Carleton University
Department of Civil and Environmental Engineering
ECOR 3800 A

Assignment 2

Release Date: May 26th
Due Date: June 2nd
Submission: in designated filing cabin.

Question 1

An organization is considering the purchase of new machines to automatically conduct some quality control tasks. The machines are expected to save production cost which is given below as Annual Income. The machines are expected to be part of the production process for 5 years. The company has a minimum attractive rate of return (MARR) of 8.0%. The following data is available for these new machines:

Alternative	Initial Cost	Annual Income	Annual Operation and Maintenance costs	Salvage value
A	$28,000	$9,000	$950	$5,000
B	$65,000	$16,000	$1,200	$7,500
C	$40,000	$12,500	$1,100	$6,500
D	$35,000	$9,000	$1,000	$2,200

a] Calculate the Net Present Worth (NPW) and Internal Rate of Return (IRR) of each alternative.
b] Using incremental IRR analysis, rank the four alternatives based on economic feasibility.
c] Use benefit-cost analysis to rank the four alternatives based on economic feasibility.

Question 2

In Question 1, Assuming that this company has only $70,000 to invest now, it is required to select the most economically feasible alternative or group of alternatives. If cash is remaining and cannot be allocated to any alternative, you can assume that it will be invested in buying bonds. The details of these bonds are as follows:

- Face value of each bond is $1,000
- Bond rate is 9%.
- Bond maturity is 5 years after purchase.
- Bond revenues are received every quarter.

You can use the NPW values to make a comparison between different alternatives. Assume that the company possesses the same MARR but, unlike Question 1, compounding is *daily*. Therefore, you may need to revise all calculations from Question 1 to take into account this new compounding information. You can buy more than one bond. However, you cannot invest in one particular alternative twice (*e.g.*, you cannot have two instances of alternative A).

Question 3

A company is considering replacing an existing machine (defender) with newer machine (challenger). If repaired, the defender can be used for another 5 years. The current market value of the defender is $7,000 (*i.e.,* it can be sold now for $7,000). The defender will have a negligible salvage value after 5 years. If kept, the defender will require an immediate $1,500 overhaul. The operating cost of the defender is $2,200 during the first year which will increase 45% per year every year after the overhaul. Future market values are expected to decline by 35% per year.

The new machine (challenger) has a service life of 7 years. It will cost $10,000 to purchase now. Its annual operation and maintenance cost is $2,000 per year in the first year. This annual operation and maintenance cost will increase by 40% per year for subsequent years. The market value of the challenger will decline by 25% every year over its service life*. Use MARR equals 10%.*

a] Find the economic life of [*i*] the defender and [*ii*] the challenger.
b] Determine when the defender should be replaced.

Question 4

Consider the following project's after-tax cash flow and the expected annual general inflation rate during the project period:

End of Year	Cash flow in Constant Dollars	Expected annual inflation
0	-$60,000	
1	$25,000	4.1%
2	$25,000	4.9%
3	$35,000	6.2%

a] Provide three possible theories for how inflation occurs.
b] Determine the average annual general inflation rate *over* the project period (3 years).
c] Convert the cash flows from constant (real) dollars into equivalent current (actual) dollars with the base year being the present (denoted as end of year 0).
d] If the annual real interest rate is 8%, what is the present equivalent of the cash flow? Is this project acceptable on economic grounds?