GE 403
Engineering Economy

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Ex.1 DuraTech Manufacturing is evaluating a process improvement project. The estimated receipts and disbursements associated with the project are shown below. MARR is 10 percent/year. Should DuraTech implement the proposed process improvement **based on future worth**?

EOY	0	1	2	3	4	5
Receipts	$0	$600	$600	$700	$700	$700
Disbursements	$1000	$300	$300	$300	$300	$300

Solution

Fw = -1000 (F/P 10%, 5) + 300 (F/A 10%, 5) + 100 (F/A 10%, 3)

Fw = -1000(1.61051)+300(6.10510) +100 (3.31) = $552.02

Since **Fw > 0**, the proposed process improvement should be implemented.

Ex.2 DuraTech Manufacturing is evaluating a process improvement project. The estimated receipts and disbursements associated with the project are shown below. MARR is 10 percent/year. Should DuraTech implement the proposed process improvement **based on annual worth**?

EOY	0	1	2	3	4	5
Receipts	$0	$600	$600	$700	$700	$700
Disbursements	$1,000	$300	$300	$300	$300	$300

Solution

Aw = -1,000(A/P 10%, 5) + 300 +100(F/A 10%, 3)(A/F 10%, 5)

Aw = -1000(0.26380)+300+100(3.31)(0.16380) = $90.42

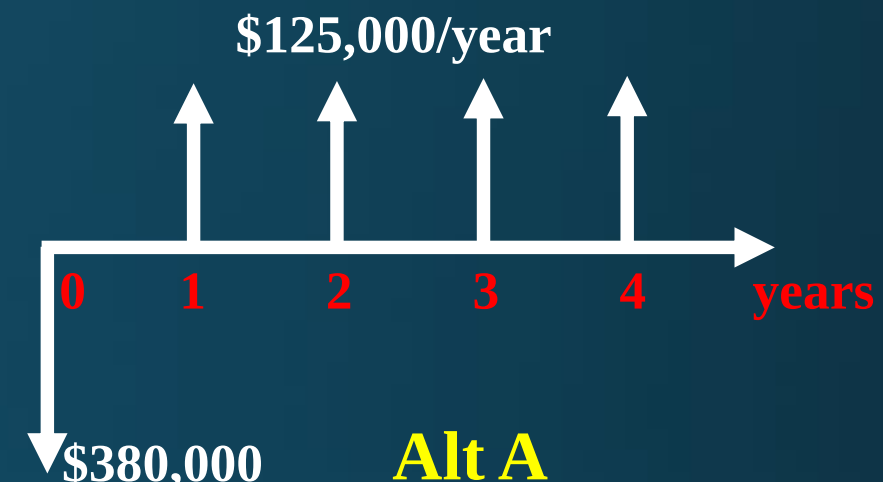
Since **Aw > 0**, the proposed process improvement should be implemented.

Ex.3 The engineering team at a company is planning to purchase an enterprise resource planning (ERP) system. The software and installation from Vendor **A** costs **$380,000** initially and is expected to increase revenue **$125,000** per year every year. The software and installation from Vendor **B** costs **$280,000** and is expected to increase revenue **$95,000** per year. The company uses a 4-year planning horizon and a 10 percent per year MARR. (The "do nothing" alternative is feasible and assumed to have a Pw of $0.) Which ERP system should be purchased based on ranking and incremental future worth analyses?

