L6 APSC221 - Comparison Methods 2 - IRR

Internal Rate of Return

Underlying: What is the required profit?

The return of an investment in a project is known as the internal rate of return (IRR)

IRR: PW and AW = 0

1. Is internal, meaning it only covers the project's cash flow; not other things
2. For the IRR to exist, both the benefits and costs must be defined

IRR Calculation

Determine interest rate i s.t. the PW of the cash flows is zero

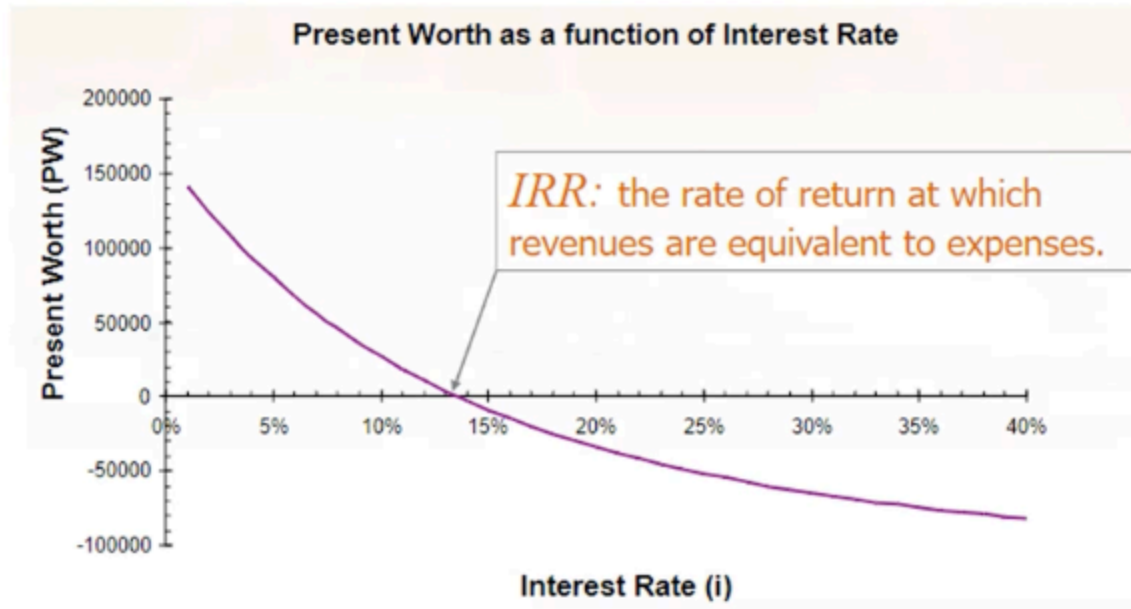$$PW = 0 = \Sigma(R_t - D_t)/(1+i)^t$$

with limits t = 0 to T
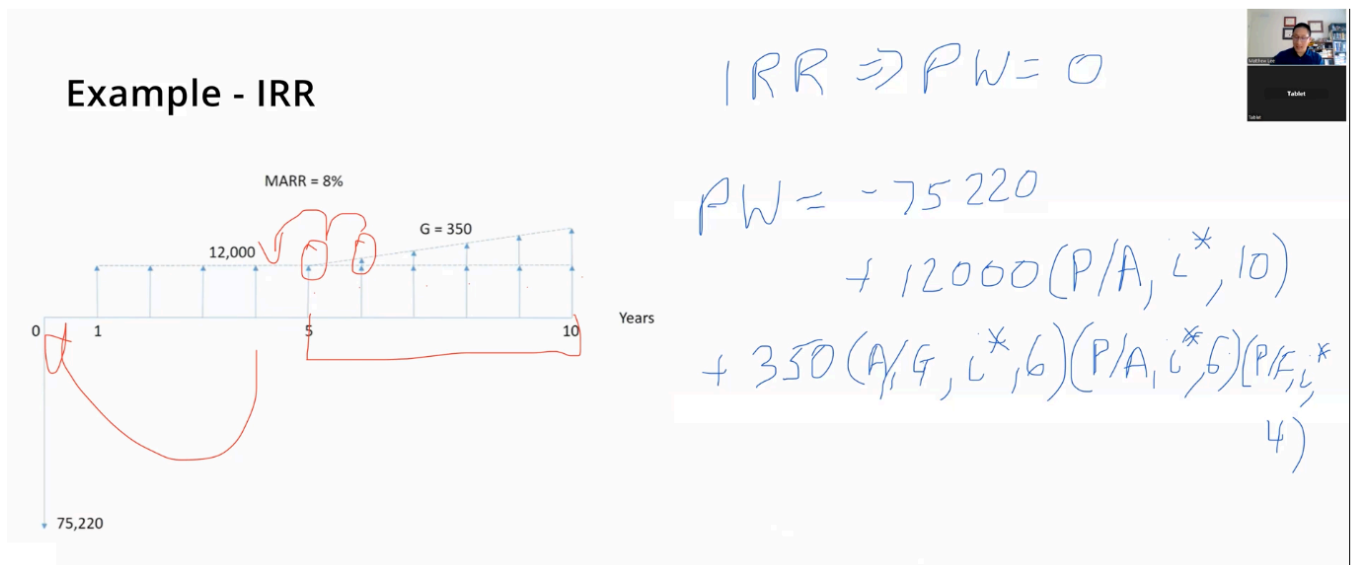
s.t.
R = Receipts (positive CF)
D = Dispersements (negative CF)

When graphed, IRR is a function, and its y-intercept is when PW = 0 (PW is on the y-axis)

$$PW = 0 = \sum_{t=0}^{T} \frac{R_t - D_t}{(1 + i^*)^t}$$

Present Worth as a function of Interest Rate

IRR: the rate of return at which revenues are equivalent to expenses.

In practice, IRR is solved on excel.

Example - IRR

$IRR \Rightarrow PW = 0$

$PW = -75220$

$+ 12000 \left(P/A, i^*, 10 \right)$

$+ 350 \left(A/G, i^*, 6 \right) \left(P/A, i^*, 6 \right) \left(P/F, i^*, 4 \right)$

If IRR is higher than MARR, then the cash flow is viable rather than do-nothing option.

Multiple IRRs

But, calculating IRR with an even-number polynomial will result in two asymptotes, thus two IRRs.

If cash flows change from positive to negative often, calculating IRR will be impossible due to multiple IRR results.

This adds one more assumption:

The sequence of cash flows can have only 1 sign change between positive and negative cash flows.

Evaluation for ME Projects

Highest IRR is not as simple to determine.

Process:

1. Sort the projects from the lowest to highest **first cost** and start with it as your current best option
2. Challenge the current best option with the next costlier project from the list
3. Determine if the incremental investment has an IRR > or equal to MARR
   a. If yes, replace the current best option with the challenger
   b. If no, repeat Step 2