Lecture 16

Review
Exam Topics
Incremental Rate of Return

If you are going to pick only one alternative from several,

- Need to compare them against each other! (based on differences in cost)
- Not only against the base rate of return $i^*$

Need to evaluate each incremental investment to see if it is worthwhile
Incremental Rate of Return

Possible mistakes:

- Highest IRR is not necessarily best
  - Another project with a "larger investment" might yield a larger total benefit!
- Project with largest initial investment is also not necessarily best

But we know that options with IRR \(< \text{i}^*\) will *never* be chosen!
Incremental Rate of Return

- If $i^* < \text{IRR of (B - A)}$, then:
  - Option B is better
- If $\text{IRR of (B - A)} < i^* < \text{IRR of A}$:
  - Option A is better
- (Assuming that $i^* < \text{IRR of A}$)
Benefit/Cost Analysis

- How to calculate conventional and modified benefit/cost ratios
- Know when a project is desirable:
  - Benefit/cost ratio greater than 1
- Option with highest benefit/cost ratio is not always best:
  - Need to do incremental benefit/cost analysis to choose the best option
Payback Period

- How to calculate crude payback
- Why it should not be used for choosing projects
- How it can be used
Breakeven Analysis

Find the value of a variable at which an alternative breaks even:
- So that its benefits equal its costs

Find the value of a variable at which two alternatives are equal
Depreciation

- Straight-line depreciation
- Declining-balance depreciation:
  - Especially double declining balance
- MACRS depreciation:
  - Using a lookup table!
Retirement and Replacement

Know how to determine the economic service life:
- Annual equivalent cost is minimized

Know when to replace equipment if the annual equivalent cost of the replacement is:
- Higher
- Lower than cost of the current equipment
Retirement and Replacement

Remember to treat the current market value of the defender as:

■ An opportunity cost of keeping it
■ Not a benefit of selling it!
Example with Different Lifetimes

- **Use annual equivalent**

- **Annual equivalent of current pump:**
  - Annual expenses $2,000/year
  - $700 (A/P, 18%, 10) = $156/year
    - This is a *cost* of keeping the current pump
    - We don’t get it unless we sell!
  - Total = $2,156/year
Different Lifetimes (continued)

- Annual equivalent of replacement:
  - Annual expenses $1,100/year
  - $3,400 (A/P, 18%, 20) = $635/year
  - Total = $1,635/year

- Is it better to replace the pump?
- If we considered the $700 as a benefit of the new pump:
  - It would be annualized over 20 years
  - *Even though it lasts for only 10 years!*
Example

- Equipment is 2 years old
  - Purchased for $25,000
- Assume \( i^* = 15\% \) (before tax)
- Resale value = $13,000 today
  - $10,000 in 1 year
  - $7,500 in 2 years
  - $5,500 in 3 or more years
Example

- Based on the *outsider viewpoint* (opportunity cost, *not cash flow!*), keeping the equipment is the same as buying it used for $13,000.

- Assuming operating costs are the same as for new equipment:
  - Can safely ignore in comparison!
**Example**

- Compare alternative lifetimes
- **Cost of keeping for 1 year:**
  - $13,000 (A/P, 15%, 1) = $14,950
    - This is a *cost* of keeping the equipment
    - You don’t get it unless you sell!
  - **Year 1 salvage value** = -$10,000
  - **Total** = $4,950
    - *(in year 1 dollars!)*
Example

Cost of keeping for 2 years (given that I am keeping it for 1 year):

- $10,000 (A/P, 15%, 1) = $11,500
- Year 2 salvage value = -$7,500
- Total = $4,000

*(in year 2 dollars!)*
Example

Cost of keeping for 3 years (given that I am keeping it for 2 years):

- $7,500 (A/P, 15\%, 1) = $8,625
- Year 3 salvage value = -$5,500
- Total = $3,125

(in year 3 dollars!)
### Example

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<thead>
<tr>
<th>Year</th>
<th>&quot;Cash flow&quot;</th>
<th>Discounted</th>
<th>Discount rate</th>
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<tr>
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<td>4304</td>
<td>0.15</td>
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<tr>
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</tr>
<tr>
<td>3</td>
<td>3125</td>
<td>2055</td>
<td></td>
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</tbody>
</table>

Present worth:
- Year 1: 4304
- Years 1 and 2: 7329
- Years 1, 2, 3: 9384

Annual equivalent:
- (already in year 1 dollars): 4950
- \(7329 \cdot (A/P, 15\%, 2)\) = 4508
- \(9384 \cdot (A/P, 15\%, 3)\) = 4110

What is the best option?

- Keeping for 3 years has *lowest cost*.