Benha University
College of Engineering at Benha
Department of Mechanical Eng.
Subject : Engineering Economy Date: 9/1/2016

Model Answer of the Final Exam

Elaborated by: Dr. Mohamed Elsharnoby

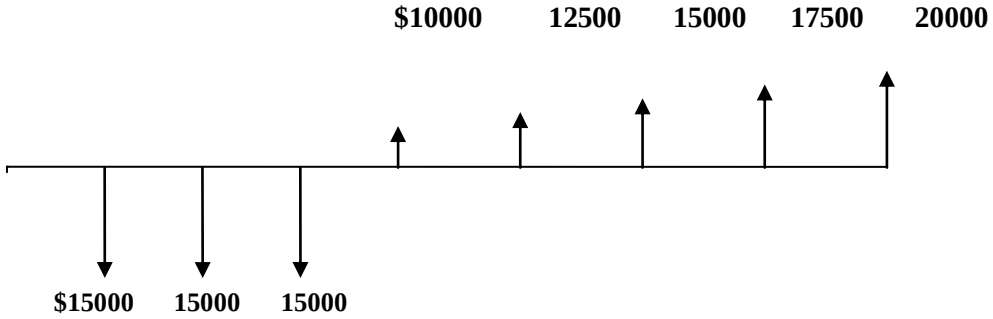
نموذج الاجابة المادة :اقتصاد هندسى م 561 الغرقة الخامسة

التاريخ السبت 9 يناير2016

أستاذ المادة : د. محمد عبد اللطيف الشرنوبى

PROPLEM 1

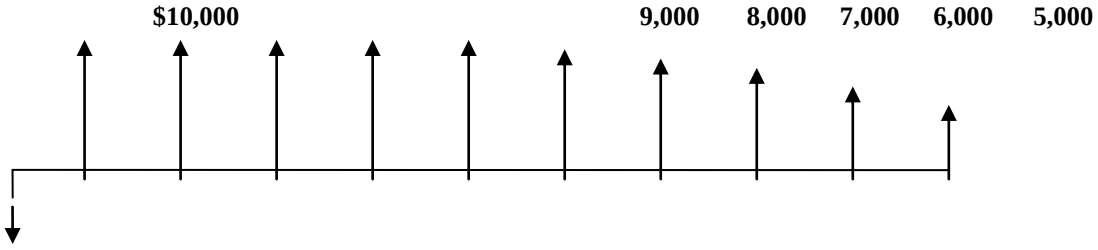
1. An investor can make three year-end payments of $15,000, which generates receipts of $10,000 at the end of year 4, that will increase annually by $2500 for the following 4 years. If the investor can earn a rate of return of 10 percent on alternative 8-year investments, is this alternative attractive?



NPW = -15000(P/A,10%,3) $+\left[10000(P/A,10\%,5)+2500(P/G,10\%,5)\right](P/F,10\%,3)$,

=-15000*2.4869+(10000*3.7908+2500*6.8618)*0.7513-1000*0.4665
NPW= -37303.5 +(37908+17154.5)*0.7513-466.5 = $ 4130
Then the rate of return is greater than 10%
this alternative is attractive

2-If you get a loan (L)from a bank which should be repaid as a series of payments (shown in figure)- $10,000 at the end of each of the first five years, $9,000, at the end of the6th year, $8,000, at the end of the 7th year, $7,000, at the end of the 8th year, $6,000, at the end of the 9th and $5,000, at the end of the 10th . What is the amount of the loan you obtained if the bank gets 10% interest rate:
i) compounded annually, ii) compounded monthly, iii) compounded continuously?



i) compounded annually,

$$L=10000(P/A,10\%,5)+\left[9000(P/A,10\%,5)-1000(P/G,10\%,5)\right](P/F,10\%,5)$$

L = 10000*3.7908+(9000*3.7908-1000*6.8618)*0.6209

L= 37908 + (34117.2-6861.8)*0.6209
L= $ 54830.88

ii) Compound monthly
Use the formula to find (P/A,i_{eff}%,5), (P/G,i_{eff}%,5)., (P/F,i_{eff}%,5).
$I_{eff}=(1+10/12)^{12}-1=0.104713$