Solution

DN

Alt B



Alt A

Ranking Approach

$Fw)_{DN}$ = $0

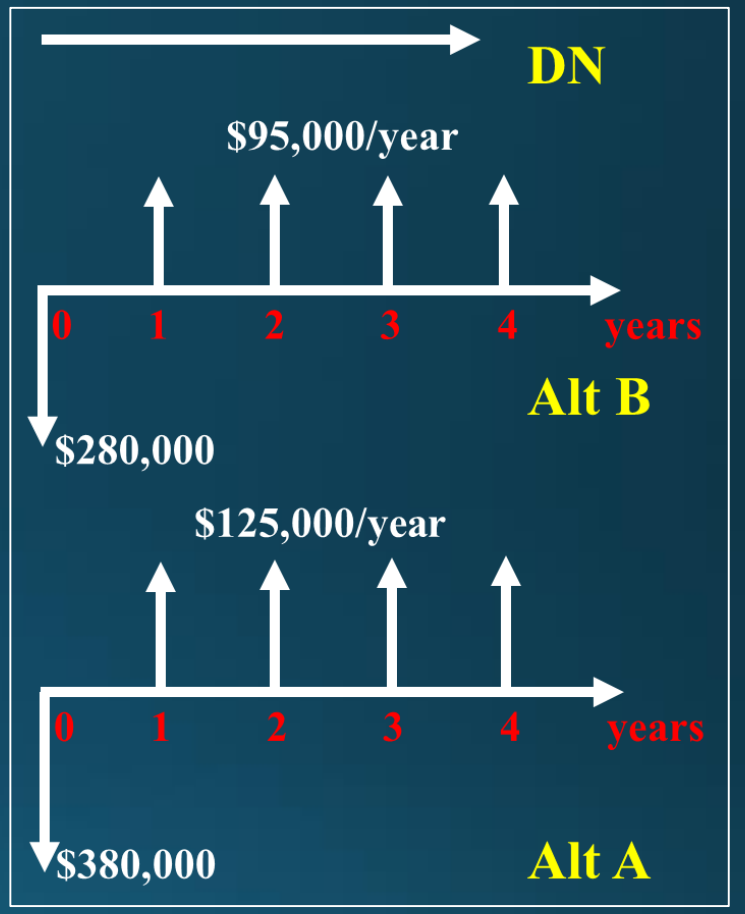
$Fw)_{B}$ = -280,000(F/P 10%, 4) + 95,000(F/A 10%, 4) = $30,947.63

$Fw)_{A}$ = -380,000(F/P 10%, 4)+ 125,000(F/A 10%, 4) = $23,767.83

Solution

Incremental Approach

- Order alternatives from lowest to highest initial investment
- Determine incremental cash flows between alternatives
- Calculate **Fw** on incremental cash flows

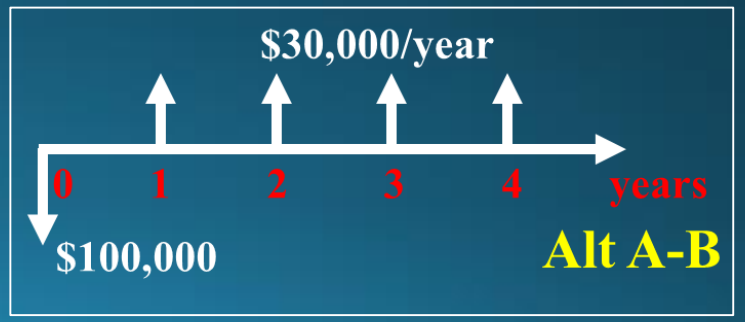


$Fw)_{B-DN}$ = -280,000(F/P 10%. 4)+ 95,000(F/A 10%, 4) = $30,947.63

Fw > $0, therefore B is better than doing nothing

$Fw)_{A-B}$ = -100,000 (F/P 10%. 4) + 30,000(F/A 10%, 4) = -$7179.8

Fw < $0, therefore B is better than A



Ex.4 The engineering team at a company is planning to purchase an enterprise resource planning (ERP) system. The software and installation from Vendor **A** costs **$380,000** initially and is expected to increase revenue **$125,000** per year every year. The software and installation from Vendor **B** costs **$280,000** and is expected to increase revenue **$95,000** per year. The company uses a 4-year planning horizon and a 10 percent per year MARR. (The "do nothing" alternative is feasible and assumed to have a Pw of $0.) Which ERP system should be purchased based on ranking and incremental annual worth analyses?

