ENMG 400

FACULTY OF ENGINEERING & ARCHITECTURE
AMERICAN UNIVERSITY OF BEIRUT
FINAL
SUMMER 04-05

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(ENMG 400) Engineering Economy
Open Book and Notes (2 Hrs.)
The Question Sheet Must Be Returned With the Booklet

August 13, 2005

1. (25%)
On January 1, 2005, Lebanon Taxi, your company, was considering the purchase of a used Lancer aircraft for its air service. As of that date, you estimated the following constant-dollar (as of January 1, 2005) figures:

First cost	$40,000
Annual profit	$6,000
Resale value (at end of study period)	$20,000

The study period was to be 6 years.

You also estimated that profit from the operation of the aircraft will rise at the rate of 6 percent per year, while the resale value will rise at 10 percent per year.

An MACR-GDS 5-year period depreciation method is to be used based on the constant- dollar values given above. The income tax rate for your company is 45 percent. Your deflated opportunity cost of capital is 6 percent, the constant-dollar rate. The current-dollar after-tax opportunity cost of capital is 15 percent. Gain or loss on disposal of assets is to be counted as income or loss, respectively, for the year during which resale occurs. Use the net present-value method to determine whether the aircraft should have been purchased.

2. (25%)
Land Development Corporation is considering the purchase of a crane. The crane will cost $175,000 and will have an estimated salvage value of $50,000 at the end of 6 years. Only 50% of the initial cost of crane will be paid in cash, and the remaining 50% will be financed through a local bank at an interest rate of 10% over six years. The asset will generate annual before tax revenues of $100,000 over the next 6 years. The asset will be depreciated by the MACRS method, using a 5-year GDS recovery period. The tax bracket of the company is 40% and the firm's opportunity cost of capital is known to be 18%. All above dollar figures represent constant dollars at time 0. With an inflation rate of 6%, compute the after-tax net present value.

3. (25%)
Mr. X is considering buying one of two offered bonds. The first is a 12% bond maturing in 8 years and paying interest semiannually. It is being offered for $800 on the market. The second bond matures in 10 years and pays 8% interest quarterly. What offering price for the second bond will make the investor indifferent to which bond is purchased (i.e. both bonds should have the same rate of return)? Assume that the Face value of the bond is $1000.

4. (25%)
A company is considering the retirement of an existing machine. The machine was purchased 2 years ago for $8,000. It is being depreciated using the MACRS method with a recovery period of 7 years. The machine is expected to produce estimated revenues for the coming years of 8,000 in year 1 (1 year from today), $9,000 in year 2, and $10,000 in year 3. Subsequent revenues will be $11,500 per year. The machine requires increasing amounts of maintenance and operating costs each year, and its salvage value decreases over time as shown.

End of Year (As of today)	Maintenance and Operating Costs ($)	Salvage Value ($)
0		5,500
1	4,000	4,000
2	5,000	3,000
3	6,000	3,000
4	7,000	2,000
5	9,000	700
6	11,000	0

The company is in the 40% tax bracket and its after-tax MARR is 20%.

Determine the retirement age of the machine.

P1

First cost	$40,000
Annual profit	$6,000
Resale value (at end of study period)	$20,000

profit rise 6% OC = 15

Resale value rise 10 %

Year	BTCF Constant	BTCF Current	Depreciation Rate	Depreciation	Taxable Income	Tax @ -0.45	ATCF	ATCF
0	($40,000)	($40,000)					$ (40,000.00)	$ (40,000.00)
1	$6,000	$ 6,360.00	20%	$ (8,000.00)	$ (1,640.00)	$ 738.00	$ 7,098.00	$ 7,098.20
2	$6,000	$ 6,741.60	32%	$ (12,800.00)	$ (6,058.40)	$ 2,726.28	$ 9,467.88	$ 9,468.20
3	$6,000	$ 7,146.10	19%	$ (7,680.00)	$ (533.90)	$ 240.26	$ 7,386.35	$ 7,386.54
4	$6,000	$ 7,574.86	12%	$ (4,608.00)	$ 2,966.86	$ (1,335.09)	$ 6,239.77	$ 6,239.89
5	$6,000	$ 8,029.35	12%	$ (4,608.00)	$ 3,421.35	$ (1,539.61)	$ 6,489.74	$ 6,489.86
6	$6,000	$ 8,511.11	6%	$ (2,304.00)	$ 6,207.11	$ (2,793.20)	$ 5,717.91	$ 34,205.08
6	$20,000	$ 35,431.22			$ 15,431.22	$ (6,944.05)	$ 28,487.17	

NPV @15% ($199.54)

