Transportation Economics and Decision Making

Lecture-1

Introduction

- Name
- Brief Introduction
- Did you take *Engineering Economy* in under graduation?
- How much do you recall *Engineering Economy ?*

What is Transportation Economics

- A decision assistance tool used for rationally evaluating feasibility of any investment by making use of a set of mathematical techniques.

- In order to apply transportation economics principles it is necessary to understand basic terminologies and fundamental concepts.

Alternative

- An alternative is a stand-alone solution for a given problem.
- We face alternatives in virtually everything we do.
- Examples-
  - Deciding the mode of transportation to work
  - Deciding on route choice to reach our destination
  - Departure time to work
  - Replace a bus or rehabilitate a bus
  - Rebuild a midblock or reconstruct
- Alternatives to a particular problem should always be comparable (*if needed they can be mutually exclusive*)

Evaluation Criterion

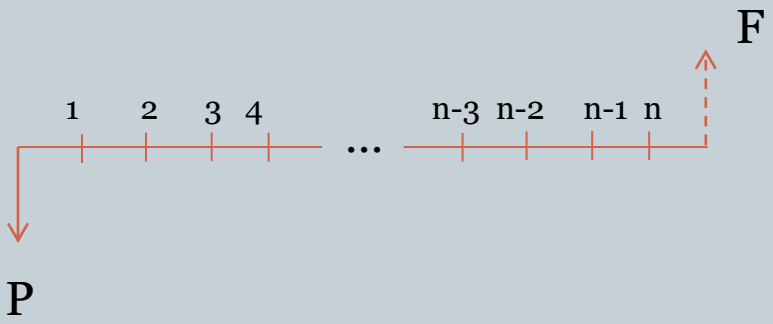
- In order to compare different methods for accomplishing a given objective it is necessary to have an evaluation criterion that can be used for judging alternatives.
- Example:
  - While driving to a destination we often consider the best route. How did we quantify the best route?
  - May be
  - travel time,
  - travel cost,
  - Distance
- In economics various criterion includes dollars, number of years or some intangible factors.

Time Value of Money

- When an alternative is quantified into dollars, it is imperative to recognize the time value of money.
- The change in amount of money over a given time period is called time value of money (one of the crucial concepts of economics).
- Manifestation of time value of money is termed as interest, which is a measure of the origin sum borrowed/invested; and the final amount owed or accrued.

Compound Amount (CA)

- Given- P, Find -F
- Other data given: n, I

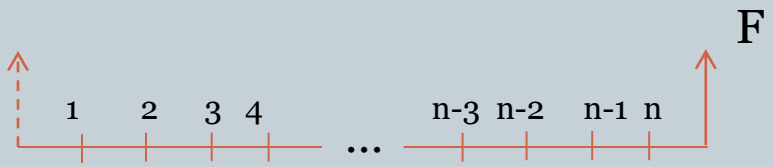


$$F = P(1+i)^n, \text{ where CA} = (1+i)^n$$

- Compound amount at the end of n periods.

Present Worth (PW)

- Given- F, Find -P
- Other data given: n, i

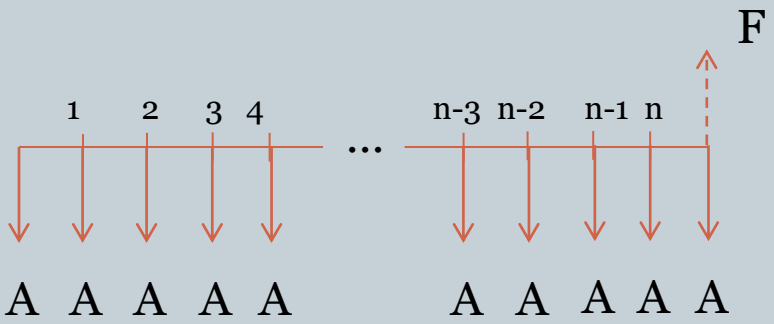


$$P = \frac{F}{(1+i)^n}, \text{ where PW} = \frac{1}{(1+i)^n}$$

Present worth of single sum to be withdrawn at the end of "n" periods in the future