Present Worth:P = A{[(1+i)^n – 1]/[i(1+i)^n]} =A (P/A,i,n)
(P/A,i,n) = 3.74558

Present Worth P = G {[(1+i)^n – i n – 1]/[i^2(1+i)^n]} = G (P/G,i,n)
(P/G,i,n) = 6.74834

Present worth: P = F (1+i)$^{-n}$ = F (P/F,i,n)
(P/F,i,n) = 0.607788
L = 10000*3.74558+(9000*3.74558-1000*6.748343)*0.60778859
L= 37455.8 + (33710.2-6748.3)*0.6077886
L= $ 53842.9

iii) compounded continuously
i_{eff} = 0.1051709
Present Worth:P = A{[(1+i)^n – 1]/[i(1+i)^n]} =A (P/A,i,n)
(P/A,i,n) = 3.741238

Present Worth P = G {[(1+i)^n – i n – 1]/[i^2(1+i)^n]} = G (P/G,i,n)
(P/G,i,n) = 6.737457

Present worth: P = F (1+i)$^{-n}$ = F (P/F,i,n)
(P/F,i,n) = 0.60653
L = 10000*3.741238+(9000*3.741238-1000*6.737457)*0.60653
L= 37412.8 + (33671.1-6737.5)*0.60653
L= $ 53748.8

3) The total Marginal cost

Year	Market value	Loss in Market value	Foregone interest	Operating Cost,$	Maintenance Cost,$	Salvage Value, $	Total Recovery Cost
0	$60000						
1	35.000	-$25000	-$6000	--15,000	-3000	35.000	-$49000
2	30.000	-$5000	-$3500	-17,000	-3000	30.000	-$28500
3	25.0000	-$5000	-$3000	-19,000	-3000	25.0000	--$30000
4	20,000	-$5000	-$2500	-21,000	-3000	20,000	-$31500
5	15,000	-$5000	-$2000	-23,000	-3000	15,000	--$33000

The life cost of one year is 49000
The EUAC for two years is = (49000+28500/(1+i))*(A/P,10%,2)= (49000+28500/(1+i))*5762= (49000 +25909)*0.5762=-$43162.6
The EUAC for three years is = (49000+28500/(1+i)+30000*(1+i)$^{-2}$)* A/P,10%,3)= (49000 +25909+24793.3)*0.4021=-$40090.3
The EUAC for four years is = (49000+28500/(1+i)+30000*(1+i)$^{-2}$)*+31500*(1+i)$^{-3}$)(A/P,10%,4)= (49000 +25909+24793.3 +23666.3)*0.3155=-$38922
The EUAC for five years is = (49000+28500/(1+i)+30000*(1+i)$^{-2}$)*+31500*(1+i)$^{-3}$+33000*(1+i)$^{-4}$)(A/P,10%,5)= (49000 +25909+24793.3 +23666.3+22539.4)*0.2638=-$38409
Economic life is 5 years

Year	Market value	EUAC of Capital recovery	Foregone interest	Operating Cost,$	Maintenance Cost,$	Salvage Value, $	Total Recovery Cost
0	$60000						
1	35.000	-$25000	-$6000	--15,000	-3000	35.000	-$49000
2	30.000	-$5000	-$3500	-17,000	-3000	30.000	-$28500
3	25.0000	-$5000	-$3000	-19,000	-3000	25.0000	--$30000
4	20,000	-$5000	-$2500	-21,000	-3000	20,000	-$31500
5	15,000	-$5000	-$2000	-23,000	-3000	15,000	--$33000

For one year
EUAC of Capital recovery for one year = -$60000*(A/P,10%,1) +$ 35000*(A/F,10%,1)
=-$ 66000+$ 35000 =-$31000
EUAC of Capital recovery for two years =-$ 60000*(A/P,10%,2) + $ 30000*(A/F,10%,2)

=-$ 60000*0.5762 +$ 30000* 0.476 =-$ 20292
EUAC of Capital recovery for three years = -$60000*(A/P,10%,3) +$ 25000*(A/F,10%,3)

