# IE2111 ISE Principles & Practice II Lab 4 - Risk Analysis using Monte Carlo Simulation

#### **Objectives and Learning Outcomes**

At the end of the lab session, you will be able to do the followings:

- 1. Perform Probabilistic Risk Analysis using Monte Carlo Simulation.
- 2. Interpret Risk Profiles and make final recommendations.

#### **Problem Description**

This is a continuation of the problem analyzed in Lab 3.

#### **Risk Analysis using Monte Carlo Simulation**

To better understand and assess the risk associated with each alternative, you recommended that the probabilistic behavior of the sensitive variables identify in the previous section fully studied and Monte Caro Simulation be performed on these variables to determine the risk profiles for the two alternatives.

Expert's assessments of the probability distributions of the sensitive variables are given in the table below:

	Alternative A	Distribution	Parameters
1	Annual volume	Uniform Integer	min=13,000; max=17,000
2	Unit selling price	Truncated Normal	mean=10; sd=0.5; min=9; max=11
3	Annual Maintenance cost	Uniform	min=24,000; max=26,000
4	Manpower cost/worker/hour	Truncated Normal	mean=12; sd=1.5; min=9; max=15
5	Output per hours (pieces)	Triangular	min=7.50; mode=8.00; max=8.50
6	Variable material cost per unit	Triangular	min=2.80; mode=3.00; max=3.20

	Alternative B	Distribution	Parameters
1	Annual volume	Uniform Integer	min=13,000; max=17,000
2	Unit selling price	Truncated Normal	mean=10; sd=0.5; min=9; max=11
3	Annual Maintenance cost	Uniform	min=9,000; max=11,000
4	Manpower cost/worker/hour	Truncated Normal	mean=8; sd=0.5; min=7; max=9
5	Output per hours (pieces)	Triangular	min=5.50; mode=6.00; max=6.50
6	Variable material cost per unit	Triangular	min=2.80; mode=3.00; max=3.20

Generate the Risk profiles for the AW and IRR of Alternatives A and B and answer the following questions:

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#### 1. AW Analysis

## 1.1 Mean and Variance Analysis What is the Expected AW of Alternative A? What is the Standard Deviation of AW of Alternative A? What is the Expected AW of Alternative B? What is the Standard Deviation of AW of Alternative B? Is there any Mean-Variance Dominance? Yes / No 1.2 **Downside Risk:** What is the probability that Alternative A will be infeasible? What is the probability that Alternative B will be infeasible? 1.3 **Upside Potentials:** What is the probability that Alternative A will achieve $AW \ge $10,000$ ? What is the probability that Alternative A will achieve $AW \ge $20,000$ ? What is the probability that Alternative A will achieve $AW \ge $30,000$ ? What is the probability that Alternative B will achieve $AW \ge $10,000$ ? What is the probability that Alternative B will achieve $AW \ge $20,000$ ? What is the probability that Alternative B will achieve $AW \ge $30,000$ ? 1.4 Value-at-Risk: What is the Alternative A equivalent annual value-at-risk at 90% confidence? What is the Alternative A equivalent annual value-at-risk at 95% confidence? What is the Alternative B equivalent annual value-at-risk at 90% confidence? What is the Alternative B equivalent annual value-at-risk at 95% confidence? 1.5 **Stochastic Dominance Analysis:** Is there any first order stochastic dominance? Yes / No

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### 2. IRR Analysis

# 2.1 Mean and Variance Analysis What is the Expected *IRR* of Alternative A? What is the Standard Deviation of *IRR* of Alternative A? What is the Expected *IRR* of Alternative B? What is the Standard Deviation of *IRR* of Alternative B? Is there any Mean-Variance Dominance? Yes / No 2.2 **Downside Risk:** What is the probability that Alternative A will be infeasible? What is the probability that Alternative B will be infeasible? 2.3 **Upside Potentials:** What is the probability that Alternative A will achieve $IRR \ge 15\%$ ? What is the probability that Alternative A will achieve $IRR \ge 20\%$ ? What is the probability that Alternative A will achieve $IRR \ge $25\%$ ? What is the probability that Alternative B will achieve $IRR \ge 20\%$ ? What is the probability that Alternative B will achieve $IRR \ge 30\%$ ? What is the probability that Alternative B will achieve $IRR \ge 40\%$ ? 2.4 **Stochastic Dominance Analysis:** Is there any first order stochastic dominance? Yes / No

### 3. Conclusion

What is your final recommendation to the company?

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