TIE4203 Sustainability Systems Analysis
Solutions to Assignment #4

(a)

	Product	Sustainability	Company	RGM	$w \approx$	$\lambda \approx$
Product	1	3	4	2.28943	0.62501	3.0183
Sustainability	1/3	1	2	0.87358	0.23849	3.0183
Company	1/4	1/2	1	0.50000	0.13650	3.0183
				3.66301	1.0000	3.0383

Using the RGM method, the approximate weights of the 3 main criteria are

1. Product: 0.62501
2. Sustainability: 0.23849
3. Company: 0.13650

Main criterion Product is the most important as it has the highest local weight.
Main criterion Company is the least important as it has the lowest local weight.
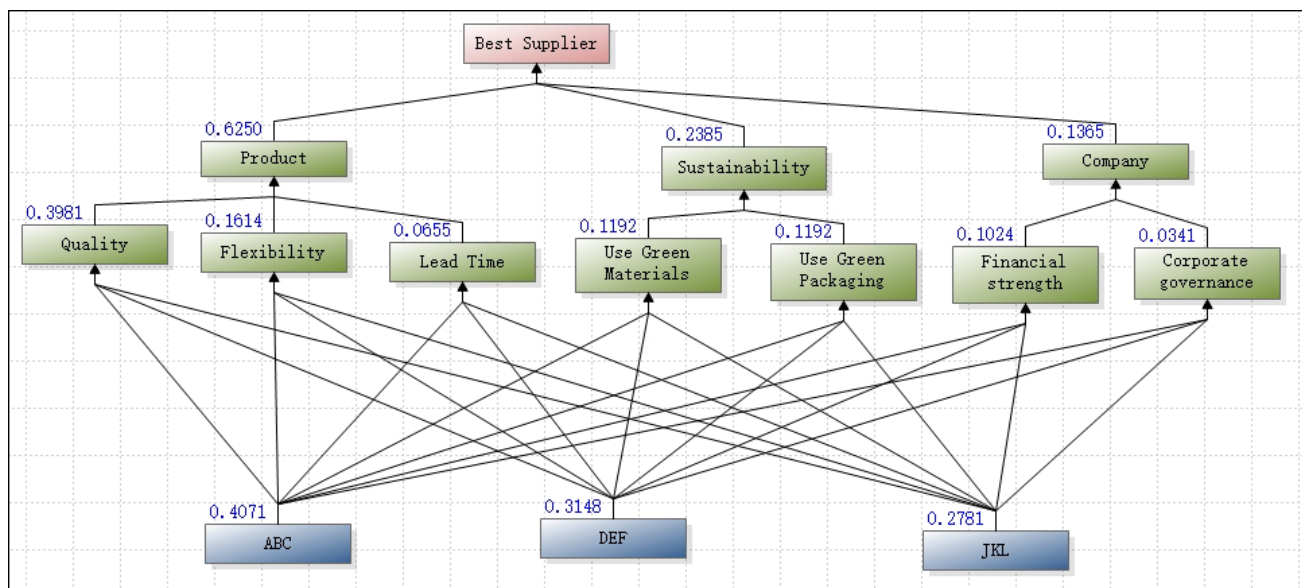
(b) From (*a*): $\lambda_{max} \approx 3.0383$
$CI = (3.0383 - 3)/(3 - 1) = 0.009147$
$CR = 0.01577 < 0.1 \Rightarrow$ Inconsistency is **Acceptable.**

(c) From the matrix:

$a_{12} = 3 > 1 \Rightarrow$ "Product" is more important than "Sustainability"
$a_{13} = 4 > 1 \Rightarrow$ "Product" is more important than "Company"
$a_{23} = 2 > 1 \Rightarrow$ "Sustainability" is more important than "Company"

Hence the matrix satisfies the transitivity of preference property.

