

## Appendix to the paper entitled: Soft ELECTRE TRI outranking method based on belief functions

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# Appendix to the paper entitled: Soft ELECTRE TRI outranking method based on belief functions

Jean Dezert, Jean-Marc Tacnet

## Abstract

This short note provides the detailed results of the steps of the ELECTRE TRI (ET) and the Soft ELECTRE TRI (SET) methods presented in [1] that has been applied in the example on a waste disposal selection in an environmental context scenario. ELECTRE TRI (ET) and the Soft ELECTRE TRI (SET) methods have already been published elsewhere: in this note, we only provide a helpful support to engineers or researchers for verifying and testing the implementation of these methods according to their needs.

## Index Terms

ELECTRE TRI, information fusion, belief functions, outranking methods, multicriteria analysis, operational research.

vspace-2mm

## I. RECALL OF THE EXAMPLE UNDER ANALYSIS

The example under analysis in [1] to test SET method had been introduced by Maystre in [2] and concerns the choice of the location of an urban waste resource recovery disposal which aims to re-use the recyclable part of urban waste produced by several communities. Indeed, this disposal must collect at least  $20000m^3$  of urban waste per year to be economically viable. It must be a collective unit and the best possible location has to be identified. Each community has to bring its urban waste production to the disposal: the transport costs are valued in tons by kilometer per year ( $t.km/year$ ). Building such a disposal is generally not easily accepted by population, particularly when the environmental inconveniences are already high. This initial environmental status is measured by a specific criterion. Building an urban waste disposal implies to use a wide area that could be used for other activities such as a sport terrain, touristic equipments, a natural zone, etc. This competition with other activities is measured by a specific criterion ( $g_5$ ).

### A. Alternatives, criteria and profiles definition

In this example, seven possible locations (alternatives/choices)  $a_i$ ,  $i = 1, 2, \dots, 7$ , for urban waste resource recovery disposal are compared according to the following five criteria  $g_j(\cdot)$ , ( $j = 1, 2, \dots, 5$ ):

- $g_1 =$  Terrain price (decreasing preference);
- $g_2 =$  Transport costs (decreasing preference);
- $g_3 =$  Environment status (increasing preference);
- $g_4 =$  Impacted population (increasing preference);
- $g_5 =$  Competition activities (increasing preference).

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- Price of terrain ( $g_1$ ) is expressed in  $\text{€}/\text{m}^2$  with decreasing preferences (the lower is the price, the higher is the preference);
- Transport costs ( $g_2$ ) are expressed in  $t \cdot \text{km}/\text{year}$  with decreasing preferences (the lower is the cost, the higher is the preference);
- The environment status ( $g_3$ ) corresponds to the initial environmental inconvenience level expressed by population with an increasing direction of preferences. The higher is the environment status, the lower are the initial environmental inconveniences. It is rated with an integer between 0 and 10 (highest environment status corresponding to the lowest initial environmental inconveniences);
- Impacted population ( $g_4$ ) is an integrated criterion to measure negative effects based on subjective and qualitative criteria. It corresponds to the status of the environment with an increasing direction of preferences. The higher is the evaluation, the lower are the negative effects. It is rated with a real number between 0 (great number of impacted people) and 10 (very few people impacted);
- Activities competition ( $g_5$ ) is an integrated criterion, evaluated by a real number, that measures the competition level between activities with an increasing direction of preferences. The higher is the evaluation, the lower is the competition with other activities on the planned location (tourism, sport, natural environment ...).

The evaluations of the seven alternatives are summarized in Table I.

<b>Criteria</b> $g_j \rightarrow$ <b>Choices</b> $a_i \downarrow$	$g_1$ ( $\text{€}/\text{m}^2$ )	$g_2$ ( $t \cdot \text{km}/\text{year}$ )	$g_3$ {0, 1, ..., 10}	$g_4$ [0, 10]	$g_5$ {0, 1, ..., 100}
$a_1$	-120	-284	5	3.5	18
$a_2$	-150	-269	2	4.5	24
$a_3$	-100	-413	4	5.5	17
$a_4$	-60	-596	6	8.0	20
$a_5$	-30	-1321	8	7.5	16
$a_6$	-80	-734	5	4.0	21
$a_7$	-45	-982	7	8.5	13

Table I: Inputs of ET (7 alternatives according to 5 criteria).

