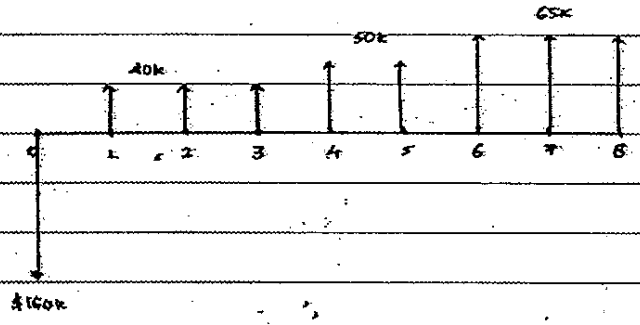
SEMESTER 2. AY 2011 - 2012. Set 1

CVA252. ENGINEERING ECONOMICS & FINANCE.

Yes, U can!

01. (a). Project A :

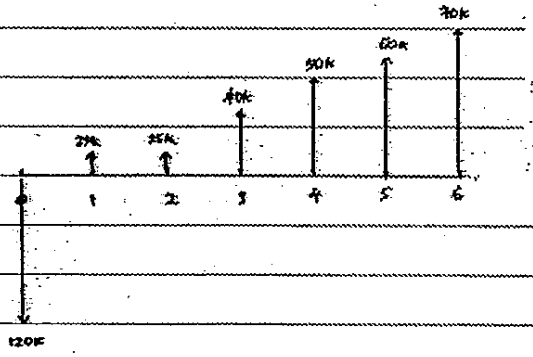


$$AW = -160,000\,(P/F, 10\%, 8) + 40,000 + [10,000\,(P/A, 10\%, 2)(P/F, 10\%, 3) + 25,000\,(P/A, 10\%, 3)(P/F, 10\%, 5)]\,(P/F, 10\%, 8).$$

$$= -160,000\,(0.18744) + 40,000 + [10,000\,(1.7355)(0.9513) + 25,000\,(2.4869)(0.6209)]\,(0.18744).$$

$$= \$19,689$$

Project B :



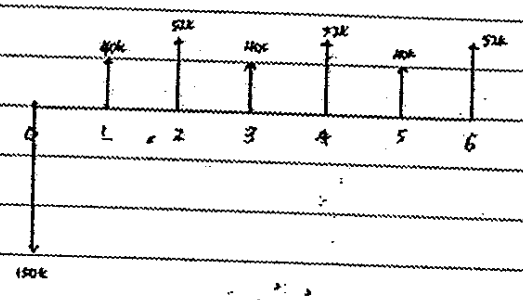
$$AW = -120,000\,(P/F, 10\%, 6) + 25,000 + [15,000\,(P/A, 10\%, 4) + 10,000\,(P/G, 10\%, 4)]\,(P/F, 10\%, 2)(P/F, 10\%, 6).$$

$$= -120,000\,(0.22961) + 25,000 + [15,000\,(3.1699) + 10,000\,(4.3781)](0.8264)(0.22961).$$

$$= \$14,777.$$

Yes, U can!

Project C :



$PW = -150{,}000\,(P/F, 10\%, 6) + 40{,}000 + 12{,}000\,(P/G, 10\%, 2)$

$= -150{,}000\,(0.2296) + 40{,}000 + 12{,}000\,(0.4762)$

$= \$\,11{,}273.$

∴ Based on Annual worth Analysis, Project A should be chosen. (Highest PW value).

Assumptions for Annual worth Analysis :

- Alternatives needed for LCM years or more.
- Alternatives repeated over each cycle of LCM.
- Same cash flow estimates in every cycle.

(b). Consider Year 4 as reference year.

For top diagram :

$NPV\,(\text{year } 4) = [100(1.06) + 100](1.10) + 100 + 100\,(P/F, 6\%, 2) + 100\,(P/F, 6\%, 4) + 100\,(P/F, 6\%, 6)$

$= 226.6 + 100 + 100(0.8900) + 100(0.7921) + 100(0.7050)$

$= 565.31$

From bottom diagram :

$565.31 = x + x\,(P/F, 6\%, 2)$

$565.31 = x + x(0.8900)$

$x = \$\,299.11$

Yes, U can!

