Nominal and Effective Interest Rates
Payment Period ≠ Compounding Period
Mortgages and Car Loans
MARR and WACC
Present Worth and Annual Worth
Capitalized Cost
Cost Projects with Unequal Lives
Revenue Projects with Limited Capital
Internal Rate of Return
Modified Internal Rate of Return
Incremental ROR Analysis
Bond Yields
True Cost of a Loan
Benefit/Cost Ratio
Incremental B/C Analysis
Breakeven Analysis
Depreciation
Nominal & Effective Interest

Nominal Interest Rate
Example = APR
\[ r = i \times m \]

Effective Interest Rate
Example = APY
\[ i_e = (1 + i)^n - 1 \]
\[ PP \neq P \]

\[ \text{en sin (P A i n) etc} \]
\[ \text{i and n must be ree r t time} \]

\[ i_e = (1 + i)^n - 1 \]
Mortgages and arrears

Mortgage Payments
Payment = A of original loan amount

Mortgage Balance
Balance = P of remaining payments

Rest of a loan
Calculate IRR of cash flows
If project earns more than the MARR

If = project earns exactly the MARR

If project earns less than the MARR
Present value of project it at \( n = \infty \)

\[
(P|A, i\%, \infty) = \frac{1}{i}
\]

\[
(A|P, i\%, \infty) = i
\]
Revenue Projects

“Do Nothing” is an Option

Mutually Exclusive Projects
Choose the one project with the highest PW, FW or AW > 0

Independent Projects
Choose all with PW, FW, or AW > 0
Cost Projects

“Do Nothing” is not an Option

Mutually Exclusive Projects
Choose the one project with the
least negative PW, FW or AW
or the least positive E AC

Independent Projects
no such thing
Cost Projects with Unequal Lives

"Repeatability Assumption"

Study Period: LCM of Project Lives

Cash flows are replicated to fill the study period

Choose option with least negative AW or lowest EU AC
Revenue Projects with Limited Capital

1. Calculate the PW of each project

2. Eliminate all projects with PW < 0

3. Assemble remaining projects into possible bundles

4. Eliminate bundles whose initial cost exceeds the capital limits

5. Calculate the PW of each bundle as the sum of the PWs

6. Choose the bundle with the highest PW
Internal Rate of Return

The interest rate $i^*$ that makes the PW = 0 have to solve by trial and error:

- If PW > 0, increase your guess for $i^*$
- If PW < 0, decrease your guess for $i^*$

Bracket the interest rate and interpolate.
Modified Internal Rate of Return

1. Draw the net cash flow diagram
2. Compound all positive cash flows to Time $n$
3. Discount all negative cash flows to Time $0$
4. Solve for the external rate of return:
   $$F = P(1 + i')^n$$
Incremental RRRaisal sis

Start with lowest cost project which is

do nothing for revenue projects and
accept a more expensive project only if

$$\Delta i \geq M_{RR}$$
Yield to Maturity

Purchase price depends on the market value. Assume coupon rate, MRR, TM are all Rs. Coupons paid twice a year usually. Bond is redeemed for face value at maturity. TM is IRR of the cash flows.
True Cost of a Loan

True Cost  IRR of the cash flows
Benefit Cost Ratio

\[ \frac{B}{C} = \frac{PW}{PW} = \frac{AW}{AW} = \frac{FW}{FW} = \frac{CC}{CC} \]
Benefit/Cost Ratio

Conventional B/C = \frac{\text{Benefits} - \text{Disbenefits}}{\text{Capital Costs} + \text{O&M Costs}}

Modified B/C = \frac{\text{Benefits} - \text{Disbenefits} - \text{O&M Costs}}{\text{Capital Costs}}
n re ena B/C na sis

tart it o est ost ro e t ased on
t e deno inator of t e B/C for a and
a e t a o e e ensi e ro e t on if
\Delta B/C