The alternatives (possible locations for an urban waste resource recovery disposal) are compared to two decision profiles  $b_1$  and  $b_2$  as described in Table II. At the end, the goal is to decide to which category (bounded by the decision profiles), each alternative belongs. The weights, indifference, preference and

<b>Profiles</b> $b_h \rightarrow$ <b>Criteria</b> $g_j \downarrow$	$b_1$	$b_2$
$g_1$ : $\text{€}/\text{m}^2$	-100	-50
$g_2$ : $t \cdot \text{km}/\text{year}$	-1000	-500
$g_3$ : {0, 1, ..., 10}	4	7
$g_4$ : [0, 10]	4	7
$g_5$ : {0, 1, ..., 100}	15	20

Table II: Evaluation profiles.

veto thresholds for criteria  $g_j$  are given in Table III.

<b>Thresholds</b> $\rightarrow$ <b>Criteria</b> $g_j \downarrow$	$w_j$ (weight)	$q_j$ (indifference)	$p_j$ (preference)	$v_j$ (veto)
$g_1: \text{€}/m^2$	0.25	15	40	100
$g_2: t \cdot km/\text{year}$	0.45	80	350	850
$g_3: \{0, 1, \dots, 10\}$	0.10	1	3	5
$g_4: [0, 10]$	0.12	0.5	3.5	4.5
$g_5: \{0, 1, \dots, 100\}$	0.08	1	5	8

Table III: Thresholds.

## APPENDIX 1: RESULTS OF ET STEPS

- Results of ET-Step 1 (Partial indexes):

The partial concordance indexes  $c_j(a_i, b_1)$  and  $c_j(b_1, a_i)$  for profile  $b_1$  are listed in Table IV and the partial concordance indexes  $c_j(a_i, b_2)$  and  $c_j(b_2, a_i)$  for profile  $b_2$  are listed in Table V.

$c_j(a_i, b_1) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.8000	1.0000	1.0000	1.0000	1.0000
$a_2$	0.0000	1.0000	0.5000	1.0000	1.0000
$a_3$	1.0000	1.0000	1.0000	1.0000	1.0000
$a_4$	1.0000	1.0000	1.0000	1.0000	1.0000
$a_5$	1.0000	0.1074	1.0000	1.0000	1.0000
$a_6$	1.0000	1.0000	1.0000	1.0000	1.0000
$a_7$	1.0000	1.0000	1.0000	1.0000	0.7500

$c_j(b_1, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	1.0000	0.0000	1.0000	1.0000	0.5000
$a_2$	1.0000	0.0000	1.0000	1.0000	0.0000
$a_3$	1.0000	0.0000	1.0000	0.6667	0.7500
$a_4$	0.0000	0.0000	0.5000	0.0000	0.0000
$a_5$	0.0000	1.0000	0.0000	0.0000	1.0000
$a_6$	0.8000	0.3111	1.0000	1.0000	0.0000
$a_7$	0.0000	1.0000	0.0000	0.0000	1.0000

Table IV: (ET Step 1) Partial concordance indexes for profile  $b_1$ .

$c_j(a_i, b_2) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0000	1.0000	0.5000	0.0000	0.7500
$a_2$	0.0000	1.0000	0.0000	0.3333	1.0000
$a_3$	0.0000	1.0000	0.0000	0.6667	0.5000
$a_4$	1.0000	0.9407	1.0000	1.0000	1.0000
$a_5$	1.0000	0.0000	1.0000	1.0000	0.2500
$a_6$	0.4000	0.4296	0.5000	0.1667	1.0000
$a_7$	1.0000	0.0000	1.0000	1.0000	0.0000

$c_j(b_2, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	1.0000	0.4963	1.0000	1.0000	1.0000
$a_2$	1.0000	0.4407	1.0000	1.0000	0.2500
$a_3$	1.0000	0.9741	1.0000	1.0000	1.0000
$a_4$	1.0000	1.0000	1.0000	0.8333	1.0000
$a_5$	0.8000	1.0000	1.0000	1.0000	1.0000
$a_6$	1.0000	1.0000	1.0000	1.0000	1.0000
$a_7$	1.0000	1.0000	1.0000	0.6667	1.0000

Table V: (ET Step 1) Partial concordance indexes for profile  $b_2$ .