02. (a), (i)

	Project A	Project B	A − B
First cost	38,000	29,000	9,000
Annual return	11,000	8,000	3,000
Expected life	5 years	5 years	

MARR = 11%

Project A: $-38,000 + 11,000(P/A, i^*, 5) = 0$

$(P/A, i^*, 5) = 3.455$

$i^* = 13.74\%$ > MARR (OK)

Project B: $-29,000 + 8,000(P/A, i^*, 5) = 0$

$(P/A, i^*, 5) = 3.625$

$i^* = 11.77\%$ > MARR (OK)

A−B: $-9,000 + 3000(P/A, i^*, 5) = 0$

$(P/A, i^*, 5) = 3.000$

$i^* = 19.86\%$ > MARR < Select Project A >

(ii) MARR ⇒ 15%

⇒ None of the projects should be selected, as both projects for < MARR = 15%

Yes, U can!

(b). Current Assets :

Accounts Receivable	$ 4000	
Inventories	$ 9000	
		$13,000
Fixed Assets :		
Plant, Land, Eq.	$ 77,000	
Depreciation	($ 9,000)	
		$68,000
		$81,000

Current Liabilities :

Accounts Payable	$ 5,000	
		$5,000
Long - Term Liabilities :		
Mortage Bonds	$ 8,000	
		$8,000
Shareholders' Equity :		
Capital	$ 65,000	
Retained Earnings	$ 9,000	
Dividends paid	$ 6,000	
		$68,000
		$81,000

(c), (f). * Repayment of principal amount and interest for loan :

Income statement : repayment of principal amount of loan is not shown as an expenses ; only the interest paid to lender is considered as an expense.

Balance sheet : Principal plus interests are liabilities.

* Dividends distributed to shareholders :

Income statement : Dividends distributed to shareholders are excluded.

Balance Sheet : Dividends is an item of shareholders' Equity.

(h). Net Income of a company can be calculated as :

Net Income = Net sales - Cost of Goods sold - Operating Expenses - other Income and Expenses ± Extraordinary items.

On the event where unordinary activities occur such as earthquake, etc, the loss caused by those activities is considered as extraordinary items. If the value of the extraordinary items are very high, it will result in a negative net income. Negative Net Income shows that a company records a loss, which will then affect investors' view of the company.

Yes, U can!

03. (a). (i).

Year	Depreciation	Book Value
0		250,000
1	35,000	215,000
2	35,000	180,000
3	35,000	145,000
4	35,000	110,000
5	35,000	75,000
6	35,000	40,000

(ii).

Year	Depreciation	Book value
0		250,000
1	50,000	190,000
2	50,000	140,000
3	40,000	100,000
4	30,000	70,000
5	20,000	50,000
6	10,000	40,000

(iii).

Year	Depreciation	Book value
0		250,000
1	62500	187,500
2	46875	140,625
3	35156	105,469
4	26367	79,102
5	19775	59,326
6	14832	44,495

→ Loss on disposal = 44,495 - 40,000
= $4,495

(iv).

Year	Depreciation	Book Value
0		250,000
1	83,333	166,667
2	55,556	111,111
3	37,037	74,074
4	24,691	49,383
5	9,383	40,000
6	0	40,000

→ $f = \frac{2}{6} = \frac{1}{3} = 0.333.$

ntusu

Yes, U can!

(b). Salvage Value is the expected value of a system at the end of its service life.

Net Realizable value is the actual value of a system at the end of its service life.

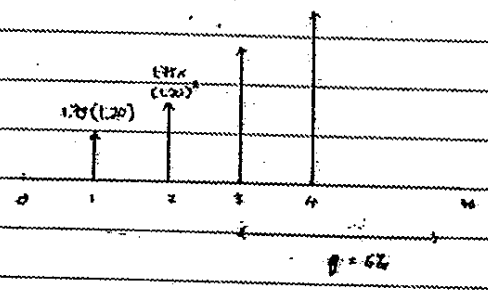
Both values can be same or can be different. It is said to be the same if there is no loss on the disposal. However, sometimes both values can be different and in such case, there will be loss / gain on disposal.

