

ECE 472F – Engineering Economic Analysis & Entrepreneurship

Problem Sets

Note: Solutions for these problem sets are available on Blackboard. Suggested practice problems from the textbook are listed in the course outline and should be completed prior to attempting these problem sets.

PROBLEM SET # 1 (suggested completion date: October 2nd, 2015)

Question 1

Kingston Hydro has two electric power generation plants that it operates to provide electricity to its customers. Engineers at Kingston Hydro have collected the following cost data on its two plants:

	Annual Fixed Costs	Variable Costs	Maximum Capacity (MW-hr/year)
Plant 1	47 000 000	$0.8x^{1.5}$	132 000
Plant 2	38 000 000	$1.1x^{1.5}$	180 000

where x represents the yearly electrical output of each plant measured in megawatt-hours (MW-hr). Kingston Hydro currently produces 200 000 MW-hr per year to meet the demand of its customers.

- (a) What is the most economic division of power production between the two plants?
- (b) In a few sentences, explain why your recommendation in Part (a) is the most economic.
- (c) The demand for power is expected to increase by 40%. How should power be produced now and what is the marginal cost at the new power production level? For full credit, be sure to explain the steps in your solution procedure in a couple of sentences.
- (d) A nearby hydro utility, Hydro Quebec, appears to have surplus generating capacity as it has offered to sell power to Kingston Hydro. The contract for this year is as follows:

\$475.00 per MW-hr up to 100 000 MW-hr.

What would be the most economic operating point at the increased level of demand in Part (c)? How much power should Kingston Hydro purchase from Hydro Quebec? For full credit, be sure to explain the steps in your solution procedure in a few sentences.

- (e) What is the marginal cost at the new operating point that you have recommended in Part (d)?

Question 2

Canadex Laboratories is a leading manufacturer with extensive product lines of pharmaceutical grade health care products including all-natural vitamins, minerals, botanicals, and high-quality health supplements. Its natural health supplements line has been selling well and engineers at Canadex have developed improvements to the company's manufacturing process that will improve the range of supplements that can be produced. The design team is requesting \$10 000 000 from the company's capital budget. Economic analysis on the engineering team's project proposal has determined a rate of return on investment of 14.1%.

Canadex would raise the required funding by using 30% debt and 70% equity. The vice president of finance says that experience has shown that this is the optimal debt-equity ratio for Canadex. The VP's plan for raising the required funding is as follows:

1. \$1 000 000 would be borrowed from the company's bank at an annual rate of 6%.
 2. The remainder of the debt would be raised by selling bonds which would pay bondholders 10% per year.
 3. The equity portion of the financing would be raised by selling shares to new investors. Shares are currently trading at \$25.00 which should return 14% per year to shareholders.
- (a) How many shares should be sold and what is the total value of the bonds that should be issued?
- (b) What is Canadex's annual percentage cost of debt?
- (c) What is Canadex's annual percentage cost of capital?
- (d) Should Canadex go ahead with this project? Justify your recommendation.

Question 3

As a sideline, John buys used classic automobiles and restores them hoping to make a substantial profit as classic cars have become quite popular. John has just purchased a 1968 Corvette which he believes he can restore. He paid \$10 000 for this used car and is expecting to spend \$16 000 in repairs and restoration. Since old Corvettes are popular, he expects to fetch \$50 000 for the restored Corvette. But after spending \$20 000 on the restoration, the Corvette is still not ready for sale. It needs around another \$25 000 in repairs to make it "showroom quality". That is the only way that he will get "top dollar" for the car. He is fed up with wasting money on this project and one of his friends has offered him \$7 500 to take it off his hands. He is tempted to do so because even if he restores it completely, his \$50 000 sale price estimate was too optimistic. With the recent downturn in the economy, he is likely only to get \$40 000 for it.

What is your recommendation to John? Be sure to justify your recommendation with an appropriate financial analysis and explanation using the most appropriate engineering economic principles.

Question 4

At the beginning of the year, you invest in three companies A, B, and C, purchasing a quantity of shares in each as specified below.

Company	Shares Purchased	Share Price
A	100	\$42.00
B	200	\$18.50
C	50	\$76.00

Now, a year later, the company's annual results have been released so you know the profits earned. The board of directors of some of the companies has opted to declare a dividend. Assume that earnings not paid out as dividends are retained as cash.

Company	Earnings per share (EPS)	Dividend declared
A	\$ 4.20	\$ 3.00
B	\$ 2.22	\$ 0.00
C	\$ 6.50	\$ 4.00

Ignore taxes in your analysis. (We will get to that later in Chapter 5.)

- (a) Assuming the company's valuation (intrinsic value of the business) remains otherwise the same for the next year, what should be the stock prices after the dividends are paid?
- (b) At the end of the year, which company has provided the best return on your investment? Why?
- (c) Explain how a company can be still attractive to investors while not paying a dividend.
- (d) Explain how a company can pay out a dividend in excess of its earnings. Explain why it might be attractive to a company not to pay out dividends.

Question 5

Now suppose you are the 50% owner of a successful small business valued at \$600,000 from which you and your partner are both currently drawing a salary of \$80k. Last year, the company's total profit was \$60k and you expect next year's revenue and expenses to be the same (except for changes in salary). You and your partner are discussing what to do with profits next year, having identified the following three options:

- (a) Increase both of your salaries to \$100k for next year and pay the rest out in dividends
- (b) Maintain salary as-is but pay all profits out in dividends
- (c) Increase both salaries to \$90k and pay out 50% of profits as dividends

Ignoring taxes, which option most increases your wealth? Justify your answer.