The partial discordance indexes  $d_j(a_i, b_1)$  and  $d_j(b_1, a_i)$  for profile  $b_1$  are listed in Table VI and the partial discordance indexes  $d_j(a_i, b_2)$  and  $d_j(b_2, a_i)$  for profile  $b_2$  are listed in Table VII.

$d_j(a_i, b_1) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_2$	0.1667	0.0000	0.0000	0.0000	0.0000
$a_3$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_4$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_5$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_6$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_7$	0.0000	0.0000	0.0000	0.0000	0.0000

$d_j(b_1, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0000	0.7320	0.0000	0.0000	0.0000
$a_2$	0.0000	0.7620	0.0000	0.0000	1.0000
$a_3$	0.0000	0.4740	0.0000	0.0000	0.0000
$a_4$	0.0000	0.1080	0.0000	0.5000	0.0000
$a_5$	0.5000	0.0000	0.5000	0.0000	0.0000
$a_6$	0.0000	0.0000	0.0000	0.0000	0.3333
$a_7$	0.2500	0.0000	0.0000	1.0000	0.0000

Table VI: (ET Step 1) Partial discordance indexes for profile  $b_1$ .

$d_j(a_i, b_2) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.5000	0.0000	0.0000	0.0000	0.0000
$a_2$	1.0000	0.0000	1.0000	0.0000	0.0000
$a_3$	0.1667	0.0000	0.0000	0.0000	0.0000
$a_4$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_5$	0.0000	0.9420	0.0000	0.0000	0.0000
$a_6$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_7$	0.0000	0.2640	0.0000	0.0000	0.6667

$d_j(b_2, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_2$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_3$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_4$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_5$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_6$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_7$	0.0000	0.0000	0.0000	0.0000	0.0000

Table VII: (ET Step 1) Partial discordance indexes for profile  $b_2$ .

- Results of ET-Step 2 (Global concordance and credibility indexes):

The values of the concordance indexes  $c(a_i, b_h)$  and  $c(b_h, a_i)$  for the profiles  $b_1$  and  $b_2$  are listed in Table VIII and the credibility indexes  $\rho(a_i, b_h)$  and  $\rho(b_h, a_i)$  for profiles  $b_1$  and  $b_2$  are listed in Table IX.

	$c(a_i, b_1)$	$c(b_1, a_i)$	$c(a_i, b_2)$	$c(b_2, a_i)$
$a_1$	0.9500	0.5100	0.5600	0.7733
$a_2$	0.7000	0.4700	0.5700	0.6883
$a_3$	1.0000	0.4900	0.5700	0.9883
$a_4$	1.0000	0.0500	0.9733	0.9800
$a_5$	0.5983	0.5300	0.4900	0.9500
$a_6$	1.0000	0.5600	0.4433	1.0000
$a_7$	0.9800	0.5300	0.4700	0.9600

Table VIII: (ET Step 2) Global concordance indexes.

	$\rho(a_i, b_1)$	$\rho(b_1, a_i)$	$\rho(a_i, b_2)$	$\rho(b_2, a_i)$
$a_1$	0.9500	0.2789	0.5600	0.7733
$a_2$	0.7000	0.0000	0.0000	0.6883
$a_3$	1.0000	0.4900	0.5700	0.9883
$a_4$	1.0000	0.0247	0.9733	0.9800
$a_5$	0.5983	0.5300	0.0557	0.9500
$a_6$	1.0000	0.5600	0.4433	1.0000
$a_7$	0.9800	0.0000	0.2956	0.9600

Table IX: (ET Step 2) credibility indexes.