(c). (i). P_0 = \$1.75 , g = 6%.

nor = 12%.

$$P_4 = \frac{D_0(1+g)}{(r-g)} = \frac{1.75(1+0.06)}{(0.12-0.06)} = \$30.92.$$

(ii).



$$P_0 = \frac{1.75(1.20)}{(1.12)} + \frac{(1.75)(1.20)^2}{(1.12)^2} + \frac{(1.75)(1.20)^2(1+0.06)}{(0.12-0.06)} \cdot \frac{1}{(1.12)^4}$$

$$= \$39.375$$

Yes, U can!

Q4. (a) Initial cost = $2800 k

Life = 4 years

SV = $200 k

Inflation rate = 5%

Net cash inflow = $1000 k + 100k per year onwards.

Straight line Depreciation method.

Income tax rate = 40%.

MARR = 12%.

Year	PI	NCF (R$)	NCF (C$)	Dep.	TI	Tax	NCF aft. tax (C$)	NCF aft. tax (R$)
0	100.0	-2800						-2800
1	105.0	1000	1050	650	400	160	890	848
2	110.3	1100	1213	650	563	225	988	896
3	115.8	1200	1389	650	739	296	1093	945
4	121.6	1300	1580	650	930	372	1208	994
SV		200						200

Note: *. All the amount shown in table are in 1000 or k units.

*. Initial cost & SV not affected by the inflation index in the calculation above because not influenced by dep.

NPV = $-2800 + 848(P/F, 12\%, 1) + 896(P/F, 12\%, 2) + 945(P/F, 12\%, 3) + (994 + 200)(P/F, 12\%, 4)$

$= -2800 + 848(0.8929) + 896(0.7972) + 945(0.7118) + (994 + 200)(0.6355)$.

$= \$102.9 k$ > 0

∴ The investment is attractive.

(b) $CR_n = 400,000(P/F, 12\%, n) - S_n(P/F, 12\%, n)$.

$CR_1 = 400,000(P/F, 12\%, 1) - 320,000(P/F, 12\%, 1) = 128,000$

$CR_2 = 400,000(P/F, 12\%, 2) - 275,000(P/F, 12\%, 2) = 106,963$

$CR_3 = 400,000(P/F, 12\%, 3) - 245,000(P/F, 12\%, 3) = 93,934$

$CR_4 = 400,000(P/F, 12\%, 4) - 200,000(P/F, 12\%, 4) = 89,846$

$CR_5 = 400,000(P/F, 12\%, 5) - 175,000(P/F, 12\%, 5) = 83,417$

ntusu

Yes, U can!

$EUOM_n = 160,000 + 20,000 (P/G, 12\%, n)$.

$EUOM_1 = 160,000 + 20,000 (P/G, 12\%, 1) = 160,000$

$EUOM_2 = 160,000 + 20,000 (P/G, 12\%, 2) = 169,434$

$EUOM_3 = 160,000 + 20,000 (P/G, 12\%, 3) = 178,492$

$EUOM_4 = 160,000 + 20,000 (P/G, 12\%, 4) = 187,178$

$EUOM_5 = 160,000 + 20,000 (P/G, 12\%, 5) = 195,492$

$EUAC_n = CR_n + EUOM_n$

$EUAC_1 = 288000$

$EUAC_2 = 276,397$

$EUAC_3 = 272,426$

$EUAC_4 = 277,024$

$EUAC_5 = 278,909$

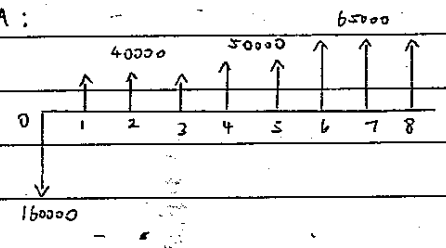
∴ The Economic life of the system = 3 years.

The Annual cost = $272,426.

Set 2

CV4252 Engineering Econs and Finance April/May 2012 Date No.

