

Measures of Economic Worth

▪ Single alternative:

- Present Worth > 0
- Future Worth > 0
- Annual Worth > 0

▪ Multiple alternatives:

Ranking approach: choose the one with the greatest (P_w, A_w, F_w) over the planning horizon.

Incremental approach (main steps):

Step one: order alternative (A,B) from lowest to highest initial investment

Step two: Compute the cash flow for the difference between the projects (A,B) by subtracting.

○ Ranking Methods or Incremental Methods

- Present Worth
- Future Worth
- Annual Worth

○ Ranking Methods only

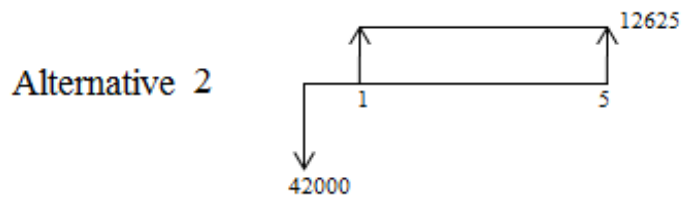
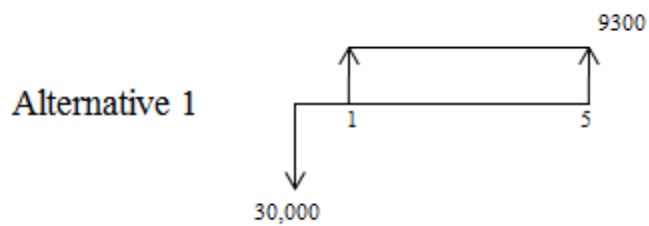
- Capitalized Worth
- Discounted Payback Period
- Payback Period

○ Incremental Methods only

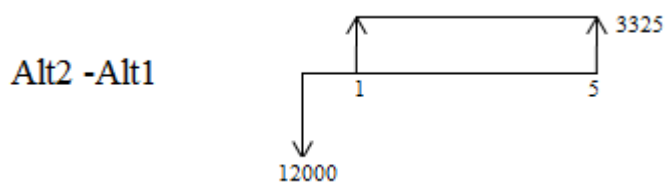
- Internal Rate of Return
- External Rate of Return
- Benefit/Cost Ratio

Example

EOY	Alternative 1	Alternative 2
0	-30000	- 42000
1	9300	12625
2	9300	12625
3	9300	12625
4	9300	12625
5	9300	12625



Incremental



Find the best alternative if MARR=12%

a. Present worth using ranking approach

$$P_{w1} = -30000 + 9300(P/A\ 12,5) = \text{SR } 3524.64$$

$$P_{w2} = -42000 + 12625(P/A\ 12,5) = \text{SR } 3510.6$$

Select 1

b. Present worth using incremental approach

$$P_{w2-1} = -12000 + 3325(P/A\ 12, 5) = \text{SR } -14 < 0$$

Select 1

c. Future worth using ranking approach

$$F_{w1} = -30000(F/P\ 12,5) + 9300(F/A\ 12,5) = \text{SR } 6212.04$$

$$F_{w2} = -42000(F/P\ 12,5) + 12625(F/A\ 12,5) = \text{SR } 6187$$

Select 1

d. Future worth using incremental approach

$$F_{w2-1} = -12000(F/P\ 12,5) + 3325(F/A\ 12,5) = \text{SR } -24.7 < 0$$

Select 1

e. Annual worth using ranking approach

$$A_{w1} = -30000(A/P12,5) + 9300 = \text{SR } 978$$

$$A_{w2} = -42000(A/P12,5) + 12625 = \text{SR } 974$$

Select 1

f. Annual worth using incremental approach

$$A_{w2-1} = -12000(A/P\ 12,5) + 3325 = \text{SR } -38 < 0$$

Select 1

g. Capitalized worth C_w

$$C_w = \frac{A_w}{i}$$
$$C_w = \frac{-30000(A/P12,5) + 9300}{0.12} = \text{SR } 8150$$

$$C_w = \frac{-42000(A/P12,5) + 12625}{0.12} = \text{SR } 8118.3$$

Select 1

h. PBP payback period

$$PBP_1 = -30000 + 9300 + 9300 + 9300 + 9300 = \text{SR } 7200$$

$$PBP_2 = -42000 + 12625 + 12625 + 12625 + 12625 = \text{SR } 8500$$

i. Discounted Payback Period(DPBP)

