

ECE 472F - PROBLEM SET # 4 (suggested completion date: November 13th, 2015)

1. Back to School

For this problem, ignore taxation. In real life there would be tax credits for tuition paid and progressive taxes payable on increasing income. You can assume that salary cash flows are received at end of year.

Bob, age 45, is an engineer in the middle of his career and is contemplating taking an MBA because he believes it will increase his earnings over the rest of his career (to age 65). His current after-tax salary is \$90,000 per year and he estimates that it will increase by 3% annually if he continues as-is.

His current employer will permit him to take a two-year unpaid leave to complete the MBA program full-time starting September 1 of this year. Tuition of \$25,000 is due at the beginning of each academic year, and living expenses remain the same whether he works or not. After graduation, he expects his after-tax salary will be \$100,000 and increase by 4.5% annually instead of the previously-forecast 3%.

He and his spouse Alice own a home worth \$600,000 with a mortgage of \$150,000 outstanding, due for renewal also on September 1st. They also have \$100,000 invested in their retirement account, split between 75% stocks and 25% bonds (average return 6.25%).

GoC 5yr bond yield ¹	2.1%
GoC 10yr bond yield	2.9%
GoC 20yr bond yield	3.4%
GoC 30yr bond yield	3.6%
Average corporate bond yield	4.5%
Rate on A&B's current 5-year mortgage	5.5%
Market rate for 5-year mortgage	4.0%
Expected return on stocks	7.0%

- Assume that Alice is willing and able to support Bob's living expenses and their mortgage out of her income but cannot cover tuition costs. What options are available for financing the tuition costs? Which would you recommend and why?
- What are the costs of returning to school? (Include opportunity costs and direct costs.)
- Discuss an appropriate discount rate for Bob to use when evaluating this decision economically. (There is no unique correct answer, so pick a value and justify it.)
- Using your chosen discount rate, what would be the Net Present Value (at Sept 1) of the decision to take a leave from work and pursue the degree?
- What is the IRR of taking the degree if Bob's cost and benefit projections are correct?
- Suppose Bob receives an inheritance of \$50,000. Does that change your analysis?

¹ Government of Canada bonds.

2. Car Purchase or Lease

Having graduated from engineering school, you now have a job where you need a car to get to work. You are able to invest your money at 6% after tax, a rate which exceeds the interest on your student loan and any other debts.

There are three options that you're considering:

- I) Buy a new car worth \$30,000 by paying \$3,000 down and \$550 per month for 60 months, then sell it after 7 years.
- II) Lease a new car for 48 months for zero down payment and \$400 per month.
- III) Buy a three-year-old used car for \$15,000 cash (which you have available), then sell it after five years.

For both the purchase and lease options, you can assume that no major repairs are needed since the vehicles are still under warranty. General operating costs (oil changes, gas, insurance, etc.) can be assumed equivalent for all options. The used car, however, will require occasional maintenance, which you project at \$1,500 per year at the end of year 1 and increasing by 20% annually.

Assume vehicles decrease in value by 15% annually, except for the new car in the first year, which drops by 40%.

Which option is optimal from an economic point of view?

3. Project Evaluation

You are in the process of allocating next year's capital budget of \$90 million. A number of proposals have been put forward and estimated, some of which are mandatory. The firm has a cost of capital of 10%.

Consider EOY 0 to be the capital cash flow and all subsequent flows are profit/loss (not capital). Cash flows are zero for years 5+.

Project	EOY 0	EOY 1	EOY 2	EOY 3	EOY 4
A1	-60	20	25	30	20
A2	-70	20	25	40	25
B	-40	12	12	12	12
C1	-20	-10	-10	-10	-10
C2	-30	-5	-5	-5	-5

Project A1 and A2 are mutually exclusive alternatives for implementing Project A.

C1 and C2 are two alternatives for pollution-control equipment that is required by a new law, one of which must be implemented to bring the firm into compliance.

- (a) Compute the payback, discounted payback, NPV, and IRR of each alternative (if applicable).
- (b) Choose which project(s) should be pursued within the given budget and justify your choices.
- (c) Suppose the capital budget was expanded to \$140 million. What would you change?