1 (a) Project A :



$AW = -160000\left(\frac{A}{P},10,8\right) + 40000\left(\frac{P}{A},10,3\right)\left(\frac{A}{P},10,8\right) + 50000\left(\frac{P}{A},10,2\right)\left(\frac{P}{F},10,3\right)\left(\frac{A}{P},10,8\right)$

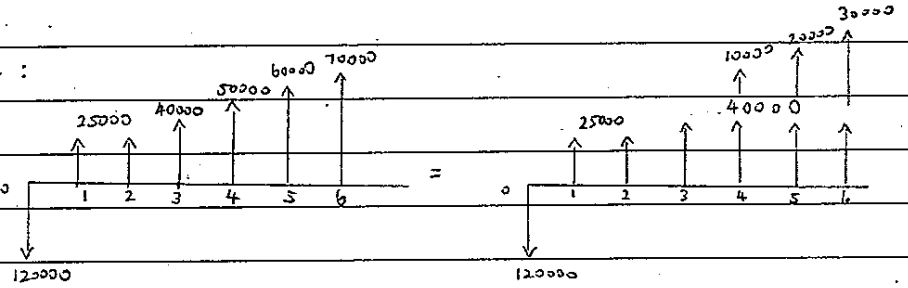
$+ 65000\left(\frac{F}{A},10,3\right)\left(\frac{A}{F},10,8\right)$

$= -160000(0.18744) + 40000(2.4869)(0.18744) + 50000(1.7355)(0.7513)(0.18744)$

$+ 65000(3.31)(0.08744)$

$= -29990.4 + 18645.78 + 12219.94 + 18812.72 = 19688$

Project B :



$AW = -120000\left(\frac{A}{P},10,6\right) + 25000\left(\frac{P}{A},10,2\right)\left(\frac{A}{P},10,6\right) + 40000\left(\frac{F}{A},10,4\right)\left(\frac{A}{F},10,6\right)$

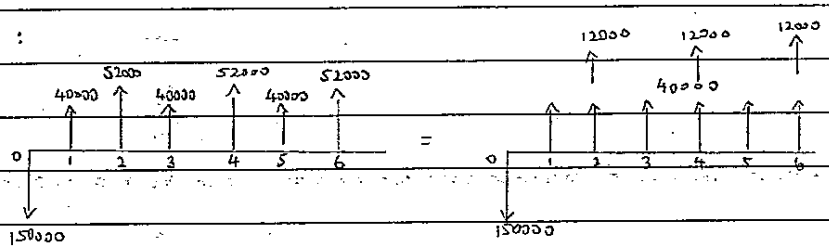
$+ 10000\left(\frac{P}{G},10,4\right)\left(\frac{P}{F},10,2\right)\left(\frac{A}{P},10,6\right)$

$= -120000(0.22961) + 25000(1.7355)(0.22961) + 40000(4.641)(0.12961)$

$+ 10000(4.3781)(0.8264)(0.22961)$

$= -27553.2 + 9962.2 + 24060.8 + 8307.4 = 14777$

Project C :



$AW = -150000\left(\frac{A}{P},10,6\right) + 40000 + 12000\left(\frac{P}{F},10,2\right)\left(\frac{A}{P},10,6\right) + 12000\left(\frac{P}{F},10,4\right)\left(\frac{A}{P},10,6\right)$

$+ 12000\left(\frac{A}{F},10,6\right)$

$= -150000(0.22961) + 40000 + 12000(0.8264)(0.22961) + 12000(0.683)(0.22961)$

$+ 12000(0.12961)$

$= -34441.5 + 40000 + 2277 + 1882 + 1555.3 = 11273$

$\rightarrow \therefore$ Project A should be chosen

Date No.

Assumptions for AW analysis : Alternatives needed for LCM years or more

Alternatives repeated over each cycle of LCM

Same cash flow estimates in every cycle

(b) Set year 4 as base year

For years 4-7, $r = 6 \times 2 = 12\%$; $m = 2$

Effective $i/r = (1 + \frac{0.12}{2})^2 - 1 = 0.1236 = 12.36\%$ $\quad \frac{P}{A} = \frac{(1+i)^n - 1}{i(1+i)^n}$

$P = 100 (\frac{F}{A}, 6, 2)(\frac{F}{P}, 10, 1) + 100 + 100 (\frac{P}{A}, 12.36, 3)$

$= 100 (2.06)(1.1) + 100 + 100 \frac{(1+0.1236)^2 - 1}{(0.1236)(1.1236)^3}$

$= 226.6 + 100 + 238.71$

$= 565.31$

$P = x + x (\frac{P}{F}, 12.36, 1)$ $\quad \frac{P}{F} = \frac{1}{(1+i)^n}$

$= x + \frac{x}{1.1236} = 1.89x$

$1.89x = 565.31 \rightarrow x = \$299.11$

Date No.