(d)

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Main criteria weights
  Product       : 0.625013
  Sustainability : 0.238487
  Company       : 0.136500

Sub-criteria weights wrt Product
  Quality             : 0.636986
  Flexibility         : 0.258285
  Reliability         : 0.104729

Sub-criteria weights wrt Sustainability
  Green materials     : 0.500000
  Green packaging     : 0.500000

Sub-criteria weights wrt Company
  Financial strength  : 0.750000
  Corporate governance : 0.250000

Alternatives' local weights

  Product > Quality
    ABC    : 0.636986
    DEF    : 0.258285
    JKL    : 0.104729

  Product > Flexibility
    ABC    : 0.636986
    DEF    : 0.104729
    JKL    : 0.258285

  Product > Reliability
    ABC    : 0.122020
    DEF    : 0.229651
    JKL    : 0.648329

  Sustainability > Green materials
    ABC    : 0.104729
    DEF    : 0.636986
    JKL    : 0.258285

  Sustainability > Green packaging
    ABC    : 0.142857
    DEF    : 0.571429
    JKL    : 0.285714

  Company > Financial strength
    ABC    : 0.104729
    DEF    : 0.258285
    JKL    : 0.636986

  Company > Corporate governance
    ABC    : 0.071927
    DEF    : 0.278955
    JKL    : 0.649118

Alternatives' weights wrt Best Supplier
  ABC      : 0.407115
  DEF      : 0.314825
  JKL      : 0.278059
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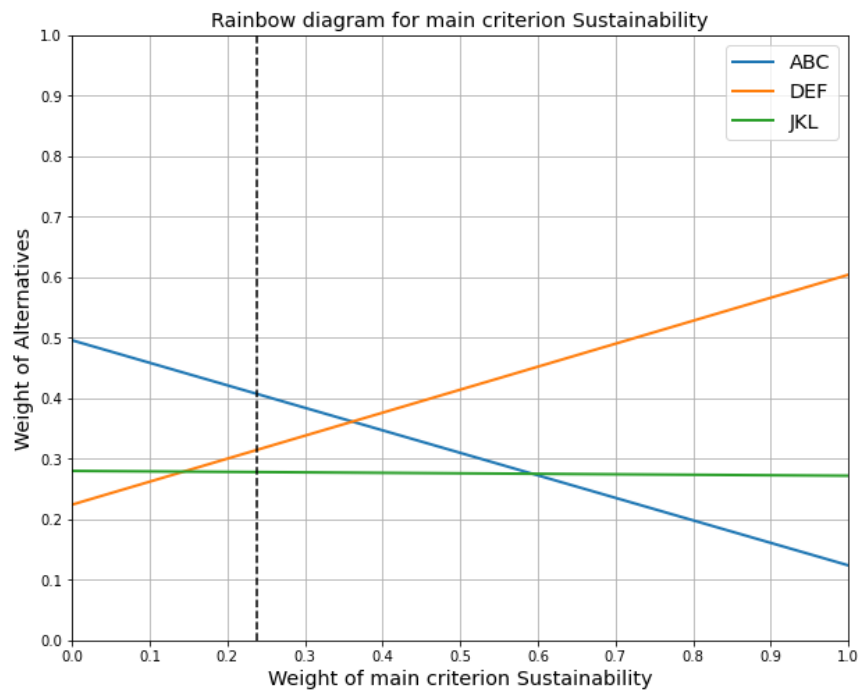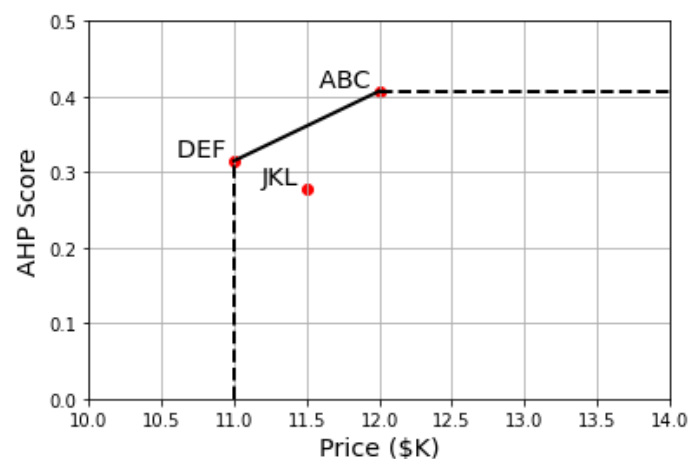
Best Supplier without consideration of cost = ABC.

(*e*) If the priority weight for the main criterion "Sustainability" is varied from 0 to 1, the following rainbow diagrams are obtained:

Rainbow diagram for main criterion Sustainability

Supplier DEF is the best supplier when the weight of the criterion "Sustainability" is between 0.37 and 1.0.

(*f*) The efficient frontier based on the prices quoted by the suppliers is:

Supplier JKL is dominated by the supplier DEF and can be eliminated from further consideration. The DSS Printer should not purchase anything from JKL. The other two companies ABC and DEF can be selected depending on the acceptable trade-off between cost and effectiveness.