IE2111 ISE Principles & Practice II
Assignment #4
Due: 12 March 2024, 5 pm

You may use Excel or any computing tools for your calculations, but you must explain or show relevant formulas or equations in your solutions. Submit your completed assignment anytime into the Drop Box outside the ISEM Department Office at E1A-06-25, or to the professor at the end of the lecture.

Two mutually exclusive investment projects are being considered by a company. Data for the base (most likely) values for the two alternatives are given below:

	Project *A*	Project *B*
Initial Investment Cost	\$120,000	\$80,000
Annual Profit	\$30,000	\$20,000
Salvage Value	\$18,000	\$10,000
Useful Life	5 years	5 years

MARR = 10%.
Study period = 5 years.

(*a*) Determine which project the company should invest in using the *PW* method. (4 marks)

(*b*) By how much must the initial cost of Project *B* be increased or decreased for the decision in Part (*a*) to be reversed? (2 marks)

(*c*) Uncertainties for Project *A* are as follows:

- Salvage value is uniformly distributed between \$16,000 and \$20,000.
- The annual profits are equal in value every year with the following probability distribution:

Cash Flow	Probability
\$25,000	0.25
\$30,000	0.50
\$35,000	0.25

Assuming that all the uncertainties are mutually independent, determine the expected value and standard deviation of the *PW* for Project *A*. (6 marks)

Note: The probability distribution Uniform(a, b) has

- Mean $= \frac{1}{2}(a+b)$
- Var $= \frac{1}{12}(b-a)^2$

(*d*) Uncertainties for Project *B* are as follows:

- Salvage value follows the triangular distribution with min = \$8,000, max = \$12,000, and mode=\$10,000.

- The annual profits are equal in value every year and is normally distributed with mean = \$20,000 and standard deviation = \$5,000.

Assuming that all the uncertainties are mutually independent, determine the expected value and standard deviation of the *PW* for Project *B*. (6 marks)

Note: The probability distribution Triangular (*a*, *b*, *c*) has

- Mean $= \frac{1}{3}(a+b+c)$
- Var $= \frac{1}{18}(a^2+b^2+c^2-ab-ac-bc)$

(*e*) Based on all the above results, are you able to recommend which project the company should invest in? Why? (2 marks)

Optional Computation Exercises (not graded**)**

Perform Monte Carlo simulation using @Risk to generate the risk profiles for Project *A* and Project *B* and answer the following questions:

i. Compare the Expected Values and Standard Deviations obtained by simulation with those computed analytically in Parts (*c*) and (*d*).

ii. Is there any First Order Stochastic Dominance between the Project *A* and Project *B*? Is there a clear choice between Project *A* and Project *B*?

iii. What are the Downside Risks for Project *A* and Project *B*?

iv. What are the Upside Potentials for *PW* = \$20,000 for Project *A* and Project *B*?

v. What are the Present Equivalent Values-at-Risk at 95% confidence for Project *A* and Project *B*?