$$n=3 \quad P_{w1} = -30000 + 9300(P/A\ 12,3) = \text{SR } -7662.981$$

$$n=4 \quad P_{w1} = -30000 + 9300(P/A\ 12,4) = \text{SR } -1752.654$$

$$n=5 \quad P_{w1} = -30000 + 9300(P/A\ 12,5) = \text{SR } 3524.64$$

$$n=3 \quad P_{w2} = -42000 + 12625(P/A\ 12,3) = \text{SR } -11676.90$$

$$n=4 \quad P_{w2} = -42000 + 12625(P/A\ 12,4) = \text{SR } -3653.46$$

$$n=5 \quad P_{w2} = -42000 + 12625(P/A\ 12,5) = \text{SR } 3510.6$$

Select 1

▪ One-shot investment

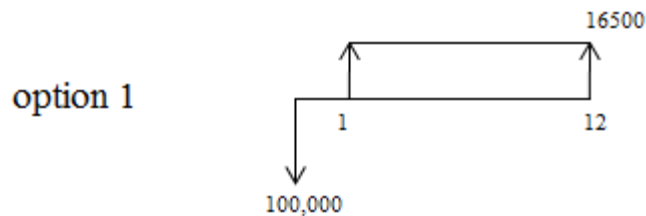
Problem 62

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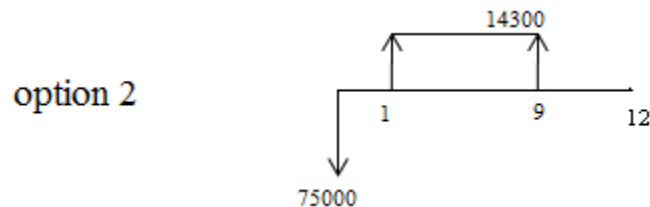
	Option 1	Option 2
Initial investment	\$ 100,000	\$ 75,000
Estimated life	12 year	9 year
Expected annual return	\$16,500	\$14,300

Based on a present worth analysis which option is preferred? (Two alternatives are one-shot investment and MARR=12%)

Solution



$$P_{w1} = -100,000 + 16,500(P/A\ 12, 12) = \$ 2,207.105$$



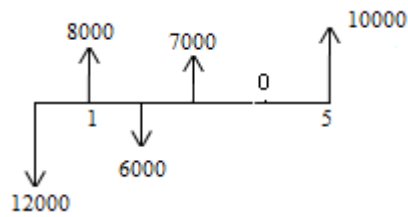
$$P_{w2} = -75,000 + 14,300(P/A\ 12, 9) = \$ 1,193.97$$

Select 1

▪ Capital recovery cost

$$CR = P(A/P\ i, n) - F(A/F\ i, n)$$

Ex

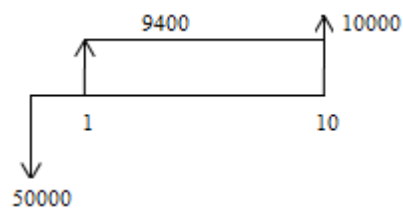


Find CR if $i=15\%$

$$CR = P(A/P i, n) - F(A/F i, n) = 12000 (A/P 15, 5) - 10000 (A/F 15, 5) = \text{SR } 2096.66$$

Problem62

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What is the capital recovery cost if $i=8\%$?

$$CR = 50000(A/P 8, 10) - 10000(A/F8, 10) = \$ 6761.2$$

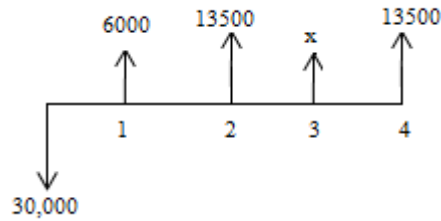
Problem8

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End of year	0	1	2	3	4
Cash flow	-30000	6000	13500	X	13500

What is the minimum value of x such that the investment is attractive based on annual worth if MARR=12%?

Economic Analysis



$$\begin{aligned} P_w &= -30000 + 6000(P/F, 12, 1) + 13500(P/F, 12, 2) + X(P/F, 12, 3) + 13500(P/F, 12, 4) \\ &= -5301.255 + 0.71178X \end{aligned}$$

$$A_w = [-5301.255 + 0.71178X] (A/P, 12, 4) \quad , \quad A_w \geq 0$$

$$X = \frac{(5301.255 \times 0.32923)}{(0.71178 \times 0.32923)} = \$7447.88 \quad , \quad X \geq \$7447.88$$

Home work

Chapter 5: problems (10, 12, 25)

Chapter 6: problems (20, 47)

Chapter 7: problems (8, 23, 25)