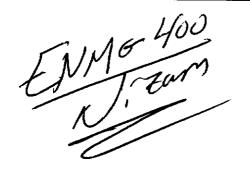
E. 118 & Arch Lifted



ENMG400 Engineering Economy Fall 2004/2005 Exam 2 (AlKhal, Nizam & Traboulsi)

INSTRUCTIONS

- 1. Before starting this exam, place your name, student ID No., and name of your instructor on the booklet provided.
- 2. Answer all questions on the booklet provided.
- 3. Show all work, equations, calculations, and cash flow diagrams.
- 4. Partial credit will be given only when your work is neatly shown and is conceptually correct.
- 5. You have ninety (90) minutes to complete this exam.
- 6. This is an open book exam.

Question 1 (25 points)

A firm is considering three mutually exclusive alternatives for the design of a certain system. This system is expected to provide annual savings in labor. The alternatives and their relevant information are shown below.

	Design A	Design B	Design C
Initial Investment (\$)	12,000	18,000	5,000
Net Annual Savings (\$/year)	3,200	5,000	1,800
Useful Life (years)	5	10	5

Salvage values for all design alternatives are considered to be zero and the firm's MARR is 15%.

(a) At what interest rate will Design A and Design C have the same equivalent worth?

Find i such that

PW(A-C) = 0

$$-7000 + 1400(P/A,i\%,5) = 0$$

$$(P/A,i\%,5) = 5$$

i = 0% since the sum of the 5 annual amounts of 1400 exactly equals the initial amount of 7000.

(b) Using IRR analysis, recommend the most economically attractive design alternative.

A design has to be chosen, hence the Do-Nothing is not an option. Rank designs in increasing initial investment: C, A, B

A-C: $\Delta i_{(A-C)} = 0\%$ from part (a)

Since $\Delta i_{(A=C)}$ < 15%, reject A and keep C

B-C: Using PW we repeat design C twice.



PW(B-C) = -13000 + 3200(P/A,
$$\Delta i_{(B-C)}$$
, 10) + 5000(P/F, $\Delta i_{(B-C)}$, 5) = 0

Substituting $\Delta i_{(B-C)} = 15\%$

-13000 +3200(P/A, 15%,10) + 5000(P/F, 15%,5) = 5546

This means that $\Delta i_{(B-C)} > 15\%$

Hence, reject C and recommend B.

Question 2 (25 points)

Four proposals are under consideration by your company. Proposals A and C are mutually exclusive, proposals B and D are also mutually exclusive and cannot be implemented unless proposal A or C has been selected. No more than \$200,000 can be spent at time 0. The MARR is 15%.

Proposals

	Α	В	С	D
Initial Investment (\$)	70,000	40,000	150,000	60,000
PW @ 15%	6,500	4,200	9,650	6,100
Life (years)	5	5	5	5

(a) List all feasible combinations of proposals.

{Do-Nothing}, {A}, {C}, {A,B}, {A,D}, {B,C}

(b) Select from the above the best economically justified projects.

Select the feasible combination with the highest PW.

Select {B,C} with a total PW of \$13,850 and a total budget of \$190,000.

It is assumed that that any unused amount from the budget is invested at the MARR.

Question 3 (30 points)

A textile company is considering the replacement of its 3-year-old knitting machine which has a current market value of \$8,000. Because of a rapid change in fashion style, the existing machine is not expected to meet required standards after 5 years. The estimated operating costs and salvage values for the old machine are given as follows:

		End of Year					
	1	2	3	4	5		
Operating Cost	1,000	1,500	2,000	2,500	3,000		
Salvage Value	6,000	4,000	3,000	2,000	0		

As an alternative, a new improved machine is available on the market at a price of \$10,000 and has an estimated life of 6 years. The pertinent cost information can be summarized as follows:

		End of Year					
	1	2	3	4	5	6	
Operating Cost	700	900	1,100	1,300	1,500	3,000	
Salvage Value	8,000	6,000	4,000	2,000	0	0	

If the interest rate is 15%, determine which alternative should be selected and how long should the selected machine be kept in service.

Defender		MARR		15.00%
Year	Operating Cost	Salvage Value	PW	EAUC
0		8000		
1	-1000	6000	-3652.17	4,200.00
2	-1500	4000	-6979.21	4,293.02
3	-2000	3000	-9346.26	4,093.45
4	-2500	2000	-11604.69	4,064.72
5	-3000	0	-14239.73	4,247.93

Challenger

Year	Operating Cost	Salvage Value	PW	EUAC
0		10,000		
1	-700	8000	-3652.17	4,200.00
2	-900	6000	-6752.36	4,153.49
3	-1100	4000	-9382.43	4,109.29
4	-1300	2000	-11612.27	4,067.37
5	-1500	0	-13501.54	4,027.72
6	-3000	0	-14798.52	3,910.32

Replace the defender and keep it for 6 years

Question 4 (20 points)

Three flood-control projects are being considered. In summary, the initial investment required and the annual benefits, dis-benefits, and costs resulting from these investments are as follows (in millions of \$):

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Operation and Maintenance	6.5	8.25	7
Benefits from savings to the	3.5	3.5	3.5
government			
Benefits to the public	10	13.2	11.2
Dis-benefits to the public	3.25	4.3	3.6
Initial investment	25	33	28
Expected Life	40	40	45

If an interest rate of 5% is used, determine which alternative should be chosen using the **modified** benefit-cost analysis.

	P1	P2	Р3	P2-P1	P3-P1
Operation and	6.5	8.25	7		
Maintenance				1.75	0.5
Savings to the	3.5	3.5	3.5		
government				0	0
Benefits to the public	10	13.2	11.2	3.2	1.2
Dis-benefits to the public	3.25	4.3	3.6	1.05	0.35
Initial investment	25	33	28		
Expected Life	40	40	45		
AW of the Initial	1.46	1.92	1.58	0.47	
Investment					0.12

modified B/C 0.86 2.96 Choose **P1 P3**