**Establishing the planning horizon and the minimum attractive Rate of return**

- Planning horizon Duration (when alternatives have unequal lives)
    - Shortest lives.
    - Longest lives.
    - Lest common multiple of lives.
    - Standard length.

**Ex.1**

Two alternatives have the following net cash flow (NCF), salvage value (SV) profiles

| EOY | Alternative 1 | | Alternative 2 | |
|---|---|---|---|---|
| | NCF(SR) | SV(SR) | NCF(SR) | SV(SR) |
| 0 | -50K | 50K | -80K | 80K |
| 1 | 25K | 25K | 15K | 50K |
| 2 | 30K | 10K | 25K | 30K |
| 3 | 35K | 5K | 35K | 20K |
| 4 | | | 45K | 10K |
| 5 | | | 55K | 5K |

Specify the planning horizon and complete set of cash flows for each alternative using each of the following:

a. Longest life among a alternatives.
b. Shortest life among a alternatives.
c. Least common multiple of lives approach.
d. Planning horizon of 3 year.
e. Assuming the two a alternatives are one shot investment.

Solution

a. Longest life among a alternatives t=5

| EOY | Alternative 1 | Alternative 2 |
|---|---|---|
| 0 | -50k | -80k |
| 1 | 25k | 15k |
| 2 | 30k | 25k |
| 3 | 35k+5k-50k | 35k |
| 4 | 25k | 45k |
| 5 | 30k+10k | 55k+5k |

b. Shortest life among a alternatives.

| EOY | Alternative 1 | Alternative 2 |
|---|---|---|
| 0 | -50k | -80k |
| 1 | 25k | 15k |
| 2 | 30k | 25k |
| 3 | 35k+5k | 35k+20k |

c. LCM = 15

| EOY | Alternative 1 | Alternative 2 |
|---|---|---|
| 0 | -50k | -80k |
| 1 | 25k | 15k |
| 2 | 30k | 25k |
| 3 | 35k+5k-50k | 35k |
| 4 | 25k | 45k |
| 5 | 30k | 55k+5k-80k |
| 6 | 35k+5k-50k | 15k |
| 7 | 25k | 25k |
| 8 | 30k | 35k |
| 9 | 35k+5k-50k | 45k |
| 10 | 25k | 55k+5k-80k |
| 11 | 30k | 15k |
| 12 | 35k+5k-50k | 25k |
| 13 | 25k | 35k |
| 14 | 30k | 45k |
| 15 | 35k+5k | 55k+5k |

d. t=3 years

| EOY | Alternative 1 | Alternative 2 |
|---|---|---|
| 0 | -50K | -80K |
| 1 | 25K | 15K |
| 2 | 30K | 25K |
| 3 | 35K+ 5K | 35K + 20K |

e. One shot investment

| EOY | Alternative 1 | Alternative 2 |
|---|---|---|
| 0 | -50k | -80k |
| 1 | 25k | 15k |
| 2 | 30k | 25k |
| 3 | 35k+5k | 35k |
| 4 | 0 | 45k |
| 5 | 0 | 55k+5k |

**Ex.2**

Consider the net cash flows (NCF) and salvage values (SV) shown below . Assume the alternatives can be indefinitely renewed with same cash flows and salvage values. Specify the planning horizon and complete set of cash flows for each alternative using each of the following :

| | Alternative 1 | | Alternative 2 | |
|---|---|---|---|---|
| EOY | NCF | SV | NCF | SV |
| 0 | -$100 | $100 | -$70 | $70 |
| 1 | $20 | $40 | $30 | $50 |
| 2 | $20 | $20 | $40 | $30 |
| 3 | $40 | | $50 | |
| 4 | $60 | | | |

a) Least common multiple of lives

L.C.M= 12 years

| EOY | Alt 1 | Alt 2 |
|---|---|---|
| 0 | -$100 | -$70 |
| 1 | $20 | $30 |
| 2 | $20 | $40 |
| 3 | $40 | -$20 |
| 4 | -$40 | $30 |
| 5 | $20 | $40 |
| 6 | $20 | -$20 |

| EOY | Alt 1 | Alt 2 |
|---|---|---|
| 7 | $40 | $30 |
| 8 | -$40 | $40 |
| 9 | $20 | -$20 |
| 10 | $20 | $30 |
| 11 | $40 | $40 |
| 12 | $60 | $50 |

b) Shortest life among Alternatives

Shortest life = 3 years

| EOY | Alt 1 | Alt 2 |
|---|---|---|
| 0 | -$100 | -$70 |
| 1 | $20 | $30 |
| 2 | $20 | $40 |
| 3 | $40 | $50 |

c) Longest life among Alternatives

Longest life = 4 years

| EOY | Alt 1 | Alt 2 |
|---|---|---|
| 0 | -$100 | -$70 |
| 1 | $20 | $30 |
| 2 | $20 | $40 |
| 3 | $40 | -$20 |
| 4 | $60 | $80 |

**Capitalized worth**

A special type of cash flow series is a perpetuity.

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$$\mathbf{C_w = P_w \text{ , when } n = \infty}$$

$$\mathbf{p_w = A\frac{(1+i)^n-1}{i(1+i)^n} \quad , \ n=\infty}$$

$$\mathbf{C_w = A\frac{(1+i)^n-1}{i(1+i)^n} = A\frac{\cancel{(1+i)^n}}{i\cancel{(1+i)^n}} - \frac{\cancel{1}}{i\cancel{(1+i)^n}} = \frac{A}{i}}$$

$$\mathbf{C_w = \frac{A}{i}}$$

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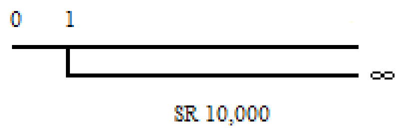
**Ex.1**




Find Capitalized worth if i=10%

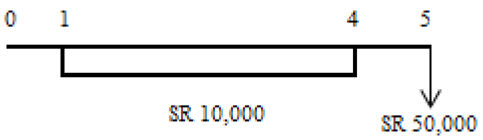
solution

$$C_w = \frac{A}{i} = \frac{10{,}000}{0.10} = SR100{,}000$$

**Ex.2**

Maintenance costs over a 4 years period for an urban highway are SR 10000/year and rehabilitation at end of year 5 is SR 50000. It is anticipated that this sequence will repeat itself every 5 year forever. Determine the capitalized cost of the maintenance and rehabilitation cost based on a time value of money of 10%.

Solution




$$Pw= 50{,}000(P/F10{,}5) + 10{,}000(P/A10{,}4) = SR\ 62744$$

$$A_W = 62744(A/P10{,}5)= SR\ 165518.6$$

$$Cw= \frac{A}{i} = \frac{165518.6}{0.10} = SR\ 1655186$$

**Ex.3**

Consider an investment project, the cash flow pattern of which repeats itself every 5 years forever as shown below. At an interest rate of 10%, compute the capitalized cost for this project.

| EOY | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | ∞ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NCF(SR) | 0 | -1000 | -1000 | -400 | -400 | -200 | -1000 | -1000 | -400 | -400 | -200 | ... |

Pw = 1000 (P/A 10,2) + 400 (P/A 10,2) (P/F 10,2) + 200 (P/F 10,5)
= 1000 ( 1.73554 ) + 400 ( 1.73554 ) ( 0.82645 ) + 200 ( 0.62092 )
= 2433.46

Aw = 2433.46 ( A/P 10,5 ) = 2433.46 ( 0.26380 ) = 641.95

Cw = 641.95/0.1 = 6419.5