Cost Indexes:
Cost at time A \( = \) Index value at time A
Cost at time B \( = \) Index value at time B

Power sizing:
Cost of asset A \( = \) \[\text{Size (capacity) of asset A} \times x\]
Cost of asset B \( = \) \[\text{Size (capacity) of asset B} \times x\]

Learning Curve:
\[T_N = T_{\text{initial}} \times N^b\]
\[b = \frac{\log(\text{learning curve rate})}{\log 2}\]

Simple Interest:
Interest earned on amount \( P : I = Pin \)
Maturity value: \( F = P(1+in) \)
i = interest rate per time period
n = number of time periods

Compound Interest:
\( F = P(1+i)^n \)
\( F \) = future value
\( P \) = present value
i = periodic interest rate
n = number of periods

Ordinary Simple Annuity:
\[ P = A \left[ \frac{1-(1+i)^{-n}}{i} \right] \]
\[ F = A \left[ \frac{(1+i)^n - 1}{i} \right] \]

Ordinary Geometric Gradient Annuity:
\[ P = A_i \left[ \frac{1-(1+g)^n}{i-g} \right] ; i \neq g \]
\[ F = A_i \left[ \frac{(1+g)^n - (1+i)^n}{i-g} \right] ; i \neq g \]

Ordinary Arithmetic Gradient Annuity:
\[ A_{eq} = G \left[ \frac{1 - n}{i(1+i)^n - 1} \right] \]
\[ P = G \left[ \frac{(1+i)^n - in - 1}{i^2(1+i)^n} \right] \]

Nominal, Periodic, Effective Interest Rates:
i = \( \frac{r}{m} \)
(1+i\text{eff}) \( = \) \( (1+\frac{r}{m})^m \)
r = nominal interest rate per year
m = number of compounding periods per year
i\text{eff} = effective interest rate (compounded annually)
i = periodic interest rate

Equivalent Interest Rates:
(1+i\text{p})^p = (1+i\text{c})^c
i\text{p} = interest rate for payment period
p = number of payment periods per year
i\text{c} = interest rate for compounding period
c = number of compounding periods per year

Ordinary General Annuity:
\[ P = A \left[ \frac{1-(1+i_p)^{-n}}{i_p} \right] \]
\[ F = A \left[ \frac{(1+i_p)^n - 1}{i_p} \right] \]
i\text{p} = interest rate for payment period
n = number of payment periods
P, F, A as above for annuities
Perpetual Annuities:

Ordinary: \( P = \frac{A}{i} \)

Due: \( P = \frac{A}{i} (1+i) = \frac{A}{i} + A \)

Geometric Growth: \( P = \frac{A}{i-g} ; i > g \)

\( P, A, i, g \) as above for annuities

Investment Criteria:

NPV = \[ CF_0 + \frac{CF_1}{(1+r)} + \frac{CF_2}{(1+r)^2} + \ldots + \frac{CF_n}{(1+r)^n} \]

NPV = net present value

NFV = \[ CF_0(1+r)^n + CF_1(1+r)^{n-1} + \ldots + CF_n \]

NFV = net future value

EACF = equivalent annual cash flow = \[ \frac{NPV}{1-(1+r)^{-n}} \]

\( CF_j \) = cash flow at time \( j \)

\( n \) = lifetime of investment

\( r = MARR \) = minimum acceptable rate of return

\( i = \text{IRR} \) = internal rate of return

\( PV(\text{neg CFs, } e_{\text{fin}})\times(1+i)^n = FV(\text{pos CFs, } e_{\text{inv}}) \)

\( i' = \text{MIRR} \) = modified internal rate of return

\( e_{\text{inv}} = \text{financing rate of return} \)

\( e_{\text{fin}} = \text{reinvestment rate of return} \)

Benefit - cost ratio, BCR = \[ \frac{PV(\text{positive cash flows})}{PV(\text{negative cash flows})} \]

Probability:

\( E(X) = \text{Weighted average} = \frac{w_1S_1 + \ldots + w_kS_k}{w_1 + \ldots + w_k} \)

\( w_i \) = weight for Scenario \( i \)

\( S_i \) = value of \( X \) for Scenario \( i \)

\( E(X) = \mu_X = \text{expected value of } X = \sum_{j} P(x_j)x_j \)

