

**MSCI 261 Engineering Economics: Financial Management for  
Engineers  
Spring 2014**

**HW 4**

**Due: Friday, 25 July before 5 p.m. Place hard copy in drop box; soft copy to Learn.**

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**Textbook - Chapter 9**

**Ch9 1 (8 marks).** With increased population in Waterloo area, some city officials proposed to build a new library next to the Columbia Lake. However, others are against the proposal, and instead suggested to upgrade the existing library in the Uptown. The following table shows the benefits and costs of these two mutually exclusive options.

	Option A (new library)	Option B (upgrading library)
Improved service/year	\$130,000	\$100,000
Road maintenance cost/year	\$30,000	\$40,000
Construction cost	\$900,000	\$400,000
Increased house value	\$200,000	\$0

The MARR is 10%, and the time horizon of this project is 20 years. Which option should be selected?

**Ch9 Q2 (14 marks).** A construction company is considering buying one of two types of heavy construction equipment (A and B). Each type of equipment is expected to have a 5-year useful life with zero salvage value. Equipment A can be purchased at a cost of \$30,000, and Equipment B would cost \$55,000. The net cash flows for each type of equipment are given below.

Year	A	B
0	-30,000	-55,000
1	6,000	24,000
2	6,000	10,000
3	12,000	21,000
4	6,000	-7,000
5	25,564	26,610

- (a) Using the payback period approach, determine which type of equipment the company should purchase. (Please use Excel to answer this.)
- (b) Assuming the interest rate is 12%, use the benefit cost ratio approach to determine which type of equipment the company should purchase.

**Ch9 Q3 (10 marks).** Two mutually exclusive projects (A and B) are under consideration.

Year	Project A	Project B
0	-\$5,000	-\$9,000
1	\$2,750	\$1,000
2	\$2,750	\$3,000
3	\$2,750	\$5,000
4	\$2,750	\$7,000
5	\$2,750	\$9,000

- (4 marks).** Which project should be selected if the *payback period method* is used to make the decision?
- (3 marks).** Which project should be selected if PW were used, given a 15% interest rate?
- (3 marks).** Explain any differences in results.

## Textbook - Chapter 11

**Ch11 Q1 (8 marks).** WatCon Construction Co. had purchased several machines during the last few years. Its first asset was a tow truck purchased in 2005 for \$60,000. In 2007, it purchased a van for \$20,000. A second tow truck was bought in 2010 for \$50,000. What was the value of their UCC at the end of 2011, given a CCA rate of 30% for all the equipment? Construct a full table from 2005 till 2011 to derive the UCC value of 2011. You need to fill out all the cells in the table and explain the calculation step.

**Ch11 Q2 (16 marks).** A company is considering buying a new machine out of two different models. The MARR is 10%.

	Model I	Model II
First cost	\$80,000	\$100,000
Salvage value	20,000	25,000
Annual operating costs	18,000 throughout the service life	15,000 from year 1 through 10, and 20,000 from year 11 through 25
Service life (years)	20	25

- Assuming sum-of-years digits depreciation, what book value will Model I have after three years?
- Assuming double-declining balance depreciation, what depreciation and book value will Model II have after 7 years?
- For Model I, what salvage value (S) must have after 20 years in order for the equivalent uniform annual cost to be \$26,500?

**Ch11 Q3 (18 marks).** WatCon Construction Co. had purchased several machines and furniture during the last few years. It purchased a manufacturing machine in 2008 for \$120,000. In 2010, it purchased office furniture for \$40,000. In 2011, it sold an old machine for \$60,000 and bought a new machine for \$80,000 and a new furniture for \$20,000. What is the value of their UCC at the end of 2012? The CCA rate for machine is 30% and the rate for furniture is 20%. Construct a full table from 2008 till 2012 to derive the UCC value of 2012. You need to fill out all the cells in the table and explain the calculation step.