- Results of ET-Step 3 (Fuzzy and crisp outranking):

Using a  $\lambda = 0.75$  for the  $\lambda$ -cut strategy, one gets the outranking relations listed in Table X.

	$b_0$	$b_1$	$b_2$	$b_3$
$a_1$	>	>	<	<
$a_2$	>	$R$	$R$	<
$a_3$	>	>	<	<
$a_4$	>	>	$I$	<
$a_5$	>	$R$	<	<
$a_6$	>	>	<	<
$a_7$	>	>	<	<

Table X: (ET Step 3) Outranking relations obtained with ET ( $\lambda = 0.75$ ).

- Results of ET-Step 4 (hard assignment):

The final hard (binary) assignments obtained by ET method using the pessimistic and optimistic decisional attitudes are listed in Table XI.

	$C_1$	$C_2$	$C_3$
$a_1$	0	1	0
$a_2$	1	0	0
$a_3$	0	1	0
$a_4$	0	1	0
$a_5$	1	0	0
$a_6$	0	1	0
$a_7$	0	1	0

(a) Pessimistic decisions.

	$C_1$	$C_2$	$C_3$
$a_1$	0	1	0
$a_2$	0	0	1
$a_3$	0	1	0
$a_4$	0	0	1
$a_5$	0	1	0
$a_6$	0	1	0
$a_7$	0	1	0

(b) Optimistic decisions.

Table XI: (ET Step 4) Hard assignments obtained with ET ( $\lambda = 0.75$ ).

## APPENDIX 2: RESULTS OF SET STEPS

The results obtained in SET Steps for both SET-B (Bayesian SET version) based on the weighted averaging fusion rule, and in SET-NB (non-Bayesian SET version) based on Proportional Conflict Redistribution fusion rule #5 (PCR5) proposed in [3] are detailed in this second Appendix.

- Results of SET-Step 1 (Partial indexes):

The partial concordances obtained for the sigmoidal model detailed in [1] and proposed in Step 1 of the SET method are listed in Tables XII–XIII.

$c_j(a_i, b_1) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.7674	1.0000	0.9975	0.8808	0.9975
$a_2$	0.0217	1.0000	0.4997	0.9656	1.0000
$a_3$	0.9878	1.0000	0.9820	0.9907	0.9933
$a_4$	1.0000	0.9999	0.9997	0.9997	0.9997
$a_5$	1.0000	0.1662	1.0000	0.9993	0.9820
$a_6$	0.9995	0.9992	0.9975	0.9350	0.9999
$a_7$	1.0000	0.9692	1.0000	0.9998	0.7311

$c_j(b_1, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.9995	0.0002	0.8808	0.9656	0.4999
$a_2$	1.0000	0.0001	0.9997	0.8808	0.0001
$a_3$	0.9878	0.0021	0.9820	0.6608	0.7311
$a_4$	0.1121	0.0499	0.4997	0.0362	0.1121
$a_5$	0.0006	0.9996	0.0093	0.1121	0.8808
$a_6$	0.7674	0.3161	0.8808	0.9350	0.0333
$a_7$	0.0090	0.9487	0.1121	0.0052	0.9933

Table XII: (SET Step 1) Partial concordance indexes for profile  $b_1$ .

$c_j(a_i, b_2) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0006	0.9983	0.4997	0.1121	0.7311
$a_2$	0.0000	0.9986	0.0003	0.3392	0.9991
$a_3$	0.0217	0.9887	0.1121	0.6608	0.4999
$a_4$	0.9424	0.8533	0.8808	0.9820	0.9526
$a_5$	0.9995	0.0000	0.9975	0.9656	0.2679
$a_6$	0.3977	0.4278	0.4997	0.2083	0.9820
$a_7$	0.9945	0.0139	0.9820	0.9907	0.0064

$c_j(b_2, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	1.0000	0.4945	0.9997	0.9993	0.9933
$a_2$	1.0000	0.4388	1.0000	0.9975	0.2679
$a_3$	1.0000	0.8692	1.0000	0.9907	0.9975
$a_4$	0.9975	0.9901	0.9975	0.7914	0.9526
$a_5$	0.7674	1.0000	0.8808	0.8808	0.9991
$a_6$	0.9999	0.9987	0.9997	0.9987	0.8808
$a_7$	0.9732	1.0000	0.9820	0.6608	1.0000

Table XIII: (SET Step 1) Partial concordance indexes for profile  $b_2$ .