\( \text{Var}(X) = \text{variance of } X = \sum_{j} P(x_j)(x_j - \mu_X)^2 \)

\( P(x_j) = \text{Probability}(X = x_j) \)

Depreciation:

\( B = \text{initial (purchase) value or cost basis} \)

\( S = \text{estimated salvage value after depreciable life} \)

\( d_t = \text{depreciation charge in year } t \)

\( N = \text{number of years in depreciable life} \)

Book value at end of period \( t \): \( BV_i = B - \sum_{t=1}^{t} d_t \)

Straight-Line (SL):

Annual charge: \( d_t = (B - S)/N \)

Book value at end of period \( t \): \( BV_i = B - t\times d_t \)

Sum-of-Years’-Digits (SOYD):

\( \text{SOYD} = N(N+1)/2 \)

Annual charge: \( d_t = (B-S)(N-t+1)/\text{SOYD} \)

Declining balance (DB):

\( D = \text{proportion of start of period } BV \text{ that is depreciated} \)

Annual charge: \( d_t = BD(1-D)^{n-1} \)

Book value at end of period \( n \): \( BV_n = B(1-D)^n \)

Capital Cost Allowance (CCA):

\( d = \text{CCA rate} \)

\( UCC_n = \text{Undepreciated capital cost at end of period } n \)

Annual charge: \( CCA_n = B(d/2) \) for \( n = 1; \)

\( CCA_n = B(d/2)(1-d)^{n-2} \) for \( n \geq 2 \)

\( UCC \text{ at end of period } n: \ UCC_n = B(1-d/2)(1-d)^{n-1} \)

\( PV(\text{CCA tax shields gained}) = \left[ \frac{BdTC}{i+d} \right] \left[ \frac{1}{1+i} \right] \)

\( PV(\text{CCA tax shields lost}) = \left[ \frac{SdTC}{i+d} \right] \left[ \frac{1}{(1+i)^N} \right] \)

\( T_C = \text{firm’s tax rate}; \ i = \text{discount rate} \)

Investment Project Cash Flows:

Taxable income = OR–OC–CCA–I

Net profit = taxable income \times (1-T) \)

Before-tax cash flow (BTCF) = I+CCA+taxable income

After-tax cash flow (ATCF) = Net profit + CCA + I

\( = (\text{Taxable income})\times(1-T) + CCA + I \)

\( = (\text{BTCF} - I - CCA)(1-T) + CCA + I \)

\( = (\text{OR} - \text{OC})(1-T) + I(T) + CCA(T) \)

Net cash flow from operations

\( = \text{ATCF} - I - \text{DIV} \)

\( = (\text{OR} - \text{OC})(1-T) + I(T) + CCA(T) - I - \text{DIV} \)

\( = (\text{OR} - \text{OC} - I)(1-T) + CCA(T) - \text{DIV} \)

Net profit + CCA – DIV

\( \text{OR= operating revenue}; \ \text{OC= operating cost} \)

\( I= \text{interest expense}; \ \text{DIV= dividends}; \ T= \text{tax rate} \)

Net cash flow = Net cash flow from operations

\(+ \text{New equity issued} + \text{New debt issued} \)

\(+ \text{Proceeds from asset disposal} - \text{Repurchase of equity} \)

\(- \text{Repayment of debt (principal)} - \text{Purchase of assets} \)

Net capital investment = \[ B \left[ 1 - \frac{dITC}{i+d} \left[ \frac{1}{1+i} \right] \right] \]

Net salvage value = \[ S \left[ 1 - \frac{dITC}{i+d} \left[ \frac{1}{(1+i)^N} \right] \right] \]

Inflation:

\( (1+i') = (1+i)(1+f) \)

\( i' = i + f + (i)(f) \)

\( i = \text{market interest rate}; \ i' = \text{real interest rate} \)

\( f = \text{inflation rate} \)

Weighted Average Cost of Capital (WACC):

\( \text{WACC} = \frac{D}{V} \times (1-T_C) \times \frac{d}{i} + \frac{E}{V} \times i_e \)

\( V = D + E \)

\( D = \text{market value of debt}; \ E = \text{market value of equity} \)

\( V = \text{market value of firm} \)

\( i_d= \text{cost of (rate of return on) debt} \)

after-tax cost of debt: \( i_{td} = i_d(1-T) \)

\( i_e = \text{cost of equity} \)