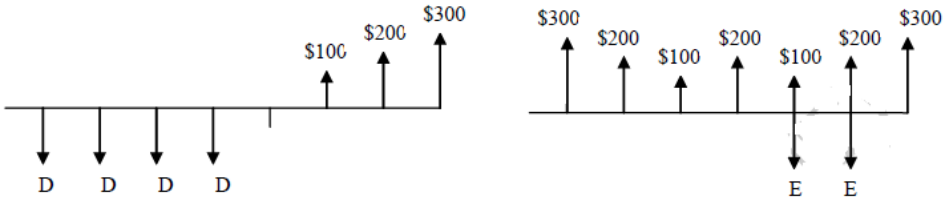
نموذج الاجابة المادة :اقتصاد هندسى م 561
الفرقة الخامسة كهرباء
التاريخ الأربعاء 29 مايو 2019
أستاذ المادة : د. محمد عبد اللطيف الشرنوبى

Benha University College of Engineering at Benha
Questions For Final Examination Time :120 min.
Subject: Engineerin Economy M561 May/29/ 2019
Fifth year Structural and Electrical engineering
Examiner:Dr.Mohamed Elsharnoby

1. Compute the value of D&E in the diagram, At an interest rate of 10%.



2. Three mutually exclusive alternatives are being considered.

Year	A	B	C
0	-$2500	-$6000	-$10000
1	$750	$1700	$2700
2	$800	$1750	$2750
3	$7 50	$1800	$2800
4	$900	$1850	$2850
5	$950	$19 00	$2900

If the minimum attractive rate of return is 8%, which alternative should be selected? Solve the problem by
(a) Present worth analysis
(b) Annual cash flow analysis
(c) Incremental ROR analysis

3)Three mutually exclusive investment alternatives for implementing an office automation plan in an engineering design firm are being considered. The study period is 10 years, and the useful lives for the three alternatives are also 10 years. Market values of the three alternative are assumed to be zero at the end of their useful lives. If the firms MARR is 10% per year, which alternative should be selected in the view of the following estimates?

	Alternative		
	A	B	C
Capital investment	-$390,000	-$920,000	-$660,000
Net annual revenues less expenses	69,000	167,000	133,500

4- Three mutually exclusive alternative public works projects are currently under consideration. Their respective costs and benefits are included in th table below. Each of the projects has a useful life of 50 years, and the interest rate is 10% per year. Which if any of these projects should be selected?

	Alternative		
	A	B	C
Capital investment	$8,500,000	$10,000,000	$12,000,000
Annual oper. &maint costs	750,000	725,000	700,000
Salvage value	1,250,000	1,750,000	2,000,000
Annual benefits	2,150,000	2,265,000	2,500,000

5-Suppose that your salary is $35,000 in year one, will increase at 6% per year through year four, and is expressed in actual dollar as follows:

End of year, K	Salary (A$)
1	$ 35,000
2	37,100
3	39,326
4	41,685

If the general price inflation rate (f) is expected to average 8%per year, what is the real dollar equivalent of these actual dollar salary amounts? Assume that the base dollar value is at year one (K=1)

6) The annual maintenance costs of an electric pump this year are estimated to be $1,800. Since the level of maintenance is expected to be the same in the future, these costs will be constant, assuming no inflation. If the pump's life is predicted to be 13 years, find the present equivalent of its maintenance costs when the annual inflation rate is 9% and the annual market rate is 12%. Solve using:

i) Geometric gradient.

ii) Constant-dollar analysis.

G O O D L U C K

Note: A table of formulae are on the back of the questions if you need.

- ***Single Payment formulas:***
  Compound amount: $F = P(1+i)^n = P(F/P,i,n)$
  Present worth: $P = F(1+i)^{-n} = F(P/F,i,n)$

- ***Uniform Series Formulas:***
  Compound Amount: $F = A\{[(1+i)^n - 1]/i\} = A(F/A,i,n)$
  Sinking Fund: $A = F\{i/[(1+i)^n - 1]\} = F(A/F,i,n)$
  Capital Recovery $A = P\{[i(1+i)^n]/[(1+i)^n - 1] = P(A/P,i,n)$
  Present Worth: $P = A\{[(1+i)^n - 1]/[i(1+i)^n]\} = A(P/A,i,n)$

- ***Arithmetic Gradient Formulas:***
  Present Worth $P = G\{[(1+i)^n - i\,n - 1]/[i^2(1+i)^n]\} = G(P/G,i,n)$
  Uniform Series $A = G\{[(1+i)^n - i\,n - 1]/[i(1+i)^n - i]\} = G(A/G,i,n)$

- ***Geometric Gradient Formulas:***
  If $i \neq g$, $P = A\{[1 - (1+g)^n(1+i)^{-n}]/(i-g)\} = A(P/A,g,i,n)$
  If $i = g$, $P = A[n(1+i)^{-1}] = A(P/A,g,i,n)$

