Competition Grading

- Grade worth 15% of total.
- Grade = [100(60-T) + 75(T-14)]/(60-14)
  - » T=team's best time
  - » NOTE: Used 60 seconds as baseline
  - » Nonfinishers use T=60 (none this time!)

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Competition Results

- Best time: 14.4 seconds
  - » Team 1
    - – Gregg Andrews
    - – Michael Barefield
    - – David Cai
    - – Josh Harbison
    - – Jason Knight

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Final Design Presentation

- 20 minutes max
- Every team member speaks
- 10% of grade
  - » team component -- overall presentation
  - » individual component -- individual delivery

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Financial Engineering

- Recent feedback from E&CE Industrial Advisory Board:

"Every E&CE graduate needs to understand engineering economics."

- Important part of professional engineer license -- *Fundamentals of Engineering* exam
- INSY 3600 – Engineering Economy

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Financial Engineering

- Accounting
  - » Recording and summarizing financial transactions
  - » Cost accounting
- Engineering economy
  - » Economic analysis used to make decisions that have effects on current and future financial transactions

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Economic Decision-Making

- If and when should a piece of equipment, facility, or process be replaced?
- Is one machine or process more economical than another?
- Is a specific product profitable in the long-run?
- Which products should be stored in inventory and where?

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Accounting

- Asset = anything of monetary value
- Liability = debt that the company owes
- Net worth = ownership interest in the company = capital stock + retained earnings
- Revenue = income due to the sale of a product or service
- Expense = expenditure for operations

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Accounting

- Balance sheet
  - Assets, liabilities, net worth
- Income statement
  - Revenues, expenses, net profit

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Cost Accounting

- Fixed costs (overhead)
  - » Equipment, facility, tooling
  - » Usually allocated to products based on percentage of variable costs
  - » Activity Based Costing
- Variable costs
  - » Direct material
  - » Direct labor

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Cost Accounting Example

- Part A (a PC motherboard) requires:
  - » one hour of labor @ $40/hr.
  - » $50 in parts.
- Part B (a PDA device board) requires:
  - » 0.2 hours of labor @ $40/hr.
  - » $35 in parts.
- Both parts use the production machinery costing $80,000,000 50% of the time.
- 50,000 of Part A and 200,000 of Part B are made.

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Variable Costs

- Part A:
  - » $50+$40=$90 per part
  - » 90*100,000 = $9M total variable cost
- Part B:
  - » 0.2*($40)+$35=$43 per part
  - » 43*500,000 = $21.5M total variable cost

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Fixed Costs

- Usual approach is % allocation of variable costs:
  - » Part A % = (Part A variable)/(Total variable) = 29.5%
  - » Part B % = (Part B variable)/(Total variable) = 70.5%
- Fixed costs on this basis:
  - » Part A = 0.295*$80M = $23.6M
  - » Part B = 0.705*$80M = $56.4M
- This is not a very good estimate of actual cost, since both parts use the machine 50%.

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Activity-Based Costing

- Allocate costs based on actual use:
- In the previous example, split the fixed cost of the machine 50/50, since both parts use the machine equally:
- Total costs:
  - » Part A = $9M + $40M = $49M
  - » Part B = $21.5M + $40M = $61.5M

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Unit Costs

- Unit cost = Total cost/ # of units
  - » Part A unit cost = $49M/100,000 = $490
  - » Part B unit cost = $61.5M/500,000 = $123
- There are some tricky aspects of this -- what if machine had to be purchased for one part regardless?

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Time Value of Money

- P = present value
- F = future value
- A = total payment spread evenly over n years
- i = annual interest rate (rate of return)
- n = number of years

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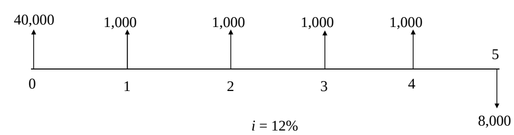
Cash Flow Diagram



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Time Value

- Single-payment compound amount

$$F = P(1+i)^n$$

- Present value of a future cash flow

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

- Would you rather have $100 today or $100 next year?

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Example

- Rate of return is 12%; time horizon is 5 years:

  1. Current manual process costs 10,000 per year.
  2. Machine A costs 30,000 to purchase with 2,000 per year operating cost. Salvage value at the end of five years is zero.
  3. Machine B costs 40,000 now and 1,000 per year to operate. At the end of 5 years it will be worth 9,000.

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Example

- Simply adding up the cash flow values for each alternative is not a valid comparison.
- Need to convert all dollars to same time for valid comparison.
- Usually convert to present value (PV).

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Example

- Alternative 1: Net Present Value (NPV)

$$\begin{aligned}&+0\\&+10{,}000/(1.12)\\&+10{,}000/(1.12)^2\\&+10{,}000/(1.12)^3\\&+10{,}000/(1.12)^4\\&\underline{+10{,}000/(1.12)^5}\\&\ \ 36{,}048\end{aligned}$$

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Example

- Alternative 2: Net Present Value (NPV)

$$\begin{aligned}&+30{,}000\\&+2{,}000/(1.12)\\&+2{,}000/(1.12)^2\\&+2{,}000/(1.12)^3\\&+2{,}000/(1.12)^4\\&\underline{+2{,}000/(1.12)^5}\\&\ \ 37{,}210\end{aligned}$$

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Example

- Alternative 3: Net Present Value (NPV)

$$\begin{aligned}&+40{,}000\\&+1{,}000/(1.12)\\&+1{,}000/(1.12)^2\\&+1{,}000/(1.12)^3\\&+1{,}000/(1.12)^4\\&+1{,}000/(1.12)^5\\&\underline{-9{,}000/(1.12)^5}\\&\ \ 38{,}498\end{aligned}$$

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Example Comparison

Alternative	Cash Flow	NPV
1	50,000	36,048
2	40,000	37,210
3	36,000	38,498

- Conclusion: Alternative 3 has the best cash flow but the worst NPV. *Choose #1.*

Excel File

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Excel's Financial Functions

- FV( )
- NPV( )
- PV( )
- PMT( )

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