# Engineering Economics and Problem Solving, 4N4, 2013

# 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? Has the chair position been rotating (everyone must get a chance to be chair twice)? These are professional skills which we need to work on to develop.

### Question 2 [12]

Parents want to save for their child's university tuition by writing a cheque for the same amount each year, for a total duration of 16 years. Assume they can save this money at 6% interest, compounded annually.

In the 17th, 18th, 19th, 20th and 21st year they wish to receive cheques which are worth $16,000 in today's money, as they figure this is what their child will require, based on today's university tuition and board 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 doing to the calculation?)
3. What is the annual amount the parents must deposit into the RESP?

### Question 3 [6]

Calculate and plot the book value and depreciation written off each year for a heat exchanger that cost $200,000 to purchase, $50,000 to ship and rough-in, and an additional $150,000 to finalize the piping and instrumentation. The lifetime is expected to be 9 years.

### Question 4 [12]

For the question started in class on Friday, 20 Sep 2013, on the Kappa number analyzer. Complete the table for the 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 15%.

Now repeat these 3 calculations under a hypothetical scenario: the government does not allow any depreciation on the value of the equipment; however they do allow you to write off the capital expense as an eligible expense, but only 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.

**Question 5 [12]**

Evaluate the NPV and DCFRR for the following case: a company purchases a second-hand jacketed reactor at a cost of $450; site preparation is $80, engineering planning, safety and hazard analysis, and installation is $500 and lasts a year. Once started, we expect to operate the reactor for 10 years. The salvage value is expected to be $0 in the final year.

Based on today's rates we could make a net revenue of $205 per year in today's money, but we will inflate the revenue by 5% each year, based on historical market trends for the product. Also major maintenance is expected in the 6th year of full operation, at a cost of $100, (also estimated in today's dollars, so use an inflation rate of 5% to inflate it to future dollars).

The company's MARR is 15%. All figures are in $1000's of dollars.

Calculate the payback time, NPV and DCFRR. From now on in the course you **must always** assume tax and depreciation are required, unless explicitly specified otherwise.

**Question 6 [15]**

You are operating a subsidiary company in Argentina 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 the Netherlands at a cost of € 20 million (EUR). An additional ARS $ 170 million is estimated for installation, shipping, all other units. Royalties are payable to a Canadian company that is licensing the necessary patents, know-how and flow sheet. This license fee is CAD 3.50 per tonne produced.

It is expected that all expenses to build and start the plant will be evenly spread over 24 months (just split the capital cost evenly over 2 years, no TVM), with production starting in the 25th month. The plant will operate at 50% capacity in the first year of operation, then at 75% per year, then at 90% per year, then at 100% capacity for all subsequent years.

The main raw material can be obtained very cheaply in Argentina, which is why you are building the plant here for which the cost is ARS 250 per tonne of final product. Utility and other costs are expected to be around ARS 90 per tonne final product. Salaries and other labour costs are estimated at ARS 3 million per year.

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

Corporate income taxes in Argentina can be assumed at 30% per annum, depreciation is allowed on the declining balance method at 32%. 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?

Report your analysis to the Canadian parent company, in CAD. Their MARR is 25%.

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

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