=-$ 60000*0.4021 +$25000* 0.3021=-$16573.5
EUAC of Capital recovery for four years =-$ 60000*(A/P,10%,4) +$ 20000*(A/F,10%,4)
=-$ 60000*0.3155 +$20000* 0.2155=-$14620

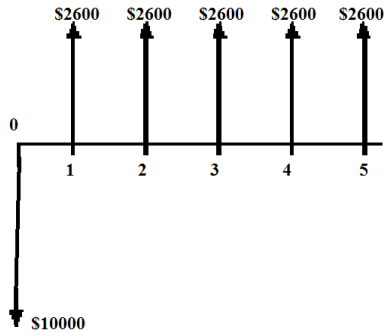
EUAC of Capital recovery for five years =-$ 60000*(A/P,10%,5) +$ 15000*(A/F,10%,5)
=-$ 60000*0..2638 +$15000* 0.1638 =-$13371

Year	Market value	EUAC of Capital recovery	Operating Cost,$	Maintenance Cost,$	Total EUAC
0	$60000				
1	35.000	-$31000	--15,000	-3000	-$49000
2	30.000	-$20292	-17,000	-3000	-$40292
3	25.0000	-$16573.5	-19,000	-3000	--$38573
4	20,000	-$14620	-21,000	-3000	-$38620
5	15,000	-$13371	-23,000	-3000	--$39391

Year	Market value	EUAC of Capital recovery	EUAC OP cost,$	Maintenance Cost,$	Total EUAC
0	$60000				
1	35.000	-$31000	--15,000	-3000	-$49000
2	30.000	-$20292	-15,932.4	-3000	-$39224.4
3	25.0000	-$16573.5	-16873.2	-3000	--$36446.7
4	20,000	-$14620	-17636	-3000	-$35256
5	15,000	-$13371	-18620	-3000	--$34991

Economic life is 5 years
4)
For Alternative B

Year	CF before taxes	SL Depr.	Taxable Inc.	Tax (40%)	CF after taxes
	(a)	(b)	(c) = (a) – (b)	(d) = -40%(c)	(a) + (d)
0	-$10,000				-$10,000
1	3,000	2000	1,000	-400	2600
2	3,000	2000	1,000	-400	2600
3	3,000	2000	1,000	-400	2600
4	3,000	2000	1000	-400	2600
5	3,000	2000	1000	-400	2600



For the ACFS above (A/P,i,5) = 2600/10000 = 0.26
For i = 9% (A/P,9%,5) = 0.2571
For i = 10% (A/P,10%,5) = 0.2638
The ROR after taxes $i \approx 9.4\%$
When the inflation rate is 6%
The real rate of return $i' = \frac{i-f}{1+f} \approx 3.21\%$
For Alternative A

Year	CF before taxes	SL Depr.	Taxable Inc.	Tax (40%)	CF after taxes
	(a)	(b)	(c) = (a) – (b)	(d) = -40%(c)	(a) + (d)
0	-$20,000				-$20,000
1	5,000	4000	1,000	-400	4600
2	5,400	4000	1,400	-560	4840
3	6,000	4000	2,000	-800	5200
4	5,500	4000	1500	-600	4900
5	-5,000	4000	-9000	0	-5000

From tables of CFS of A and B we found that B is more attractive

This is corresponding IRR =

5)

Using the geometric gradient with real factor = (1+i)/(1+f)

$= A\,(P/A,g,i,n) \quad = A\,\{[1-(1+g)^n(1+i)^{-n}]/(i-g)\} \quad P \quad$ If $i \neq g$,

P = 1800*9.9132- = -17843.8 = 1800*1.12=$ 19450

i) Constant dollar

i' = (i-f)/(1+f) = 2.75229%

$= A\,(P/A,i,n) \quad = A\{[(1+i)^n - 1]/[i(1+i)^n]\}$ Present Worth:P

P = 1800 *(0.42327)/(0.0275229*1.42327)=1800*10.8054 =19450

G O O D L U C K