 15% interest?

3.34 Gail has won a lottery that pays her $100,000 at the end of this year, $110,000 at the end of the next year, $120,000 the following year, and so on, for 30 years. Leon has offered Gail $2,500,000 in exchange for all the money she will receive. If Gail can get 8% interest on her savings, is this a good deal?

**Solutions:**

**3.4** F = 1 000 000

i = 12%

N = 30

Using the formula: P = F/(1 + i)N = 1 000 000/(1 + 0.12)30 = 33 377.92

Using the tables produces a slightly different result due to the number of significant digits in the table:

P = F(P/F, 12%, 30) = 1 000 000(0.0334) = 33 400

You should invest about $ 33 400.

**3.9 (a)** F = 40(F/A, 1%, 24) = 40(26.969) = 1079

**(b)** F = [30 + 1(A/G, 1%, 24)](F/A, 1%, 24) = [30 + 1(11.010)](26.969) = 1106

**3.18** Sum the present worths of the $350 annuity and the 10 000 future value at 5% per period over 20×2 = 40 periods.

P = 350(P/A, 5%, 40) + 10 000(P/F, 5%, 40) = 350(17.158) + 10 000(0.14205) = 7425.80

I should pay no more than (approximately) $7426 for the bond.

**3.25 (a)** 2000 + 350 + 210 = 100(P/A, 3%, N)

(P/A, 3%, N) = 2560/100 = 25.6

Solve for N using linear interpolation:

N = 45 + (50 − 45)(25.6 − 24.519)/(25.730 − 24.519) = 49.4632

It will take about 50 months to complete her payment.

**(b)** A = 2560(A/P, 3%, 24) = 2560(0.05905) = 151.168

Yoko’s monthly payment will have to be $151.

**3.27** A = (P – S)(A/P, i, N) + Si

= (140 000 – 37 000)(A/P, 14%, 5) + 37 000(0.14)

= 133 000(0.2918) + 37 000(0.14)

= 43 989.4

The investment would have to save about $43 989 per year over its 5-year life.

**3.30** A' = 10 000

G = 1000

i = 0.15

N = 6 for gradient to annuity

6 for annuity to present value

2 for future value to present value

P = [10 000 + 1000(A/G, 15%, 6)](P/A, 15%, 6)(P/F, 15%, 2)

= [10 000 + 1000(2.0971)](3.7844)(0.75614)

= 34 616.29

The software is worth $34 616 today.

**3.34** This is an arithmetic gradient with

A' = 100 000

G = 10 000 per year

N = 30 years

i = 0.08 per year

A = A' + G(A/G, 8%, 30) = 100 000 + 10 000(9.1897) = 100 000 + 91 897 = 191 897

P = A(P/A, i, N) = 191 897(P/A, 8%, 30) = 191 897(11.258) = 2 160 376

Yes, it is a good deal.