Solution for Assignment 2

1. The value of equal annual payment series for paying a series of 7 year end payments beginning with Rs 20,000 and increasing at the rate of Rs 1,000 a year at 10% interest rate compounded annually will be
   - (a) 20,702
   - (b) 22,621
   - (c) 25,235
   - (d) 28,301

   Solution: Given, $F_1 = 20000$, $G = 1000$, $i = 10\% = 0.10$, $n = 7$
   $$A = F_1 + G(A/G, i, n) = 20000 + 1000(A/G, 10, 7) = 20000 + 1000 \times 2.6216$$
   $$= 22621 \text{ (Ans)}$$

2. The value of equal annual payment series for paying a series of 5 year end payments beginning with Rs 40,000 and decreasing at the rate of Rs 5,000 a year at 10% interest rate compounded annually will be
   - (a) 26,190
   - (b) 29,190
   - (c) 30,950
   - (d) 32,950

   Solution: Given, $F_1 = 40000$, $G = 5000$, $i = 10\% = 0.10$, $n = 5$
   $$A = F_1 - G(A/G, i, n) = 40000 - 5000(A/G, 10, 5) = 40000 - 5000 \times 1.8101$$
   $$= 30950 \text{ (Ans)}$$

3. Present value of a payment series with first year end payment of Rs 45,000 increasing by 4% per year upto year 10 at interest rate of 12%
   - (a) 2,87,850
   - (b) 2,89,510
   - (c) 2,91,110
   - (d) 2,94,450

   Solution: Given $F_1 = 45000$, $g = 4\% = 0.04$, $i = 12\% = 0.12$, $n = 10$
   $$g' = \{(1+i) / (1+g)\} - 1 = 7.69$$
   $$P = \{F_1/(1+g)\}(P/A, g', n) = (45000/1.04)6.805 = 294450 \text{ (Ans)}$$

4. Nominal rate of 8% compounded monthly will result into effective rate of ……………..% with a time interval of 2 years.
   - (a) 16
   - (b) 16.84
   - (c) 17.03
   - (d) 17.29

   Solution: Given, $r = 8\% = 0.08$, $m = 12$, $l = 2$
   Effective interest rate $= (1 + r/m)^{lm} - 1 = (1 + 0.08/12)^{24} - 1 = 0.1729 = 17.29\%$ (Ans)

5. For nominal interest rate of …………………. %, effective annual interest rate will be 12% when compounding is continuous.
   - (a) 11.33
   - (b) 11.11
   - (c) 12.21
   - (d) 12

   Solution: Given, Effective interest rate $= 12\% = 0.12$, Nominal interest rate $= r = ?$

Effective interest rate $= e^r - 1 = 0.12 \Rightarrow e^r = 1.12 \Rightarrow r = \ln(1.12) = 0.1133 = 11.33\%$ (Ans)

6. You have taken a loan of Rs 5,00,000 at interest rate of 15% compounded annually and wish to repay the loan as per following schedule. The amount A will be Rupees
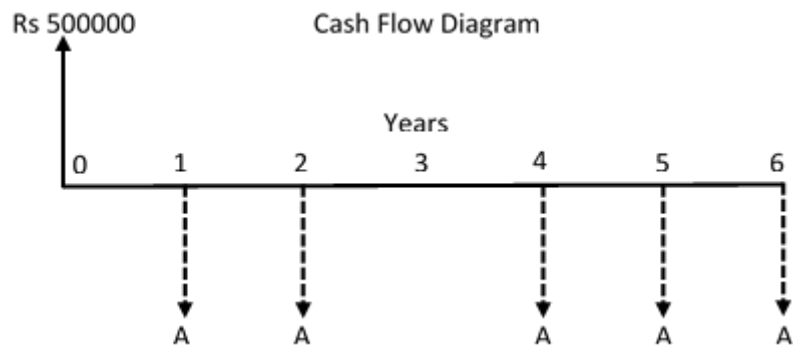
(a) 1,39,370
(b) 2,05,310
(c) 1,59,904
(d) 1,80,430

Solution: Given, P = 500000, i = 15% = 0.15
500000 = A(P/A,15,2) + A(F/A,15,3)(P/F,15,6)
500000 = A(1.6257) + A(3.4725)(0.4323)
A = 159904 (Ans)

7. You want to withdraw Rs 20,000 at the end of eleventh year from now and increase the annual withdrawal by Rs 4,000 each year thereafter till end of year 25. If interest rate is 6 % compounded annually, you need to invest for the first 10 years, an equal amount of Rupees
   (a) 32,200
   (b) 26,800
   (c) 48,750
   (d) 28,390

Solution: Given, $F_{11} = 20000$, $F_{12} = 20000 + 4000,\dots$ till F_{25}, i = 6% = 0.06
Future worth of all the equal year end deposits A, at the end of 10 year = Present worth (at the end of 10th year) of all the withdrawals made from 11th year till 25th year (following uniform gradient series for 15 years)
⇨ A (F/A,6,10) = [20000 + 4000(A/G,6,15)] x (P/A,6,15)
⇨ A x 13.1808 = [20000 + 4000 x 5.926] x 9.7122
⇨ A x 13.1808 = 43704 x 9.7122
⇨ A = 32200 (Ans)

8. The amount required at the end of year 4 to repay an amount of Rs 4,00,000 borrowed today at an interest rate of 12% compounded quarterly will be Rupees
   (a) 5,92,368
   (b) 6,41,882
   (c) 6,83,432
   (d) 6,02,334

Solution: Given, P = 400000, i = 12/4 % = 3% , n = 4 year = 16 interest period
F = 400000 (F/P, 3, 16) = 400000 x 1.604706 = 641882
The problem can also be solved as:
Effective interest rate = $(1 + 0.12/4)^4 - 1 = 0.1255088$
F = 400000 (F/P, 12.55088, 4) = 400000 x 1.604706 = 641882 (Ans)

9. In planning for your retirement, you expect to save Rs. 5,000 in year 1, Rs. 6,000 in year 2, and amounts increasing by Rs. 1,000 each year through year 20. If your investments earn 10% per year, the amount you will have at the end of year 20 is approximately
    (a) Rs. 2,42,568
    (b) Rs. 3,55,407
    (c) Rs. 5,97,975
    (d) Rs. 6,59,125
    Solution: Given, $F_1 = 5000$, $F_2 = 6000$,… till 20 years. i = 10%, n = 20
    F = [5000 + 1000(A/G, 10, 20)] x (F/A, 10, 20)
      = [5000 + 1000 x 6.5081] x 57.2750
      = 659125 (Ans)

10. A person borrowed Rs. 10,000 at 8%, compounded annually. The loan was repaid according to the following schedule.

n	Repayment Amount
1	Rs. 1,000
2	Rs. 3,000
3	Rs. 5,000
4	Rs. X

The amount X that is required to pay off the loan at the end of year 4 will be
    (a) Rs. 1,100
    (b) Rs. 3,000
    (c) Rs. 3,450
    (d) Rs. 4,500
    Solution: Given, F1 = 1000, F2 = 3000, F3 = 5000, F4 = X, i = 8%, P = 10000
    P = 1000(P/F,8,1) + 3000(P/F,8,2) + 5000(P/F,8,3) + X(P/F,8,4)
    10000 = 1000(0.9259) + 3000(0.8573) + 5000(0.7938) + X(0.7350)
    X = 3446 ≈ 3450 (Ans)