

Engineering Economics and Problem Solving, 4N4, 2014

Tutorial/Assignment 3

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This tutorial (your third assignment) has one main goal: dealing with depreciation, taxes and evaluating profitability of a project.

Question 1 [5]

An evaluation of your group's log book will be made.

- Is the log book up to date?
- Have you had regular meetings and recorded minutes?
- Who is the chair for the next assignment?

We continue to improve and build these professional skills during the 4N4 course.

Question 2 [0]

Read [this article in the Globe and Mail](#) about purchasing a car. Think and plan how you might apply what you have learned in this course to that case study.

- Which 4 alternatives are being evaluated?
- Are the alternative independent or mutually exclusive?
- What information is required for each alternative's NPV calculation?
- Which other intangible and unquantifiable aspects are influencing Victoria Hoffman's decision in the article?

Question 3 [6]

Calculate the values, and plot them, for

- the book value,
- and depreciation written off each year

for a cooling system upgrade (consists of two pumps and a heat exchanger) that cost \$500,000 to purchase, \$60,000 to ship and rough-in, and \$250,000 to finalize the piping and instrumentation. The lifetime is expected to be 9 years.

Only show detailed calculations for the first two periods; paste the final calculated values in the document however for the remaining periods.

Question 4 [12]

A company is planning on building a plant today for the cost of \$1,500 with capacity of 1350 tons/year. The cost of operating the plant is \$0.50 per ton of product, the sales price is \$1.50 per ton. We can assume we would sell everything we produce. The plant is also easy to setup and can start operating right away, since it uses off-the-shelf components that are easily assembled. The company's MARR is 10%, indicating we are in a relatively risk-free, low-tech sector.

The market department has forecasted these **demands** for the product:

Year	2014	2015	2016	2017	2018
Market demand (tons per year)	600	800	1000	1350	1350

Your task: show calculations to calculate the NPV of all cash flows from 2014 to 2018. Also calculate the DCFRR and determine if this is a worthwhile investment. Use rounded values, and note that all numbers here refer to \$000's of dollars.

Question 5 [18]

You are operating a subsidiary company in Tianjin and investigating the production of a speciality chemical which is currently being imported. Annual production capacity would be 2000 tonnes. Specialized reactors are available from France at a cost of € 20 million (EUR). An additional ¥ 800 million (CNY) is estimated for installation, shipping, and the cost of all other units around the separation step. There are royalties payable to a Canadian company that is licensing the patents, technology and concepts used in the flowsheet. Their license fee is CAD 5.30 per tonne of product produced.

The cost to build, test and start the plant will be equally spread out over 12 months, and production starts in the 13th month. The plant however will only operate at 40% capacity for one year, then 80% for the next year, then 100% after that. The raw materials are available in China, at a cost of CNY ¥ 500 per tonne of product. Utilities are about CNY ¥ 150 per tonne, and salaries and labour costs are CNY ¥ 7 million per year.

Working capital costs to get started: catalysts, supplies, etc will be ignored for this question.

Corporate income taxes in China can be assumed at 22% per annum, depreciation is allowed on the declining balance method at 30%. Assume their tax law is similar to Canadian law, for the purposes that are relevant to this economic analysis.

If the expected plant life is 10 years, what is the **price per kilogram** that the product should be sold for in order to break even in the final year of operation? Comment and interpret this value you have calculated.

Report your analysis to the Canadian parent company, in CAD. Their MARR is 25% for projects that are based in China.

Bonus: list the uncertain factors which you expect to have the greatest impact on your result. How might you investigate these uncertainties quantitatively?

Question 6 [10]

Parents want to save for their child's university tuition by writing a cheque for the same amount each year. They have 16 full years to save for their child's education. Assume they can invest this money and earn 6% interest, compounded annually.

In the 17th, 18th, 19th, 20th and 21st year they wish to receive cheques which are worth \$17,000 in today's money, as they figure this is what their child will require, based on today's university tuition, food and accommodation rates. A reasonable value to use for the inflationary cost of education is 4% annually.

The parents will save this money in an RESP.

1. What is an RESP? Give a short sentence or two in your own words.
2. Explain why there are two percentages: 6% and 4%? (What is each one's purpose in the calculation?)
3. What is the annual amount the parents must deposit into the RESP?

Question 7 [6]

This question follows on with the Kappa number analyzer, we covered in class. Complete a table for 5 years of the product's life time, except assume the profit from the device is \$23,000, instead of \$20,000 stated in class. For this revised profit calculate:

1. The payback time
2. The cumulate NPV at the end of 5 full years of operation
3. The DCFRR, and compare it to the company's MARR of 8%.

Extra work to help understand depreciation's effect on a company (not required to submit this): repeat these 3 calculations under a hypothetical scenario where the government does **not allow any depreciation** on the value of the equipment; however they do allow you to write off the complete capital expense off as an eligible expense, in the period where you incur the expense.

Present your answer with these 3 profitability metrics side-by-side and comment on the differences in the results.

END