2

(a)(i) MARR = 11%

Revenue → ∴ DN alternative required

-Arrange alternatives in ascending order of first cost

Compare DN with B (B-DN)

First Cost	29000
Anual return	8000

→ ROR eqn : $-29000 + 8000\left(\frac{P}{A}, i, 5\right) = 0$

$\left(\frac{P}{A}, i, 5\right) = 3.625$ → $i = 11.77\%$ > MARR ∴ reject DN alternative

Compare B with A (A-B)

First Cost	38000 - 29000 = 9000
Anual return	11000 - 8000 = 3000

→ ROR eqn : $-9000 + 3000\left(\frac{P}{A}, i, 5\right) = 0$

$\left(\frac{P}{A}, i, 5\right) = 3$ → $i = 19.86\%$ > MARR ∴ reject B

∴ A is the best investment alternative

(ii) If MARR = 15%, B will be rejected when compared with DN

Compare DN with A (A-DN)

First Cost	38000
Anual return	11000

→ ROR eqn : $-38000 + 11000\left(\frac{P}{A}, i, 5\right) = 0$

$\left(\frac{P}{A}, i, 5\right) = 3.455$ → $i = 13.74\%$ < MARR ∴ reject A

∴ DN alternative is chosen instead

Date No.

(b)

Current Assets		Current Liabilities	
Inventories	9000	Accounts payable	5000
Accounts receivable	4000		
	13000	Long term liabilities	
		Long term debt	8000
Fixed Assets			
Plant, Land, Equiptment	77000	Share holders' Equity	
Accumulated Depreciation	(9000)	Capital	65000
	68000	Retained Earnings	9000
	13000 + 68000	Dividends	(6000)
	= 81000		68000
			5000 + 8000 + 68000 = 81000

(c)(i) Balance sheet : Repayment of principal amount and interest for loan are both taken into consideration
(Current liabilities - accounts payable / accrued expenses, Long term liabilities - long term debt)

Income Statement : Only interest for loan taken into consideration
(Other income and expenses - interest expense)

Balance sheet : Dividends distributed to shareholders taken into consideration
(shareholders' equity - dividends)

Income statement : Dividends not taken into consideration

(ii) Net income = Operating income - other income and expenses - extraordinary items

If the extraordinary item is significant enough, it could contribute to a large proportion of the net income. An investor could make a wrong decision investing into a company with a large net income but when in fact, the company has been making losses despite winning a court case awarding damages.

Date No.

3(a)(i) Straight line method :

$D_r = \frac{250000 - 40000}{6} = 35000$

year	Dr	BV
0		250000
1	35000	215000
2	35000	180000
3	35000	145000
4	35000	110000
5	35000	75000
6	35000	40000

(ii) SOYD method :

$SOYD = \frac{6(6+1)}{2} = 21$

$D_1 = \frac{6}{21}(250000 - 40000) = 60000$

$D_2 = \frac{5}{21}(250000 - 40000) = 50000$

$D_3 = \frac{4}{21}(250000 - 40000) = 40000$

$D_4 = \frac{3}{21}(250000 - 40000) = 30000$

$D_5 = \frac{2}{21}(250000 - 40000) = 20000$

$D_6 = \frac{1}{21}(250000 - 40000) = 10000$

year	Dr	BV
0		250000
1	60000	190000
2	50000	140000
3	40000	100000
4	30000	70000
5	20000	50000
6	10000	40000

(iii) Declining balance method :

year	Dr	BV
0		250000
1	$0.25 \times 250000 = 62500$	187500
2	$0.25 \times 187500 = 46875$	140625
3	35156.25	105468.75
4	26367.19	79101.56
5	19775.4	59326.17
6	14831.54	44494.63

BV > SV ∴ There is a loss on disposal

Loss on disposal = 44494.62 − 40000 = $4494.63

Date No.