Series Compound Amount

- Given-A, Find-F
- Other data given: n, i

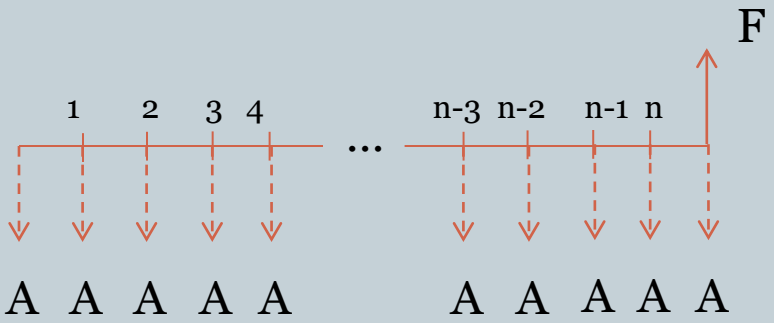


$$F = A\frac{(1+i)^n-1}{i}, \text{ where SCA} = \frac{(1+i)^n-1}{i}$$

Compound amount at the end of "n" periods to which a series of payments (A) of 'n' uniform deposits will accumulate.

Sinking Fund (SF)

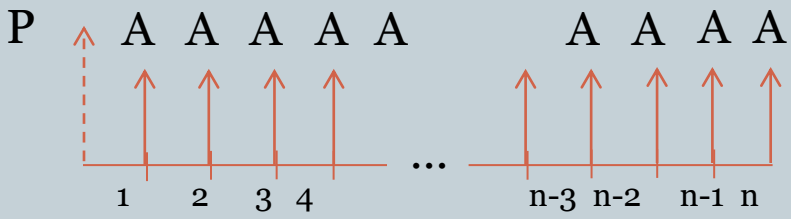
- Given-F, Find-A
- Other data given: n, i



$$A = F\frac{i}{(1+i)^n-1}, \text{ where SF}= \frac{i}{(1+i)^n-1}$$

Series Present Worth (SPW)

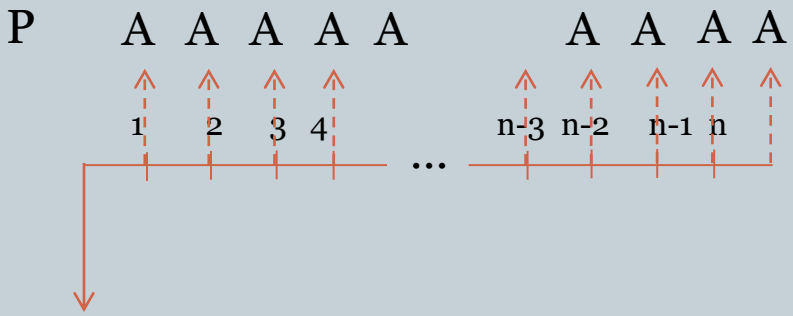
- Given-A, Find-P
- Other data given: n, i



$$P = A\frac{(1+i)^n-1}{i(1+i)^n}, \text{ where SPW}=\frac{(1+i)^n-1}{i(1+i)^n}$$

Capital Recovery (CR)

- Given-P, Find-A
- Other data given: n, i



$$A = P\frac{i(1+i)^n}{(1+i)^n-1}, \text{ where CR}=\frac{i(1+i)^n}{(1+i)^n-1}$$

Example-1

- $ 100 kept at 6% compound interest for 7 years, what will be the amount at end of 7 years?

  F = P(1+i)n

  F = 100(CA) *i,n*

  = 100(CA)*6,7*

  = 100 (1.5036)

  F = $ 150.36

- What will be the amount after 12 years, using 6% interest

  F = 100 (CA)*12,7* = 100(2.0121) = $ 201.21

Example-2

- $ 100 due in 7 years. What is its present worth?

  P = 100

  P = 100 (.6651)

  P = $ 66.51

- What is the present worth of a $100 bond after 12 years?

  P = 100

  = 100 (0.4970) = $ 49.70

Example-3

- Annual savings of $ 100 for 7 years at 6%?

  Future amount will be

  $F = 100(SCA)_{6,7}$

  $= 100 * 8.394 = \$839.38$

- What will be annual deposit that will accumulate to $100 at 6% after 7 years?

  $A = 100\ (SF)_{6,7} = 100\ (0.11914)$

  $A = \$\ 11.91$

Example-4

What is the present worth at 6% interest of $ 100 receivable each year for 7 years?

$$P = 100\,(SPW)_{6,7} = 100\,(5.582)$$

$$P = \$\ 558.20$$

Example-5

- A $100 initial fund that earns interest at 6% on its balance could be exactly paid out in 7 years

$$A = 100\,(CR)_{6,\,7}$$

$$= 100\,(0.17913)$$

$$A = \$\ 17.91$$