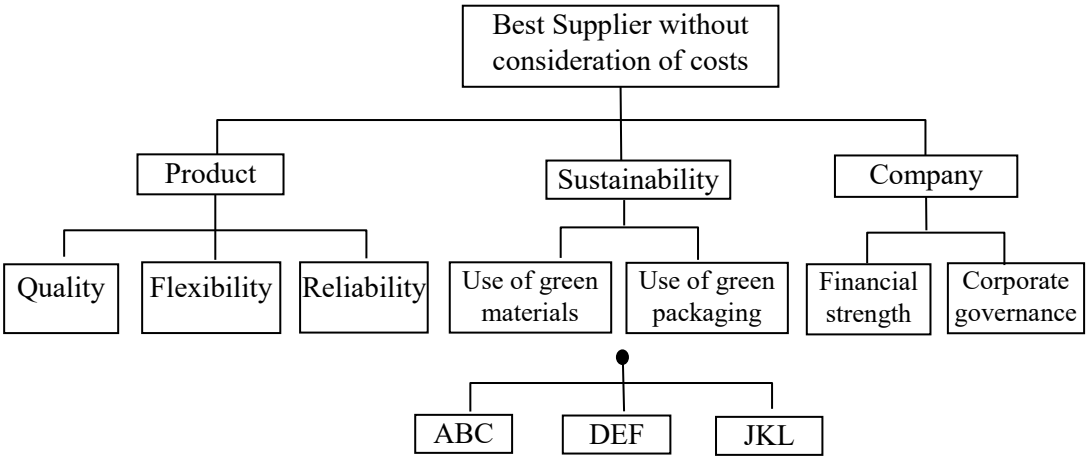
TIE4203 Decision Analysis in Industrial Operations and Management
Assignment #4
Due: Friday, 8 Nov 2024 (end of class)

You may use any software like Excel, YAAHP, or Python for this assignment. Submit your solutions at the Drop Box outside the ISEM Department Office at E1A-06-25 or to the Tutor at the end of class meetings.

Question (Total Marks 50)

DSS Printer is an offset printing company. It relies a lot on its suppliers of ink to produce good-quality prints. A top-level team comprising procurement, production, and warehouse managers was formed to determine the best cost-effective and sustainable supplier that meets the company's needs. The team agreed that they should do a cost-bind 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			1

Main Criterion Product

	Quality	Flexibility	Reliability
Quality	1	3	5
Flexibility		1	3
Reliability			1

Main Criterion: Sustainability

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

Main Criterion: Company

	Financial strength	Corporate governance
Financial strength	1	3
Corporate governance		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: Reliability

	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: Financial strength

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

Criterion: Corporate Governance

	ABC	DEF	JKL
ABC	1	1/5	1/7
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 appropriate computing tools, determine the local weights of all the matrices in the model and compute 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. (5 marks)

(*f*) The company would like to purchase 1,000 liters of special ink from one of the three suppliers. The prices quoted by ABC, DEF, and JKL are \$12,000, \$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)