Lecture 13

Accounting and Depreciation

Reasons to know accounting

- Explain engineering economic studies
- Obtain cost data
- Understand income tax
  - Understand *depreciation!*

Accounting statements

- Balance sheet:
  - Static picture of assets at a single point in time
- Profit and loss statement:
  - Also called "income statement"
  - *Change* in value of assets over time

Reasons for retirement

- A better alternative exists
  - (e.g., a new model of computer)
- Needs have changed
- The equipment has deteriorated
- The equipment has been damaged
  - As a result, there is a *typical distribution* for time until retirement

Definitions of value

- Market value
  - (There may be no market for some items!)
- Value to owner
  - Generally greater than market value
  - May be less than new replacement cost
- *Book value* of asset in accounts
  - (Related to capital gain or loss)

Meanings of depreciation

- Decrease in value
- Degraded functionality
- Difference in value between this item versus a new replacement
- *Amortized (e.g., annualized) cost:*
  - Remaining "book value" = non-amortized cost
  - Note that this definition is based on *initial cost*
    - *Not* on the item's current value!

Capital versus expense

- Consider a copy shop, which buys:
  - Ink and paper
  - Xerox machines
- Ink and paper are used up when they are bought (for all practical purposes):
  - Treated as an expense
  - When company buys/uses $1000 of paper,
    - It is $1000 *poorer* (not counting any revenue)!

Capital versus expense

- Xerox machines are used up only slowly over time:
  - Treated as "capital goods"
  - When company buys a $1000 machine,
    - It trades $1000 cash for $1000 in equipment
    - *Not poorer at all!* (assets just changed form)

Example

- Equipment rental business:
  - Starts with $50K initial investment
  - Purchases tools for $35K
- Balance sheet in year 0:
  - *Assets* *Liabilities*
  - Cash $15K
  - Tools $35K Investor $50K
    - $50K $50K (note totals are equal)

Example

- In 1st year:
  - Revenues $46K
  - Expenditures $30K
  - Difference (profit) $16K:
    - Cash $6K
    - Accounts receivable $10K

Example

- Balance sheet in year 1:
  - *Assets* *Liabilities*
  - Cash $21K
  - Owed $10K Capital $50K
  - Tools $35K Earnings $16K
    - $66K $66K (totals still equal!)

Example

- What's wrong with this picture?
  - Tools are wearing out!
- If tools have lifetime of 5 years, then:
  - *Assets* *Liabilities*
  - Cash $21K
  - Owed $10K Capital $50K
  - Tools $28K Earnings $9K
    - $59K $59K (totals still equal!)

Example

- If tools have lifetime of 5 years, then:
  - *Assets* *Liabilities*
  - Cash $21K
  - Owed $10K Capital $50K
  - Tools $28K Earnings $9K
    - $59K $59K (totals still equal!)
- Note that earnings are down by $7K:
  - Not owed to investor, use to replace tools!

Example

- Profit and loss sheet for year 1:
  - Revenue $46K
  - Losses $37K
    - Operating expenses $30K
    - Depreciation $7K
  - Profit $9K
- (In reality, we would also need to account for income taxes)

Example

- First cost ("unadjusted basis"):
  - $35K
- Recovery period *("allowable lifetime"):*
  - 5 years
    - (May not be related to actual lifetime)
- Depreciation rate:
  - 20%

Example

- Observations:
  - $28K is the *book value* of the tools:
    - Not necessarily the same as their market value
  - $7K depreciation involved *no cash flow!*
  - Profit depends on depreciation life, method
    - Same thing goes for asset value (“book value”)
  - Depreciation methods are *conventions*
    - Not based strictly on market value!

Meanings of capital gain/loss

- If I sell an asset for more than its book value:
  - *Capital gain*
- If I sell an asset for *less* than its book value:
  - *Capital loss*
- Capital gains may be taxed at different rate than other income:
  - To encourage investment?

Example

- If at the end of 1 year
  - I go out of business and sell my tools for $30K,
  - How much capital gain (or loss) do I have?
- If at the end of 5 years
  - I go out of business and sell my tools for $5K,
  - How much capital gain (or loss) do I have?
- Note that book value may be 0 even when market value is positive!

Extreme example

- Book value may have *no* relationship to market value
- In the nuclear power industry:
  - Plants cost on the order of $2 billion to build
  - Remaining book value may be $1.5 billion
  - Market value may be only $100 million!
  - Difference is *"stranded assets"*
    - Utilities may recover some of this from ratepayers!

Salvage value

- If a salvage value is *expected,*
  - Depreciation applies to first cost *- salvage*
- Example:
  - If I expected $5K salvage value in year 5,
    - I would depreciate $30K over 5 years
      - (only $6K per year)
  - Ending book value would be $5K
    - No capital gain/loss unless salvage value differs

Depreciation and taxes

- Depreciation is treated as an expense
  - (i.e., a *tax deduction*)

  in computation of income taxes
- It is a *fictitious* expense!
  - No cash changes hands
- Would you rather have that expense occur sooner or later?

Accelerated depreciation

- Depreciation methods are *conventions*
  - Not based strictly on market value!
- With *accelerated depreciation*,
  - Depreciation expenses happen sooner than with straight line depreciation
- Income tax liability is reduced early on,
  - Greater in future years
    - This is beneficial due to *time value of money!*

Review

- We learned the concepts of:
  - Depreciation
    - *Straight line*
    - *Accelerated*
  - Book value
  - Capital gain or loss
- We saw how to apply these ideas in a simple business