Formulas

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Linear Interpolation

$y = y_1 + (\frac{y_2 - y_1}{x_2 - x_1})(x - x_1)$

Time Estimate

TE = (a+4m+b)/6

Labour Cost

To calculate direct labour cost just multiply all the values together.

Power-Sizing Model

$\frac{SizeofA}{SizeofB} = (\frac{CapacityofA}{CapacityofB})^x$

where:

- x is the power size index
- Size is often cost
- Capacity is often weight, or price index

Learning Curve

T_N=$T_1 X^b$

where:

- T_N is the time needed to produce the Nth unit
- T_1 is the time needed to produce the 1st unit
- X is the number of units(total produced)
- b=$\frac{\log(learningrate)}{\log(2)}$

Project Control

Terminology

- **BCWS/PV** : Budgeted Cost of Work Scheduled / Planned Value
- **BCWP/EV** : Budgeted Cost of Work Performed / Earned Value
- **ACWP/AC** : Actual Cost of Work Performed / Actual Cost
- **BAC** : Budget at Completion
- **CV** : Cost Variance
  - positive means under budget

    - negative means over budget
- **CPI** : Cost Performance Index
    - greater than one means under budget
    - smaller than one means over budget
- **SV** : Schedule Variance
    - positive means ahead of schedule
    - negative means behind schedule
- **SPI** : Schedule Performance Index
    - greater than one means ahead schedule
    - smaller than one means behind schedule
- **ETC** : Estimated cost to completion
- **EAC** : Estimated cost at completion

Note that EV and PV will be at the same value only if the project is completed.

Earned Value

EV, PV

- EV = %Work Completed x BAC
- PV = %Work Scheduled x BAC

Evaluating Factors

Cost

- CV = EV - AC
- CPI = EV/AC

Schedule

- SV = EV - PV
- SPI = EV/PV

Revised Budget and Schedule

Estimated Cost to Completion (Revised Budget)

- *typical inefficiency* ETC = (BAC - EV) / CPI
- *atypical inefficiency* ETC = (BAC - EV)

EAC = ETC + AC

Revised Schedule

revised duration = planned duration/SPI

Time Value of Money

Nominal vs Effective Interest

- Nominal interest rate(APR) **(r)** : rate per year + Usually per year and we don't use this for calculations.

- Effective interest rate(EAR) i_a : rate per year factoring in compound
    - $\frac{r}{m}$

- Could be months, days, whatever the fuck.

- i_a=$(1+\frac{r}{m})^n$–1
- where m is the number of compounding periods and r is the interest rate per period.

- n is the compounding periods to come up with the compounding period for the EAR (can be m).

Simple Interest

F=Pn(1+in)

where:

- F is the new amount
- P is the inital amount
- i is the interest rate
- n is the number of units

Compound Interest

F=P(1+i)^n

where:

- F is the future amount
- P is the initial amount
- i is the interest rate
- n is the number of units

1>3 * 3>4 = 1>4

Compound Factors

Future Value of P

F=P(1+i)^n=P(F/P,i,n)