- ***Nominal interest rate per year, r*** **: the annual interest rate without considering the effect of any compounding**

- **Effective interest rate per year, i_a:**
  $i_a = (1 + r/m)^m - 1 = (1+i)^m - 1$ with $i = r/m$

- ***Continuous compounding,*** **:**
  r – one-period interest rate, n – number of periods
  $(P/F,r,n)^{inf} = e^{-rn}$
  $(F/P,r,n)^{inf} = e^{rn}$

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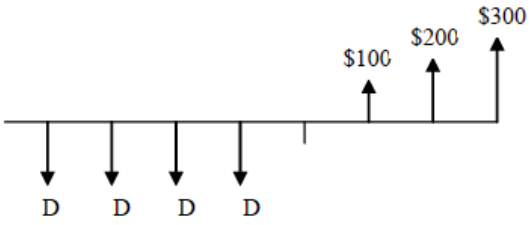
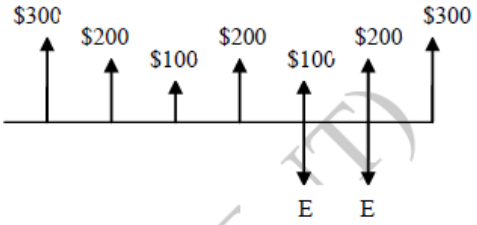
(12) Compute the value of D&E in the diagram, At an interest rate of 10%.



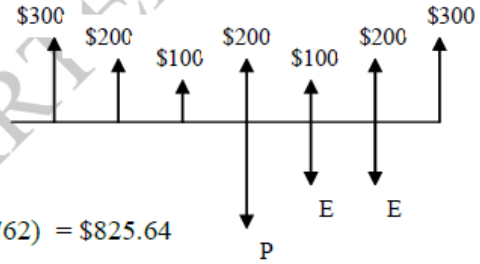


(A)-

P = $200 + $100 (P/A, 10%, 3) + $100 (P/G, 10%, 3) + $300 (F/P, 10%, 3) + $200 (F/P, 10%, 2) + $100 (F/P, 10%, 1)

= $200 + $100 (2.487) + $100 (2.329) + $300 (1.331) + $200 (1.210) + $100 (1.100)

= $1,432.90



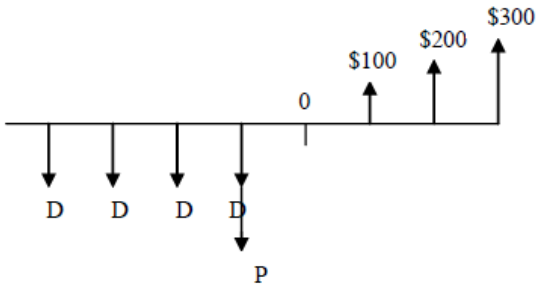
E = $1,432.90 (A/P, 10%, 2) = $1,432.90 (0.5762) = $825.64

(B)-

Present Worth of gradient series:

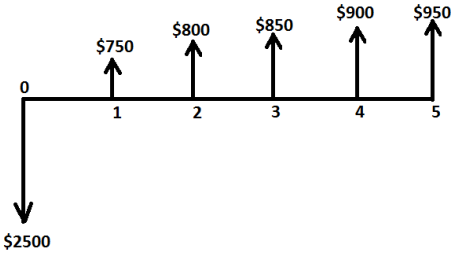
P = $100 (P/G, 10%, 4) = $100 (4.378)
= $437.80

D = $437.80 (A/F, 10%, 4)
= $4.7.80 (0.2155)
= $94.35

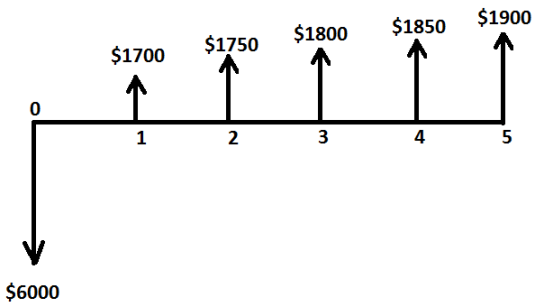


Problem #1

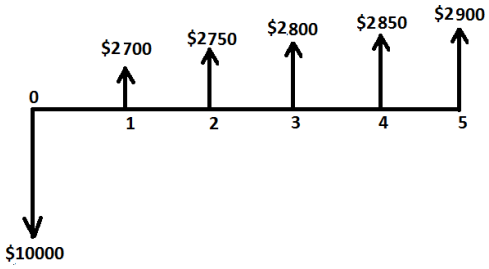
(A)



(B)



(C)