(iv) Double rate Declining-Balance method :

$f = \frac{2}{6} = \frac{1}{3}$

year	Dr	BV
0		250000
1	$\frac{1}{3} \times 250000 = 83333.33$	166666.67
2	$\frac{1}{3} \times 166666.67 = 55555.56$	111111.11
3	37037.037	74074.074
4	24691.36	49382.72
5	9382.72	40000
6	0	40000

(b) Salvage value is the amount received when the good is sold

Net Realisable value is the amount received when the good is sold, after taking into account other amounts payable, like commissions or tax

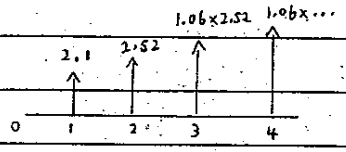
No, they are not always the same

(c)(i) $D_0 = 1.75 \quad K = 0.12$

$g = 0.06$

$P_0 = \frac{1.75(1+0.06)}{0.12-0.06} = \$30.92$

(ii) $D_0 = 1.75 \quad K = 0.12$



$D_1 = 1.2 \times 1.75 = 2.1$

$D_2 = 1.2 \times 2.1 = 2.52$

$P_0 = 2.1\left(\frac{P}{F}, 12, 1\right) + 2.52\left(\frac{P}{F}, 12, 2\right) + \frac{2.52(1+0.06)}{0.12-0.06}\left(\frac{P}{F}, 12, 2\right)$

$= 2.1(0.8929) + 2.52(0.7972) + 44.52(0.7972)$

$= \$39.38$

Date No.

4 (a) Straight line depreciation → $D_t = \frac{2800000 - 200000}{5} = 520000$

year	PI	N_{bt}	N_{bc}	D_t	TI_c	Tax	N_{ac}	N_{at}
0	100	-2800000	-2800000				-2800000	-2800000
1	105	1000000	$1000000 \times \frac{105}{100} = 1050000$	520000	$1050000 - 520000 = 530000$	$-0.4 \times 530000 = -212000$	$1050000 - 212000 = 838000$	$838000 \times \frac{100}{105} = 798095$
2	110	1100000	1210000	520000	690000	-276000	934000	849090.91
3	115	1200000	1380000	520000	860000	-344000	1036000	900869.57
4	120	1300000	1560000	520000	1040000	-416000	1144000	953333.33
SV		200000						200000

MARR = 12%

$NPV = -2800000 + 798095\left(\frac{P}{F},12,1\right) + 849090.91\left(\frac{P}{F},12,2\right) + 900869.57\left(\frac{P}{F},12,3\right)$

$+ (953333.33 + 200000)\left(\frac{P}{F},12,4\right)$

$= -2800000 + 798095(0.8929) + 849090.91(0.7972) + 900869.57(0.7118) + 1153333.33(0.6355)$

$= -36303.41 < 0$

∴ The investment is not feasible

(b) $(CR)_n = 400000\left(\frac{A}{P},12,n\right) - S_n\left(\frac{A}{F},12,n\right)$

$CR_1 = 400000\left(\frac{A}{P},12,1\right) - 320000\left(\frac{A}{F},12,1\right) = 400000(1.12) - 320000(1) = 128000$

$CR_2 = 400000\left(\frac{A}{P},12,2\right) - 270000\left(\frac{A}{F},12,2\right) = 400000(0.5917) - 270000(0.4717) = 109321$

$CR_3 = 400000\left(\frac{A}{P},12,3\right) - 245000\left(\frac{A}{F},12,3\right) = 400000(0.41635) - 245000(0.29635) = 93934.25$

$CR_4 = 400000\left(\frac{A}{P},12,4\right) - 200000\left(\frac{A}{F},12,4\right) = 400000(0.32923) - 200000(0.20923) = 89846$

$CR_5 = 400000\left(\frac{A}{P},12,5\right) - 175000\left(\frac{A}{F},12,5\right) = 400000(0.27741) - 175000(0.15741) = 83417.25$

$(EUOM)_n = 160000 + 20000\left(\frac{A}{G},12,n\right)$

$EUOM_1 = 160000$

$EUOM_2 = 160000 + 20000(0.4717) = 169434$

$EUOM_3 = 160000 + 20000(0.9246) = 178492$

$EUOM_4 = 160000 + 20000(1.3589) = 187178$

$EUOM_5 = 160000 + 20000(1.7746) = 195492$

Date No.

EUAC = CR + EUOM

year	EUAC
1	128000 + 160000 = 288000
2	109321 + 169434 = 278755
3	93934.25 + 178492 = 272426.25
4	89846 + 187178 = 277024
5	83417.25 + 195492 = 278909.25

∴ economic life = 3 years , EUAC = $272426.25