

**ENGR 301 Engineering Management Principles and Economics  
Tutorial 9**

**Please bring a copy of this to your tutorial.**

1. Two devices are available to perform a necessary function for 3 years. The initial cost for each device at time zero and subsequent annual savings produced by the device are shown in the table below. If the required interest rate is 8%, determine which device should be purchased using present worth analysis?

Year	0	1	2	3
Device A	-\$9,000	\$4,500	\$4,500	\$4,500
Device B	-\$14,500	\$6,000	\$6,000	\$8,000

2. Assets  $A_1$  and  $A_2$  have the capability of satisfactorily performing the required function.  $A_2$  has an initial cost of \$3200 and an expected salvage value of \$400 at the end of its 4-year economic life cycle. Asset  $A_1$  costs \$900 less initially, with an economic life 1 year shorter than that of  $A_2$ , but it has no salvage value and its annual operating costs exceed those of  $A_2$  by \$250. When the required rate of return is 15%, which alternative is preferred using present worth analysis when compared by:
  - a. The least common-multiple method
  - b. A 2-year study period (assuming the assets are needed for only 2 years)?
  
3. While in college Candice received \$10,000 in student loans at 5% interest. She will graduate in June and is expected to begin repaying the loans in either 5 or 10 equal annual payments. Compute her yearly payments for both repayment plans.
  
4. What uniform annual payment for 12 years is equivalent to receiving all of these at an interest rate of 8%:
  - \$3000 at the end of each year for 12 years
  - \$20000 today
  - \$4000 at the end of 6 years
  - \$800 at the end of each year forever
  - \$10,000 at the end of 15 years
  
5. A land surveyor just starting in private practice needs a van to carry crew and equipment. He can lease a used van for \$3,000 per year, paid at the beginning of each year, in which case maintenance is provided. Alternatively, he can buy a used van for \$7,000 and pay for maintenance himself. He expects to keep the van three years at which time he could sell it for \$1,500. What is the most he should pay for uniform annual maintenance to make it worthwhile buying the van instead of leasing it, if his Minimum Attractive Rate of Return (MARR) is 20%?

6. The town of South Battleford is considering building a bypass for truck traffic around the downtown commercial area. The bypass will provide merchants and shoppers with benefits that have an estimated value of \$500,000 per year. Maintenance costs will be \$125,000 per year. If the bypass is properly maintained, it will provide benefits for a very long time. The actual life of the bypass will depend on factors such as future economic conditions that cannot be forecast at the time the bypass is being considered. It is therefore reasonable to model the flow of benefits as though they will continue indefinitely. If the interest rate is 10%, what is the present worth of benefits minus maintenance costs?
  
7. A mechanical engineer has decided to introduce automated materials-handling equipment for a production line. He must choose between two alternatives: building the equipment or buying the equipment off the shelf. Each alternative has a different service life and a different set of costs.

Alternative 1: build custom automated materials-handling equipment

First cost:	\$15,000
Labour:	\$3300 per year
Power:	\$400 per year
Maintenance:	\$2400 per year
Taxes and Insurance:	\$300 per year
Service life:	10 years

Alternative 2: buy off-the-shelf standard automated materials-handling equipment

First cost:	\$25,000
Labour:	\$1450 per year
Power:	\$600 per year
Maintenance:	\$3075 per year
Taxes and insurance:	\$500 per year
Service life:	15 years

If the interest rate is 9%, determine which alternative is better using both Present Worth and Annual Cash Flow Analysis.