Solution

DN

Alt B

Alt A

Ranking Approach

$Aw)_{DN}$ = $0

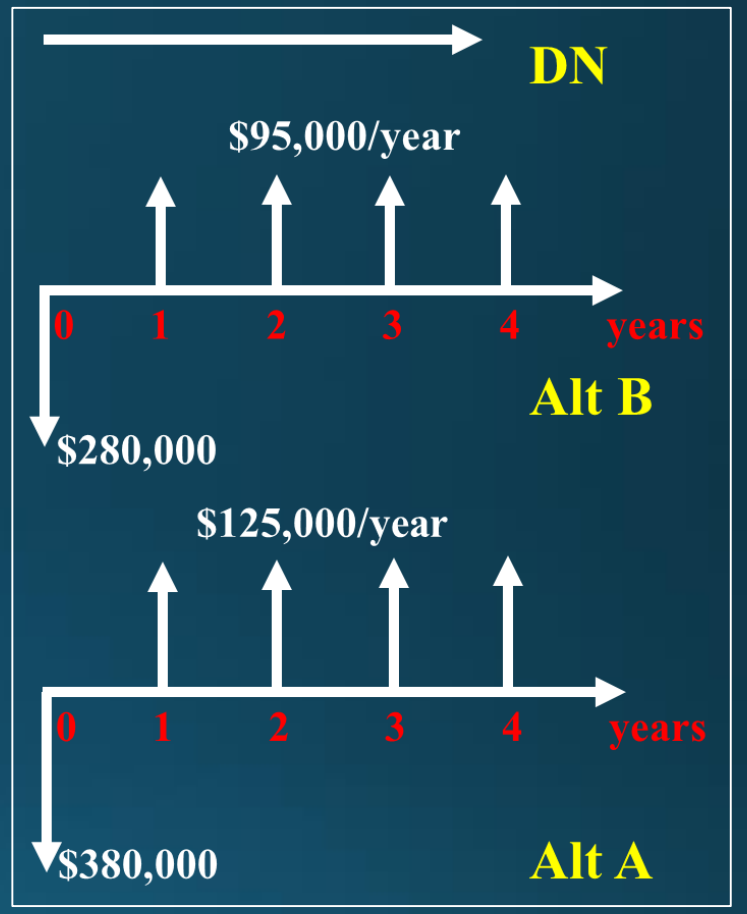
$Aw)_{B}$ = -280,000(A/P 10%, 4)+ 95,000 = $6,668.4

$Aw)_{A}$ = -380,000(A/P 10%, 4)+ 125,000 = $5,121.4

Solution

Incremental Approach

- Order alternatives from lowest to highest initial investment
- Determine incremental cash flows between alternatives
- Calculate **Aw** on incremental cash flows

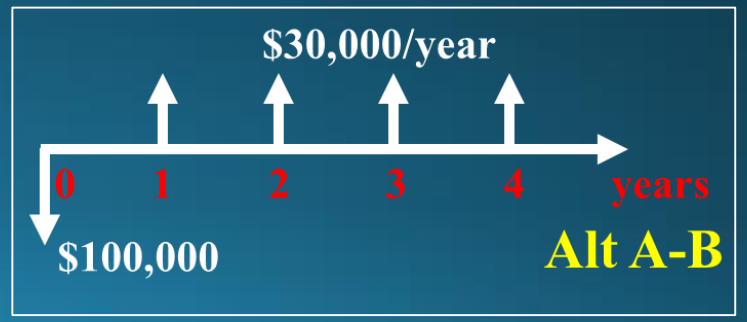


$Aw)_{B\text{-}DN}$ = -280,000(A/P 10%. 4)+ 95,000 = $6,668.4

Aw > $0, therefore B is better than doing nothing

$Aw)_{A\text{-}B}$ = -100,000 (A/P 10%. 4) + 30,000 = -$1547

Aw < $0, therefore B is better than A



Ex.5 The expected cash flows for two ovens are shown below. What are the capital recovery costs of these alternatives using a MARR of 8 percent/year.

