KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Department of Systems Engineering

MAJOR EXAM I

Summer 2015-2016 (153)

ISE 307 Engineering Economic Analysis

Name: _____

ID: _____

Section _____SN: ___

27th July 2016

Question	Points	Marks
Q1	5	
Q2	5	
Q3	5	
Q4	5	
Q5	5	
Q6	5	
Q7	5	
TOTAL	35	

Q1. (5 points) Ahmed started a new job and therefore decided to set aside *SR*2,500 annually starting from year 1.

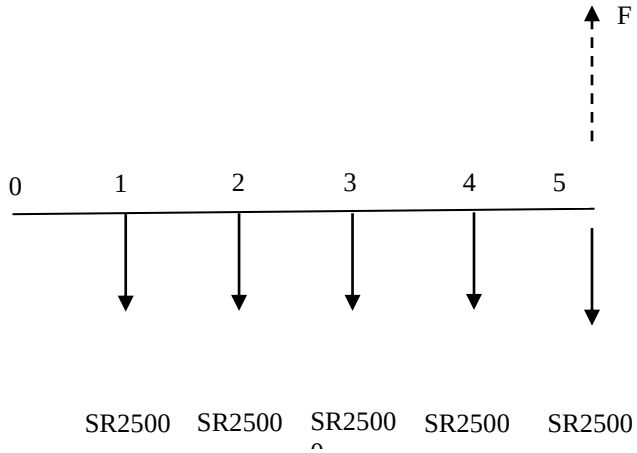
(a) How much net cash will he have in his hands at the end of year 5 given that the interest rate is 4% (A total of 5 payments are made.)? (2 points)

(b) Ahmed had a ski-vacation in 2nd year (i.e., 2nd payment) and therefore could not save any money that year, how much will that affect his net cash at the end of 5 years? (3 points)

NOTE: Show all your work in details.

Solution:

(a)



$$F_5 = A\left[\frac{(1+0.04)^5 - 1}{0.04}\right] = SR\ 13{,}540.81$$

(2 points)

(b) $F_2 = 2500(1+0.04)^3 = SR\ 2{,}812.16$ (1.5 points)

$F = 13{,}540.81 - 2812.16 = SR\ 10{,}728.65$ (1.5 points)

Q2. (5 points) You borrowed *SR*20,000 from a local bank, with the agreement that you will pay back the loan according to a graduated linearly increasing payment plan. If your first payment (at the end of 1st year) is set at *SR*1,500, what would the payments at the end of 2nd and 3rd years look like at a borrowing rate of 10% over seven years?

NOTE: Show all your work in details.

Solution:

$$P_1 = A\left[\frac{(1+0.1)^7 - 1}{0.1(1+0.1)^7}\right] = 1500\left(\frac{1.9487 - 1}{0.19487}\right) = 1500(4.8684) = SR\ 7{,}302.56$$

(1 point)

$$P_2 = G\left[\frac{(1+0.1)^7 - 0.1(7) - 1}{(0.1)^2(1+0.1)^7}\right] = G\left(\frac{1.9487 - 0.7 - 1}{0.01(1.9487)}\right) = (12.76)G$$

(1 point)

$20{,}000 = 7{,}302.56 + (12.76)G$

$G = 995.1$ (1 point)

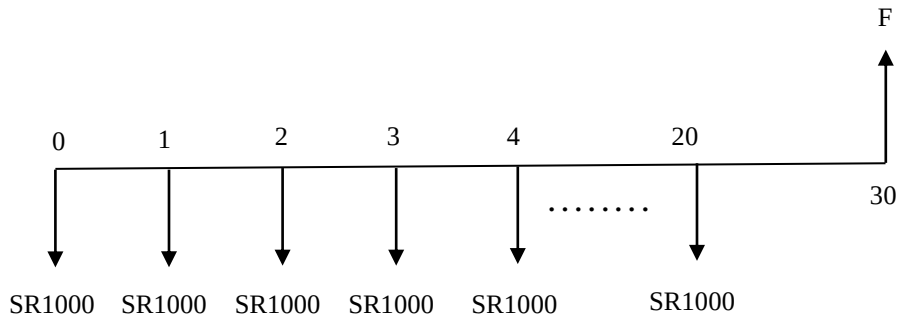
Payment at 2nd year = 1500+995.1= *SR* 2,495.1 (1 point)

Payment at 3rd year = 1500+2(995.1)=*SR* 3,490.2 (1 point)

Q3. (5 points). Suppose that you have deposited SR1000 now into a savings account that has 10% interest compounded annually. You continued to deposit SR1000 for the next 20 years as illustrated in the cash flow diagram given below. How much money you will have in your account at the end of year 30?

