Engineering Economic Analysis Homework #1
Fall 2024

Instructions:

Please attempt every problem. You must support every solution with an appropriate amount of work and/or description. Unsupported answers may receive a score of 0. Good luck!

1. Decide if the following statement is True or False.

   (a) Based on the discounted cash flow rules, one can add or subtract money at different points in time since money holds its value over time.
   False +2

   (b) If a set of investment alternatives contains all possible choices that can be made, then the set is said to be Collectively exhaustive.
   True +2

   (c) Risks and returns are generally not correlated.
   False +2

   (d) Answering "what if" questions with respect to an economic analysis is an example of the step of Performing supplementary analysis in the systematic economic analysis technique.
   True +2

   (e) If a student's time value of money rate is 10%, then the student would be indifferent between \$100 today and \$110 in 1 year.
   True +2

   (f) The weighted average cost of capital (WACC) is usually used as a lower bound for the minimum attractive rate of return (MARR).
   True +2

2. Wylie has been offered the choice of receiving \$5,000 today or an agreed-upon amount in 1 year. While negotiating the future amount, Wylie notes that he would be willing to take no less than \$5,700 if he has to wait a year. What is his TVOM in percent?
   Solution:
   Assume his TVOM is r, then

   $$5000(1+r) = 5700 \Rightarrow r = 0.14 = 14\%.$$

   Hence his TVOM in percent is 14%. +5

3. RT is about to loan his granddaughter Cynthia $20,000 for 1 year. RT's TVOM, based upon his current investment earnings, is 8%. Cynthia's TVOM, based upon earnings on investments, is 12%. Should they be able to successfully negotiate the terms of this loan? If so, what range of paybacks would be mutually satisfactory? If not, how far off is each person from an agreement?
With the given information, we have

   - Step 1: Determine the Minimum Amount RT Wants to Receive After 1 Year: As the lender, RT wants to receive a payment that compensates for his 8% TVOM. That is, he wants to receive at least, in a year,

$$FV_{RT} = 2000(1 + 0.08) = 21600.$$

+4

   - Step 2: Determine the Maximum Amount Cynthia is Willing to Pay After 1 Year. Cynthia values money at a 12% TVOM, meaning she would be willing to pay up to the future value that is equivalent to $20,000 today, adjusted by her TVOM.

$$FV_C = 20000(1 + 0.12) = 22400.$$

+4

   - Step 3: Determine the Acceptable Range. RT, as the lender, wants at least $21,600, and Cynthia, as the borrower, is willing to pay up to $22,400. Thus, the acceptable range of the loan repayment after 1 year is:

$$[\$21,600,\ 22,400].$$

+4

   Yes, RT and Cynthia should be able to successfully negotiate the terms of the loan. The repayment amount can be any value between $21,600 and $22,400. For instance, they might agree on a repayment amount of $22,000, which would satisfy both of their TVOM requirements. +2

4. If your TVOM is 15% and your friend's is 20%, can the two of you work out mutually satisfactory terms for a 1-year, $3,000 loan? Assume the lender has the money available and neither of you wants to go outside your acceptable TVOM range. Be explicit about who is lending and what is the acceptable range of money paid back on the loan.
Solution:

- Step 1: Identify who is lending and who is borrowing.
  The lender is the person with a lower TVOM rate and The borrower is the person with a higher TVOM rate. Hence, You would be the lender, lending $3,000 to your friend. +2
- Step 2: Calculate the minimum acceptable repayment amount for you (the lender).

$$FV_{you} = 3000(1 + 0.15) = 3450.$$

  You would need to be repaid at least $3,450 after 1 year. +4
- Step 3: Calculate the maximum acceptable repayment amount for your friend (the borrower).
  Your friend wants to repay no more than what they value the money in the future.

$$FV_{friend} = 3000(1 + 0.20) = 3600.$$

  Your friend is willing to repay up to $3,600 after 1 year. +4
- Step 4: Determine the acceptable range of money paid back on the loan.
  Since you need to receive at least $3,450 and your friend is willing to repay up to $3,600. Hence the acceptable range of money is

$$[\$3,450,\ \$3,600].$$

  +4

5. Three proposals (P, Q, and R) are available for investment. Exactly one or two proposals must be chosen; Proposals P and Q are mutually exclusive. Proposal R is contingent on Proposal P being funded. List all feasible mutually exclusive investment alternatives.
   Solution:
   All possible combinations are

$$P, Q, R, PQ, PR, QR, PQR.$$

   With the restrictions, all feasible mutually exclusive investment alternatives are listed below:

   - P, Q;
   - PR.

   +5

6. Suppose you have been out of school and gainfully employed for 5 years. You have three alternatives available for investment with your own money. Each has some element of risk, although some are safer than others. Following is a summary of the alternatives, the risks, and the returns:

Alternative	You Invest, $	Chance of Success	Returned to You if Success, $	Chance of Failure	Returned to You if Failure, $
A	$100,000	95%	$110,789.47	5%	$95,000
B	$100,000	60%	$150,000.00	40%	$50,000
C	$100,000	20%	$510,000.01	80%	$10,000

(a) Which one would you select and why? (It is totally your choice. It is not a right or wrong question.) +6

(b) Of the ten principles, which one(s) is(are) well illustrated by this problem?
The following principles are illustrated:

1: Money has a time value.

2: Make investments that are economically justified.

3: Choose the mutually exclusive investment alternative that maximizes economic worth.

9: Risks and returns tend to be positively correlated.

+4

(c) Of the systematic economic analysis technique's 7 steps, which one(s) is(are) well illustrated by this problem?
The following techniques are illustrated:

1: Identify the investment alternatives.

4: Estimate the cash flows.

5: Compare the alternatives.

6: Perform supplementary analyses.

7: Select the preferred investment.

+5