8.0%

	Single Payment		Equal Payment Series				Gradient Series		
N	Compound Amount Factor (F/P,i,N)	Present Worth Factor (P/F,i,N)	Compound Amount Factor (F/A,i,N)	Sinking Fund Factor (A/F,i,N)	Present Worth Factor (P/A,i,N)	Capital Recovery Factor (A/P,i,N)	Gradient Uniform Series (A/G,i,N)	Gradient Present Worth (P/G,i,N)	N
1	1.0800	0.9259	1.0000	1.0000	0.9259	1.0800	0.0000	0.0000	1
2	1.1664	0.8573	2.0800	0.4808	1.7833	0.5608	0.4808	0.8573	2
3	1.2597	0.7938	3.2464	0.3080	2.5771	0.3880	0.9487	2.4450	3
4	1.3605	0.7350	4.5061	0.2219	3.3121	0.3019	1.4040	4.6501	4
5	1.4693	0.6806	5.8666	0.1705	3.9927	0.2505	1.8465	7.3724	5

(a) NPW_A = -$ 2500 +$750(P/A,8%,5) +$ 50(P/G,8%,5)
= -$ 2500 +$750x3.9927+$ 50x7.3724 = $ 863
NPW_B = -$ 6000 +$1700(P/A,8%,5) +$ 50(P/G,8%,5)
= -$ 6000 +$1700x3.9927+$ 5 $EUAB_A$ = 750 +50(P/G<8%,5)*(A/P,8%,5)
= 750 + 50*7.3724*0.2505 = $ 842.34
$EUAW_A$ =-626.25+842.34 =$ 216
0x7.3724 = $ 1156
NPW_C = -$ 10000 +$2700(P/A,8%,5) +$ 50(P/G,8%,5)
= -$ 10000 +$2700x3.9927+$ 50x7.3724 = $ 1149
Chose B
b) $EUAC_A$ = 2500x0.2505 = $626.25
$EUAB_A$ = 750 +50(P/G,8%,5)*(A/P,8%,5)
= 750 + 50*7.3724*0.2505 = $ 842.34
$EUAW_A$ =-626.25+842.34 =$ 216

$EUAC_B$ = 6000x0.2505 = $1503
$EUAB_B$ = 1700 +50(P/G,8%,5)*(A/P,8%,5)
=1700 + 50*7.3724*0.2505 = $ 1792.34
$EUAW_B$ =-1503+1792.34 =$ 289.34

$EUAC_C$ = 10000x0.2505 = $2505
$EUAB_C$ = 2700 +50(P/G,8%,5)*(A/P,8%,5)
= 2700+ 50*7.3724*0.2505 = $ 2792.34
$EUAW_C$ =-2505+2792.34 =$ 287.34
CHHOSE B
C- Incremental analysis
B-A
NPW_{B-A} = -$ 3500 +$950(P/A,8%,5) = -$3500 + $ 950*3.9927 = $ 293
Choose B
C-B
NPW_{C-B} = -$4000 + 1000x3.9927 = - $7.3
Choose B

Problem # 3-For alternative A
(A/P,I,10) = 0.176923 From table interest rate is approximately = 12%
-For alternative B

(A/P,I,10) = 0.18152174 From table interest rate is approximately = 12.6%

-For alternative C
(A/P,I,10) = 0.202272727 From table interest rate is approximately = 15.6%
Alternative C has the maximum rate of return
ΔA/ΔP = 34000/260,000=0.13077
The internal rate of return is <6%<MARR
Alternative C is chosen.

4-We shall calculate the equivalent annual cos and benefits of each
For alternative A
EACA=8,500,000x(A/P,10%,50)+750,000 =8,500,000x 0.1009+**750,000=$1,607,650**
EABA=1,250,000x(A/F,10%,50)+2.150,000=1,250,000x 0.0009+**2.150,000=$2151125**
Benfit/cost ratio of A =2151125/ 1,607,650 =1.3380555

For alternative B
EACB=10,000,000x(A/P,10%,50)+750,000 =10,000,000x 0.1009+**725,000=$1734000**
EABA=1,250,000x(A/F,10%,50)+2.150,000=1,750,000x 0.0009+**2.265,000=$2266575**
Benfit/cost ratio of B =2266575/ 1734000=1.3071367
For alternative C
EACC=12,000,000x(A/P,10%,50)+700,000 =12,000,000x 0.1009+**700,000=$1,910,800**
EABC=2,000,000x(A/F,10%,50)+2.500,000=2,000,000x 0.0009+**2.500,000=$2501800**
Benfit/cost ratio of C =2501800/ 1,910,800=1.3092945
The best alternative is A

5-

End of year, K	Salary (A$)	Salary(R$)
1	$ 35,000	$35,000
2	37,100	34,351.85
3	39,326	33,715.70
4	41,685	33,090.90

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

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

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

i) **Constant dollar**

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

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

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