	Alt. A	Alt. B
Initial Investment	$50,000	$80,000
Estimated Life	10	5
End of Life Salvage	$10,000	$0
Annual Income	$19,400	$26,000
Annual Expense	$10,000	$6,000

Solution

Capital Recovery Cost Formulas

$CR = P(A|P\ i\%,n) - F(A|F\ i\%, n)$ | $CR = (P-F)(A|F\ i\%, n) + Pi$ | $CR = (P-F)(A|P\ i\%,n) + Fi$

Alt. A P = $50,000 F = $10,000 Useful life =10 yrs. MARR= 8%

CR = $50,000(A/P, 8%,10) – $10,000(A/F, 8%, 10)

CR = $50,000(0.14903) – $10,000(0.06903) =$6,761.2

Alt. B P = $80,000 F = $0 Useful life =5 yrs. MARR= 8%

CR = $80,000(A/P, 8%, 5) – $0(A/F, 8%, 5)

CR = $80,000(0.25046) =$20,036.8

Ex.6 Consider the net cash flows (NCF) and salvage values (SV) shown below. Assume the alternatives can be indefinitely renewed with the same cash flows and salvage values. Using a MARR 8% per year, determine **AW** of each alternative based on **a)** LCM of lives approach, **b)** their "natural" lives and **c)** assume both alternatives are one shot investments.

	Alt. A		Alt. B	
EOY	NCF	SV	NCF	SV
0	-$100	$100	-$70	$70
1	$50	$40	$30	$60
2	$50	$20	$40	$50
3	$40	$10		
4	$60	$5		

Solution

a) LCM of lives approach t = 4

EOY	0	1	2	3	4
Alt. A	-$100	$50	$50	$40	$60+$5
Alt. B	-$70	$30	$40+$50-$70	$30	$40+$50

$Aw)_A$ = [-100 + 50(P/A 8%. 2) + 400 (P/F 8%, 3) +65(P/F 8%, 4)](A/P 8%. 4)
= [-100 + 50(1.78326) + 400 (0.79383) +65(0.73503)](0.30192)
= $107.02

$Aw)_B$ = [-70+30(P/F8%,1)+20(P/F 8%,2)+30(P/F 8%,3)+90(P/F8%,4)](A/P 8%,4)
= [-70+30(0.92593)+20(0.85734)+30(0.79383)+90(0.73503)](0.30192)
= $19.6

$Aw_A > Aw_B$, therefore Alt. A is better than Alt. B

Solution

b) Natural life (t = 4 for Alt. A, t = 2 for Alt. B)

EOY	0	1	2	3	4
Alt. A	-$100	$50	$50	$40	$60+$5
Alt. B	-$70	$30	$40+$50		

$Aw)_A$ = [-100 + 50(P/A 8%. 2) + 400 (P/F 8%, 3) +65(P/F 8%, 4)](A/P 8%. 4)

= [-100 + 50(1.78326) + 400 (0.79383) +65(0.73503)](0.30192)

= $107.02

$Aw)_B$ = [-70+30(P/F8%,1)+90(P/F 8%,2)](A/P 8%, 2)

= [-70+30(0.92593)+90(0.85734)](0.56077)

= $19.6

$Aw_A > Aw_B$, therefore Alt. A is better than Alt. B

Solution

c) Alternatives are one shot investment t = 4

EOY	0	1	2	3	4
Alt. A	-$100	$50	$50	$40	$60+$5
Alt. B	-$70	$30	$40+$50	$0	$0

$Aw)_A$ = [-100 + 50(P/A 8%. 2) + 400 (P/F 8%, 3) +65(P/F 8%, 4)](A/P 8%. 4)

= [-100 + 50(1.78326) + 400 (0.79383) +65(0.73503)](0.30192)

= $107.02

$Aw)_B$ = [-70+30(P/F8%,1)+90(P/F 8%,2)](A/P 8%, 4)

= [-70+30(0.92593)+90(0.85734)](0.30192)

= $10.55

$Aw_A > Aw_B$, therefore Alt. A is better than Alt. B