NOTE: Show all your work in details.

Solution



$F = 1000\ (1.10)^{30} + 1000(F/A, 10\%, 20)*(1.10)^{10}$ [2 points + 3 points = 5 points]

$= 17449.40 + 1000*57.275*2.5937 = 17449.40 + 148554.17$

$=$ SR166,003.57

Q4. (5 points) Suppose that you are going to retire 10 years from now. It is expected that the cost of living will be SR10,000 in the first year of retirement (i.e., year 11) and then it will increase at a rate of 5% per year for the subsequent 9 years (i.e., year 12 to year 20). How much should you deposit now in your savings account with a 10% interest rate compounded annually to cover your expenses during your 10 years of retirement (i.e., years 11 to 20).

NOTE: Show all your work in details.

Solution

$P10 = 10000 [1 – (1+0.05)^{10} (1+0.10)^{-10}]/[0.10-0.05] = \$74,398.12$ [3 points]

$P = 74398.12 (1.10)^{-10} = SR28,683.70$ [2 points]

Q5. (5 points) A man is planning to retire in 25 years. He wishes to deposit a regular amount every three months until he retires so that beginning one year following his retirement (i.e., year 26), he will receive annual payments of SR50,000 for the next 10 years. How much must he deposit if the interest rate is 9% compounded quarterly?

NOTE: Show all your work in details.

Solution

$$i_{a\,(quarterly)} = \left(1+\frac{0.09}{4\times 1}\right)^{1} - 1 = 2.25\% \quad or \quad i_{a\,(quarterly)} = \frac{0.09}{4} = 2.25\% \qquad \text{(1 Point)}$$

$$F = A(F/A, 2.25\%, 100) = 360.84A \qquad \text{(1 Point)}$$

$$i_{a\,(yearly)} = \left(1+\frac{0.09}{4\times 1}\right)^{4} - 1 = 9.3\% \qquad \text{(1 Point)}$$

$$P = A(P/A, 9.3\%, 10) = 50,000 \times 6.333 = 316688.76 = 360.84A \qquad \text{(1 Point)}$$

$$A = 877.643 \qquad \text{(1 Point)}$$

Q6. (5 points) Ahmed is considering the purchase of a used car. The price, is SR10,500. Ahmed is able to pay SR2,500 initially (down payment). The balance. SR8,000, will be borrowed at an interest rate of 10% compounded continuously. The loan should be paid in 48 equal monthly payments.

a. Compute the monthly payment.

b. After the 25th payment, Ahmed wants to pay off the remaining loan in a lump-sum amount. What is the required amount of this lump-sum?

NOTE: Show all your work in details *(Keep 4 Decimal places in your answer)*

Solution:

$$i_{a(continously)} = e^{r/K} - 1 = e^{0.1/12} - 1 = 0.0084 \qquad \text{(1 Points)}$$

$$A = 8000\left(\frac{0.0084(1+0.0084)^{48}}{(1+0.0084)^{48}-1}\right) = 8000(0.0254) = 203.2000 \qquad \text{(2 Points)}$$

Remaining Months=48 - 25 = 23 (0.5 Points)

$P_{(after\ 25\text{-}48)} = 203.2\ (P/A,\ 0.84\%,\ 23)$

= 203.2 * 20.835

= SR 4,233.76

Q7. (5 points) Find the present worth of a series of equal payments SR100 each over 20 years, at an 18% nominal annual interest rate compounded every six months, for the following cases

a. **(2 points)** Payments are made every year starting from the end of the first year (year 1)?

b. **(3points)** Payments are made every two years starting from end of the second year (year 2)?

NOTE: Show all your work in details.

Solution:

a) I_effective (per year) = $(1 + 0.18/2)^2)- 1 =$ 18.81% **(one point)**

P=100*(P|A, 18.81% ,20) $= 100*\left[\frac{(1+i)^N - 1}{i(1+i)^N}\right] = 100*\left[\frac{(1+0.1881)^{20} - 1}{0.1881(1+0.1881)^{20}}\right]$ = 514.7 (**one point**)

b) I_effective (per 2 years) = $(1 + 0.18/2)^4$- 1 = 41.15 % **(1.5 points)**

P=100*(P|A, 41.15% , 10) $= 100*\left[\frac{(1+i)^N - 1}{i(1+i)^N}\right] = 100*\left[\frac{(1+0.4115)^{10} - 1}{0.4115(1+0.4115)^{10}}\right]$ = 235.23 **(1.5 points)**