Year	Adjustment (machine)		Base UCC		CCA		Remaining UCC		Total UCC
	Machine	Furniture	Machine	Furniture	Machine	Furniture	Machine	Furniture	
2008									
2009									
2010									
2011									
2012									

**Ch11 Q4 (15 marks).** Tom and Associates bought earth moving equipment at a cost of \$160,000 (with a CCA rate of 30%). The salvage value of the equipment is estimated to be 20% of the initial cost at the end of the useful life of 8 years Determine the depreciation and book value for this asset at the end of years 2 and 4 using the

- (5 marks).** Sum-of-years'-digits (SOYD) method
- (5 marks).** Double declining balance (DDB) method
- (5 marks).** Capital Cost allowance (CCA) method

**Ch11 Q5 (10 marks).** Your accountant has sent you the table below showing annual depreciation charges for an asset by five methods. Unfortunately, his fax machine left out the cost and salvage value of the asset (which apparently has a five year life period) and the column headings. Determine which column is: straight line, sum-of-years digits, 150% declining balance, double declining balance, and units of production. First cost (P) minus salvage value (S) is \$10,000. Calculate the first cost and salvage value.

Year	A	B	C	D	E
1	\$4,500	\$2,000	\$3,333	\$2,500	\$6,000
2	3,150	2,000	2,667	1,500	3,600
3	2,205	2,000	2,000	3,000	400
4	145	2,000	1,333	1,000	0
5	0	2,000	667	2,000	0

## Replacement Analysis

**Problem 1:** An existing machine is worth \$2500 today and will lose \$1000 in value next year and \$500 for each of the following 3 years, at which time it will have zero salvage value and will be scrapped. Operating costs for the next year are estimated at \$8000, and are expected to increase by \$1000 per year for each of the following 3 years.

A new, improved machine that performs the same function as the existing machine can be purchased for \$16 000 and is expected to have annual operating costs of \$6000 to the end of its service life, 7 years. At that time the machine will have a salvage value of \$1500. Depreciation is straight line and no improvements in design are foreseeable. There is an ongoing need for the services the machine offers. The MARR is 12%. Should the existing machine be replaced? If so, when?

**Problem 2:** An office copier was purchased 2 years ago for \$700. At the time of the purchase, it was believed that the machine would have an economic life of 5 years and a salvage value of \$100 (straight line depreciation). Operating costs over the first 2 years for material, labour and maintenance, have averaged \$4200 per year and are expected to continue at the same level. Some type of copier will be needed for the foreseeable future.

The same company that manufactured the presently used copying machine has a new model which costs \$1000 but will perform the current workload with operating costs of \$3500 per year. They are offering \$500 for the old model as a trade-in on the new machine. The expected salvage value for the new model is \$200 at the end of 10 years (straight line depreciation).

Another company has a different type of copier which is available only on a lease basis. The company claims that leasing their copier at \$750 per year will reduce the operating costs of the present amount of work to \$2750 per year. Since they do not accept trade-ins, the machine now in use would have to be sold in the open market, where it is expected to bring only \$250.

If the MARR is 10%, should the defending copier be replaced by one of the challengers? Why or why not?

**Problem 3:** A grinder was purchased 3 years ago for \$40 000. It has provided adequate service, but an improved version is now available for \$35 000 which will reduce operating costs and cut inspection expenses. Costs and salvage values for the two machines are shown below. The required rate of return is 15% and the services of a grinder will be needed for only 4 more years.

a) What are the replacement alternatives?

b) Should a replacement be made? If so, when?

Year	Defender		Challenger	
	Op. costs	Salvage value	Op. costs	Salvage value
0		\$12 000		\$35 000
1	3400	7000	200	30 000
2	3900	4000	1000	27 000
3	4600	2500	1200	24 000
4	5600	1000	1500	20 000
5			2000	17 000
6			2600	15 000

**Problem 4:** Modified Internal Rate of Return

Two projects have the following cash flows:

Year	Project A	Project B
0	-5000	-3000
1	3000	-2000
2	6000	6000
3	-1000	8000
4	2000	1000

Using a MIRR analysis, which is the preferred project if the MARR is 6%? Use the IRR comparison approach (i.e. look at the incremental investment), but use a MIRR computation when there may be multiple IRRs.