< 0, bad investment

P2

Year	BTCF Constant	BTCF Current	Bulldozar Payment	Depreciation Rate	Depreciation	Loan Interest	Taxable Income	Tax @ -0.4	ATCF	ATCF
0	$ (87,500.00)									$ (87,500.00)
1	$ 100,000.00	$ 106,000.00	($20,090.65)	20%	$ (35,000.00)	$ (8,750.00)	$ 42,159.35	$ (16,863.74)	$ 69,045.61	$ 69,045.81
2	$ 100,000.00	$ 112,360.00	($20,090.65)	32%	$ (56,000.00)	$ (7,615.94)	$ 28,653.42	$ (11,461.37)	$ 80,807.99	$ 80,808.31
3	$ 100,000.00	$ 119,101.60	($20,090.65)	19%	$ (33,600.00)	$ (6,368.46)	$ 59,042.49	$ (23,617.00)	$ 75,393.96	$ 75,394.15
4	$ 100,000.00	$ 126,247.70	($20,090.65)	12%	$ (20,160.00)	$ (4,996.25)	$ 81,000.80	$ (32,400.32)	$ 73,756.73	$ 73,756.84
5	$ 100,000.00	$ 133,822.56	($20,090.65)	12%	$ (20,160.00)	$ (3,486.81)	$ 90,085.11	$ (36,034.04)	$ 77,697.87	$ 77,697.98
6	$ 100,000.00	$ 141,851.91	($20,090.65)	6%	$ (10,080.00)	$ (1,826.42)	$ 109,854.84	$ (43,941.94)	$ 77,819.33	$ 120,374.90
6	$ 50,000.00	$ 70,925.96					$ 70,925.96	$ (28,370.38)	$ 42,555.57	

NPV @18% $187,875.77
> 0, good investment

Payment fpr the bulldozar
75,000 (A/P, 10, 6) = ($20,090.65)

Rb

Y	Payment	Interest	Principle	RB
0				$ 87,500.00
1	($20,090.65)	$ (8,750.00)	$ 11,340.65	$ 76,159.35
2	($20,090.65)	$ (7,615.94)	$ 12,474.71	$ 63,684.64
3	($20,090.65)	$ (6,368.46)	$ 13,722.18	$ 49,962.46
4	($20,090.65)	$ (4,996.25)	$ 15,094.40	$ 34,868.06
5	($20,090.65)	$ (3,486.81)	$ 16,603.84	$ 18,264.22
6	($20,090.65)	$ (1,826.42)	$ 18,264.22	$ 0.00

P3

Solution:

Two bonds must provide the same rate of return.

$800 = 60(P/A,I,16) + 1000(P/F,I,16) \rightarrow I = 8.30\%$ / six months

$ieff/quarter = (1+0.083)^{1/2} - 1 = 4.70\%$

$P = 20(P/A,4.70\%,40) + 1000(P/F,4.70\%,40) = 594.66$

P4

	Revenues	M&O	Dep	Dep Amount	TI	Taxes paid	CFAT	PV (CFAT)	Cum(PV)	BV	Salvage Va	Profit from	Taxes on p	Salvage Valu After taxes	AW (SV)	AW(IC)	AW(CFAT)	EUAC
			8000															
			14.29	1143.2						6856.8								
			24.49	1959.2						4897.6	5500							
0																		
1	8000	4000	17.49	1399.2	2600.8	1040.32	2959.68	2466.4	2466.4	3498.4	4000	501.6	200.64	3799.36	3,799.36	6,600.00	2,959.68	159.04
2	9000	5000	12.49	999.2	3000.8	1200.32	2799.68	1944.2	4410.6	2499.2	3000	500.8	200.32	2799.68	1,272.58	3,600.00	2,886.95	559.53
3	10000	6000	8.93	714.4	3285.6	1314.24	2685.76	1554.3	5964.9	1784.8	2000	215.2	86.08	1913.92	525.60	2,610.99	2,831.68	746.49
4	11500	7000	8.92	713.6	3786.4	1514.56	2985.44	1439.7	7404.6	1071.2	1100	28.8	11.52	1088.48	202.77	2,124.59	2,880.32	938.51
5	11500	9000	8.92	713.6	1786.4	714.56	1785.44	717.5	8122.1	357.6	700	342.4	136.96	563.04	75.66	1,639.09	2,715.88	952.45
6	11500	11000	4.46	356.8	143.2	57.28	442.72	148.3	8270.4	0	0	0	0	0	0.00	1,653.88	2,486.96	833.08

EUAC(1) = -5,500(A/P,20%,1) + 2,959 + 3,799(A/F,20%,1)
EUAC(2) = -5,500(A/P,20%,2) + [2,959(P/F,20%,1)+2,800(P/F,20%,2)](A/P,20%,2) + 2,800(A/F,20%,2)
EUAC(3) = -5,500(A/P,20%,3) + [2,959(P/F,20%,1)+2,800(P/F,20%,2)+ 2686(P/F,20%,3)](A/P,20%,3) + 1914(A/F,20%,3)
EUAC(4) = -5,500(A/P,20%,4) + [2,959(P/F,20%,1)+2,800(P/F,20%,2)+ 2686(P/F,20%,3)+2,985(P/F,20%,4)](A/P,20%,4) + 1088.48(A/F,20%,4)

Keep it for 5 more years