The partial discordances indexes obtained from the sigmoidal model [1] in Step 1 of SET method are listed in Tables XIV–XV.

$d_j(a_i, b_1) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0091	0.0000	0.0000	0.0000	0.0000
$a_2$	0.2080	0.0000	0.0093	0.0000	0.0000
$a_3$	0.0002	0.0000	0.0000	0.0000	0.0000
$a_4$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_5$	0.0000	0.0862	0.0000	0.0000	0.0000
$a_6$	0.0000	0.0000	0.0000	0.0000	0.0000
$a_7$	0.0000	0.0003	0.0000	0.0000	0.0007

$d_j(b_1, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0000	0.7167	0.0003	0.0000	0.0047
$a_2$	0.0000	0.7404	0.0000	0.0000	0.9655
$a_3$	0.0002	0.4740	0.0000	0.0000	0.0007
$a_4$	0.1121	0.1700	0.0093	0.4963	0.1121
$a_5$	0.5000	0.0000	0.4997	0.1121	0.0001
$a_6$	0.0091	0.0475	0.0003	0.0000	0.3373
$a_7$	0.2688	0.0006	0.1121	0.8797	0.0000

Table XIV: (SET Step 1) Partial discordance indexes for profile  $b_1$ .

$d_j(a_i, b_2) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.5000	0.0000	0.0093	0.1121	0.0007
$a_2$	0.8808	0.0000	0.8808	0.0016	0.0000
$a_3$	0.2080	0.0001	0.1121	0.0000	0.0047
$a_4$	0.0013	0.0028	0.0003	0.0000	0.0000
$a_5$	0.0000	0.8542	0.0000	0.0000	0.0262
$a_6$	0.0425	0.0313	0.0093	0.0145	0.0000
$a_7$	0.0001	0.2798	0.0000	0.0000	0.6604

$d_j(b_2, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0000	0.0241	0.0000	0.0000	0.0000
$a_2$	0.0000	0.0300	0.0000	0.0000	0.0262
$a_3$	0.0000	0.0024	0.0000	0.0000	0.0000
$a_4$	0.0000	0.0001	0.0000	0.0000	0.0000
$a_5$	0.0091	0.0000	0.0003	0.0000	0.0000
$a_6$	0.0000	0.0000	0.0000	0.0000	0.0001
$a_7$	0.0005	0.0000	0.0000	0.0000	0.0000

Table XV: (SET Step 1) Partial discordance indexes for profile  $b_2$ .

The partial uncertainties indexes obtained from the sigmoidal model [1] in Step 1 of SET method are listed in Tables XVI–XVII.

$u_j(a_i, b_1) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.2235	0.0000	0.0025	0.1192	0.0025
$a_2$	0.7703	0.0000	0.4910	0.0344	0.0000
$a_3$	0.0120	0.0000	0.0180	0.0093	0.0067
$a_4$	0.0000	0.0001	0.0003	0.0003	0.0003
$a_5$	0.0000	0.7476	0.0000	0.0007	0.0180
$a_6$	0.0005	0.0008	0.0025	0.0650	0.0001
$a_7$	0.0000	0.0305	0.0000	0.0002	0.2683

$u_j(b_1, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0005	0.2832	0.1189	0.0344	0.4953
$a_2$	0.0000	0.2595	0.0003	0.1192	0.0344
$a_3$	0.0120	0.5239	0.0180	0.3392	0.2683
$a_4$	0.7758	0.7801	0.4910	0.4675	0.7758
$a_5$	0.4994	0.0004	0.4910	0.7758	0.1191
$a_6$	0.2235	0.6364	0.1189	0.0650	0.6294
$a_7$	0.7222	0.0508	0.7758	0.1151	0.0067

Table XVI: (SET Step 1) Partial uncertainty indexes for profile  $b_1$ .

