Transportation Economics and Decision Making
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.
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)*
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Present worth of single sum to be withdrawn at the end of “n” periods in the future
Given-A, Find-F

Other data given: \( n, i \)

\[
F = A \left( \frac{(1+i)^n-1}{i} \right), \text{ where } \text{SCA} = \left( \frac{(1+i)^n-1}{i} \right)
\]

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

\[ P = A \frac{(1+i)^n-1}{i(1+i)^n} \], 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?
  
  \[ F = P(1+i)^n \]
  \[ F = 100(CA) \cdot 6,7 \]
  \[ = 100(1.5036) \]
  \[ F = 150.36 \]

- What will be the amount after 12 years, using 6% interest
  
  \[ F = 100 \cdot (CA)12,7 = 100(2.0121) = 201.21 \]
Example-2

- $100 due in 7 years. What is its present worth?
  \[ P = 100 \]
  \[ P = 100 \times 0.6651 \]
  \[ P = $66.51 \]

- What is the present worth of a $100 bond after 12 years?
  \[ P = 100 \]
  \[ P = 100 \times 0.4970 \]
  \[ P = $49.70 \]
Example-3

- Annual savings of $100 for 7 years at 6%?
  Future amount will be
  \[ F = 100 \times (SCA)_{6,7} \]
  \[ = 100 \times 8.394 = \$839.38 \]

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

  \[ A = 100 \times (SF)_{6,7} = 100 \times 0.11914 \]
  \[ A = \$11.91 \]
What is the present worth at 6% interest of $100 receivable each year for 7 years?

\[ P = 100 \times (SPW)_{6.7} = 100 \times (5.582) \]

\[ P = 558.20 \]
Example-5

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

\[
A = 100 \ (CR)_{6,7} = 100 \ (0.17913) = $17.91
\]