Future Value of $1

$\frac{F}{P}$=(1+i)^n

Present Value of F

P=$\frac{F}{(1+i)^n}$

Present Value of $1

$\frac{P}{F} = (1+i)^n$

Value of annuity

$F = A[1 + (1+i) + (1+i)^2 + ...(1+i)^{n-2} + (i+1)^{n-1}]$

or simplified

$F = \frac{A[(1+i)^n - 1]}{i}$

where

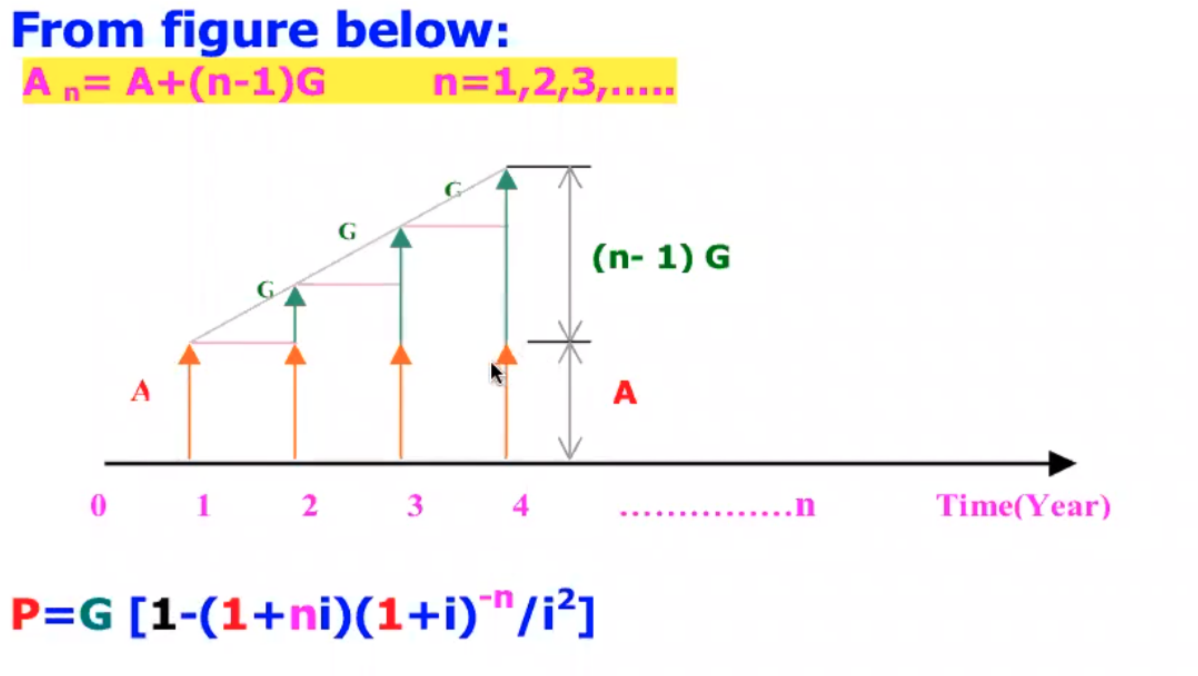
- A is the anual installment

- F is the future value
- n is the number of years * i is the interest rate

Never-ending Annuity

$P = \frac{A}{i}$

Arithmetic Gradient Series of Cash Flows



better formula using table vals

P=A($\frac{P}{A}$,i%,n)+G($\frac{P}{G}$,i%,n)

A=G($\frac{A}{A}$,i%,n)+G($\frac{A}{G}$,i%,n)

can also be A/G ??? for arithmetic gradient *uniform* series

Geometric Gradient Series

If i != g

P = $A_1 \frac{1-(1+g)^n(1+i)^{-n}}{i-g}$

If i = g

P = A_1 [n ÷ (1 + i)]

where:

- P is the present worth
- r is the interest rate
- g is the growth rate
- n is the time period
- A_1 is the [initial] annual payment

Capitalized Cost

Capitalized cost(P) is the sum of money needed to forever obtain exactly the payment amount needed(A) forever at a particular interest rate(i).

Capital Recovery Formula (Annual Cash Flow - Salvage)

- EUAC = P(A/P, i, n) – S(A/F, i, n)

OR

- EUAC = (P – S)(A/F, i, n) + Pi

OR

- EUAC = (P – S)(A/P, i, n) + Si

Infinite analysis

P=A/i

($\frac{A}{P}$,i,infinity) = i

Present Worth analysis NPW(Net Present Value)

NPW = the present value at t=0 lmao

- when doing NPW analysis we choose the plan with the **MAX** NPW
- **ALWAYS** choose a GCM analysis period!

Annual cash flow analysis

- No need to find an equal analysis period

Rate of Return (IRR)

Interest rate when annual benefits are equivalent to annual cost.

- EUAB = EUAC

or

Interest rate when PW = 0.

- If i gives a result to high go down and vice versa

Rate of Return(IRR) between two plans

- Compute $EUAB_{A-B}$ with an i to reach 0

Incremental Analysis

- Means of comparing different invenstements based on IRR.

For incremental IRR choose alternative with higher initial cost if IRR > MARR

For **Aya's Method**:

- Order projects from left to right most expensive to least

- start comparing pairs from the right
- if the delta IRR is greater than MARR than the more expensive project is better and the losers should be elimenated
- continue until there is a winner

Benefit-Cost Ratio Analysis

EUAB/EUAC > 1 then accept otherwise reject

deltaEUAB/deltaEUAC < 1 then pick the trailer otherwise the leader

Depreciation

$BV_t = BV_{t-1} - D_t$

$D_t = BV_{t-1} - BV_t$

$BV_t = BV_0 - \sum_{i=1}^{t} D_t$

Straight-Line Depreciation

$d_1 = (B - S)/N$

where: * B is the BV_0 * S is the salvage value * N is the useful life of the asset

Sum Of Years Digits Depreciation (SOYD)

$d_t = \frac{N-t+1}{SOYD}(B - S)$

where:

- d_t is the depreciation charge in any year t
- N is the number of years in depreciable life
- SOYD = N(N+1)/2 is sum of year's digits
- B is the cost of the asset made ready for use
- S is the estimated salvage value after depreciable life

Declining Balance

Normal Declining Balance

$BV_t = B(1 - d)^t$

$d = 1 - n\sqrt{\frac{S}{p}}$

where:

- d is the depreciation % rate
- **that's an nth root buster**

Double Declining Balance

$d_t = (\frac{2}{N})(BV_{t-1})$

where:

- BV is Book Value

CCA (Capital Cost Allowance) rate

$UCC_t = UCC_{t-1} - CCA_t$

$CCA_t = dUCC_{t-1}$

$UCC_t = B(1 - d/2)(1 - d)^{n-1}$

- as long as n > 1

where:

- UCC is BV aka Book Value (CRA Terminology)
- CCA is the depreciation amount
- d is the depreciation rate

Note: You are only allowed to claim 50% of your depreciation on year 1!