

# TIE4203 Decision Analysis in Industrial Operations and Management

## Assignment #4

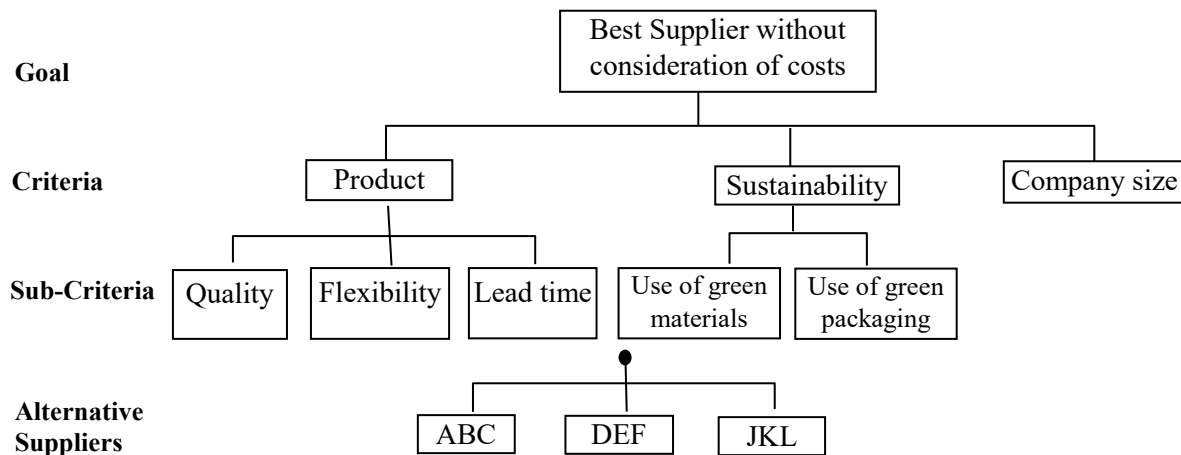
Due: Friday, 3 Nov 2023 (end of class)

You may use any software like Excel, YAAHP, or Python for this assignment.  
You may submit your solutions at the drop box outside the ISEM Department Office at E1A-06-25 any time before the due date, or turn it in at LT52 after the lecture.

### Question (Total Marks 50)

QPrint is an offset printing company. It relies a lot on its suppliers of ink to produce good quality prints. A top-level team consisting of procurement, production, and warehouse managers was formed to determine the best cost-effective supplier that meets the company's needs. The team agreed that they should do a cost-bid evaluation (i.e. without consideration of prices) of their three key suppliers, namely ABC, DEF and JKL. The team agreed to use the following AHP model and data:

#### AHP Hierarchy



#### Pairwise Comparison Matrices

Goal: Best Supplier without consideration of costs

	Product	Sustainability	Company size
Product	1	3	4
Sustainability		1	2
Company's size			1

Criterion Product

	Quality	Flexibility	Lead time
Quality	1	3	5
Flexibility		1	3
Lead time			1

Criterion: Sustainability

	Use of green materials	Use of green packaging
Use of green materials	1	1
Use of green packaging		1

**Sub-Criterion: Quality**

	ABC	DEF	JKL
ABC	1	3	5
DEF		1	3
JKL			1

**Sub-Criterion: Flexibility**

	ABC	DEF	JKL
ABC	1	5	3
DEF		1	1/3
JKL			1

**Sub-Criterion: Lead Time**

	ABC	DEF	JKL
ABC	1	1/2	1/5
DEF		1	1/3
JKL			1

**Sub-Criterion: Use of Green Materials**

	ABC	DEF	JKL
ABC	1	1/5	1/3
DEF		1	3
JKL			1

**Sub-Criterion: Use of Green Packaging**

	ABC	DEF	JKL
ABC	1	1/4	1/2
DEF		1	2
JKL			1

**Criterion: Company Size**

	ABC	DEF	JKL
ABC	1	1/3	1/5
DEF		1	1/3
JKL			1

- (a) Using the RGM method, determine the (approximate) local weights of the three main criteria. Which criterion is the most important, and which criterion is the least important? (10 marks)
- (b) Is the consistency of the matrix you used in Part (a) acceptable? Explain your answer. (5 marks)
- (c) Does the matrix you use in Part (a) satisfy the transitivity of preference property? Explain your answer. (5 marks)
- (d) Using any software, solve the AHP model. What are the global weights of the three alternative suppliers? Which is the best supplier without consideration of cost? (15 marks)
- (e) If the priority weight for the main criterion “Sustainability” is varied from 0 to 1, over what range of values would supplier DEF be the best without consideration of cost? You may explain your answer by using a rainbow diagram from Part (d). (5 marks)
- (f) The company would like to purchase 1,000 liters of a special ink from one of the three suppliers. The prices quoted by ABC, DEF, and JKL are \$12,00, \$11,000, and \$11,500 respectively. Plot an efficient frontier and indicate which supplier (if any) can be eliminated from further consideration. Explain your answer. (10 marks)