# Exercises on the PROMETHEE and GAIA methods

### Exercise 1

A qualitative criterion is expressed on the following 9-point scale:

9 – Very Good

8 – between Very Good and Good

7 – Good

6 – between Good and Average

5 – Average

4 – between Average and Bad

3 – Bad

2 – between Bad and Very Bad

1 – Very Bad

For the decision maker, a 2-points difference is considered as very important, while a 1-point difference is not negligible but is felt less important.

What would be a correct preference function choice in this case?

1. 🞏 Usual type (no thresholds)
2. 🞏 Level type with *q* = 0.5 and *p* = 1.5
3. 🞏 Linear type with *q* = 1 and *p* = 2
4. 🞏 Level type with *q* = 1.5 and *p* = 2.5
5. 🞏 V-shape type with *p* = 1

### Exercise 2

A preference function of type Linear, with *q* = 5 and *p* = 10 is associated to a quantitative criterion *f*. The criterion is to minimise. Let us compare two actions *a* and *b* such that *f*(*a*) = 37 and *f*(*b*) = 44.

We have:

1. 🞏 **(*a*,*b*) = 0 and **(*b*,*a*) = 0.4
2. 🞏 **(*a*,*b*) = 0 and **(*b*,*a*) = 0.7
3. 🞏 **(*a*,*b*) = 0.4 and **(*b*,*a*) = 0
4. 🞏 **(*a*,*b*) = 0.7 and **(*b*,*a*) = 0
5. 🞏 **(*a*,*b*) = 0 and **(*b*,*a*) = 0

### Exercise 3

A multicriteria decision problem including five actions (A, B, C, D and E) has been analysed using the PROMETHEE method. The following results have been obtained:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *π* (.,.) | A | B | C | D | E | **+ | ** |
| A | 0.000 | 0.375 | 0.500 | 0.375 | 0.500 | 0.43750 | 0.06250 |
| B | 0.250 | 0.000 | 0.125 | 0.375 | 0.375 | 0.28125 | -0.18750 |
| C | 0.500 | 0.500 | 0.000 | 0.375 | 0.625 | 0.50000 | 0.21875 |
| D | 0.250 | 0.500 | 0.250 | 0.000 | 0.375 | 0.34375 | -0.03125 |
| E | 0.500 | 0.500 | 0.250 | 0.375 | 0.000 | 0,40625 | -0.06250 |
| **− | 0.37500 | 0.46875 | 0.28125 | 0.37500 | 0.46875 |  |  |

Is it true that:

1. 🞏 Yes 🞏 No – A is the best ranked action.
2. 🞏 Yes 🞏 No – D and E are incomparable in PROMETHEE I.
3. 🞏 Yes 🞏 No – C is preferred to E in both PROMETHEE rankings.
4. 🞏 Yes 🞏 No – There are multiple incomparabilities in PROMETHEE I.
5. 🞏 Yes 🞏 No – D is preferred to E in PROMETHEE II.
6. 🞏 Yes 🞏 No – B is the worst ranked action.

### Exercise 4

A multicriteria decision problem including seven actions (A1 to A7) and five criteria (C1 to C5) has been analysed using the GAIA method ( = 89%).



Is it true that:

1. 🞏 Yes 🞏 No – The quality of the GAIA representation is good.
2. 🞏 Yes 🞏 No – A7 seems to be very good on criterion C3.
3. 🞏 Yes 🞏 No – A3 and A4 have similar profiles.
4. 🞏 Yes 🞏 No – Much weight has been given to C3.
5. 🞏 Yes 🞏 No – C2 and C3 are not conflicting.
6. 🞏 Yes 🞏 No – Four clusters of actions can be identified.