Fundamentals of Engineering Exam Review

Engineering Economics

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Reviewing the Reference Handbook

- Goal: Compare funding alternatives over time
- Components:
  - Nomenclature & Definitions
  - Fundamental Equations
  - Cost Concepts
  - Interest Tables
- Vocabulary:
  - P: Present Value
  - F: Future Value
  - i: Interest compounded each period
  - n: Number of compounding periods
  - m: Number of compounding periods per year
  - Standard notation: (F|P,i,n)

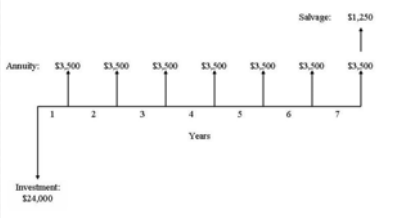
Interest Structures and Rates

- Simple
  - Interest paid out as earned
- Compound
  - Interest increased incrementally over time
  - 3 ways to represent, not always straight forward
    - Actual (i): rate associated with compounding period (use for calcs)
    - Nominal (r): annual rate w/o effects of compounding
    - Effective (i_e): effect of actual interest rate over a different period

$$i=r/m \qquad i_e=(1+i)^m-1$$

Cash Flow Diagrams

- Horizontal timeline
- Vertical cash-flow lines, direction depends on POV



Types of Payments

- Single Payments
  - Convert lump sums between present (P) and future (F) worth
- Uniform Series
  - Convert equal payments (A) to present (P) or future (F) worth
- Arithmetic Gradient
  - Convert periodic payments of increasing/decreasing amount (G) to present (P) worth
- Composite Flows
  - Convert combinations of these payments (P/F/A/G) to present (P) or future (F) worth

Using The Interest Factor Tables

- Tables save us from repeating the same calculations
- Steps:
  - Draw cash flow diagram
  - Identify what you are given and what you want to find
  - Select the correct relationship/equation
  - Fill out the symbolic notation
  - Match notation values to the interest factor tables
  - Pick correct value!

Rules for Using Fundamental Equations/ Tables

- The cash flow diagram you draw for the problem MUST match the fundamental cash flow diagram perfectly in order to use its equation
- If it doesn't, you need to make it fit!
  - Brute force
    - Treat all payments at P/F and convert to what you are looking for
  - Breakup
    - Separate payments into types and convert
    - Look for patterns- much faster!!

Net Worth Calculations

- Convert everything to a set timeframe
  - *Net present worth*
    - Convert all cash flows to an equivalent value at a time designated as the present ($t = 0$)
  - *Net annual worth*
    - Convert all cash flows to an equivalent uniform series spanning the time period: $t = 1$ through $t = n$
    - Inverse sign of equivalent annual cost

Benefit-Cost Ratio

- Ratio of NPW of benefits to NPW of costs
- Benefits may also include "disbenefits" (negative impacts)
- Compare two alternatives, or one alternative to the do-nothing alternative
- When BCR > 1 (or $\Sigma B - \Sigma C > 0$), accept the alternative

FE Examples

If a company wanted to make a single investment now instead of spending $20,000 five years from now, how much would the investment be at an interest rate of 10% per year?

a) $3,276 b) $5,276 c) $12,418 d) $32,300

A short-haul trucking company purchased a used dump truck for $12,000. The company paid $5,000 down and financed the balance at an interest rate of 10% per year for five years. The amount of its annual payment is nearest to:

a) $1,447 b) $1,846 c) $3,166 d) $4,346

A machine that has a five year life has a first cost of $50,000, an operating cost of $4,000 per month and a $10,000 salvage value. At an interest rate of 12% per year compounded monthly, the present worth of the machine is nearest to:

a) $83,285 b) $83,307 c) $60,000 d)$73,264

General Tips

- Don't be intimidated by the equations
  - You can solve most problems by finding the right equation
  - Pay attention to units
- Do as many practice problems as you can!
- Get to know the FE reference handbook.
  - Download a copy at: *http://www.ncees.org/Exams/Study_materials/Download_FE_Supplied-Reference_Handbook.php*
- When in doubt, work backwards!
  - Plug answers into the equations and see what works