$u_j(a_i, b_2) - \text{Alternative versus Profile.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.4994	0.0017	0.4910	0.7758	0.2683
$a_2$	0.1192	0.0013	0.1189	0.6591	0.0009
$a_3$	0.7703	0.0112	0.7758	0.3392	0.4953
$a_4$	0.0563	0.1439	0.1189	0.0180	0.0474
$a_5$	0.0005	0.1458	0.0025	0.0344	0.7059
$a_6$	0.5598	0.5410	0.4910	0.7772	0.0180
$a_7$	0.0054	0.7064	0.0180	0.0093	0.3331

$u_j(b_2, a_i) - \text{Profile versus Alternative.}$					
Criteria $g_j \rightarrow$ Choices $a_i \downarrow$	$g_1$	$g_2$	$g_3$	$g_4$	$g_5$
$a_1$	0.0000	0.4814	0.0003	0.0007	0.0067
$a_2$	0.0000	0.5312	0.0000	0.0025	0.7059
$a_3$	0.0000	0.1284	0.0000	0.0093	0.0025
$a_4$	0.0025	0.0098	0.0025	0.2086	0.0474
$a_5$	0.2235	0.0000	0.1189	0.1192	0.0009
$a_6$	0.0001	0.0013	0.0003	0.0013	0.1191
$a_7$	0.0263	0.0000	0.0180	0.3392	0.0000

Table XVII: (SET Step 1) Partial uncertainty indexes for profile  $b_2$ .

- Results of SET-Step 2 (Global indexes):

The global concordance indexes of SET method (Bayesian and Non-Bayesian versions) are listed in Table XVIII.

	$c(a_i, b_1)$	$c(b_1, a_i)$	$c(a_i, b_2)$	$c(b_2, a_i)$
$a_1$	0.9271	0.2615	0.5713	0.7719
$a_2$	0.7013	0.0000	0.0000	0.6886
$a_3$	0.9935	0.4839	0.5808	0.9398
$a_4$	0.9998	0.0642	0.9017	0.9658
$a_5$	0.6233	0.5348	0.0550	0.9155
$a_6$	0.9915	0.5371	0.4454	0.9897
$a_7$	0.9646	0.0000	0.2985	0.9508

(a) SET-B Step 2.

	$c(a_i, b_1)$	$c(b_1, a_i)$	$c(a_i, b_2)$	$c(b_2, a_i)$
$a_1$	0.9729	0.1771	0.7610	0.6845
$a_2$	0.7716	0.0000	0.0000	0.6269
$a_3$	0.9999	0.3750	0.7542	0.9730
$a_4$	1.0000	0.0189	0.9628	0.9941
$a_5$	0.4376	0.7582	0.0325	0.9719
$a_6$	0.9994	0.4693	0.4031	0.9991
$a_7$	0.9942	0.0000	0.2325	0.9854

(b) SET-NB Step 2..

Table XVIII: (SET Step 2) Global concordance indexes  $c(a_i, b_h)$  and  $c(b_h, a_i)$ .

The global discordance indexes of SET method (Bayesian and Non-Bayesian versions) are listed in Table XIX.



	$d(a_i, b_1)$	$d(b_1, a_i)$	$d(a_i, b_2)$	$d(b_2, a_i)$
$a_1$	0.0000	0.0000	0.0000	0.0000
$a_2$	0.0000	0.0000	0.0000	0.0000
$a_3$	0.0000	0.0000	0.0000	0.0000
$a_4$	0.0000	0.1053	0.0000	0.0000
$a_5$	0.0000	0.0000	0.0000	0.0000
$a_6$	0.0000	0.0000	0.0000	0.0000
$a_7$	0.0000	0.0000	0.0000	0.0000

(a) SET-B Step 2.

	$d(a_i, b_1)$	$d(b_1, a_i)$	$d(a_i, b_2)$	$d(b_2, a_i)$
$a_1$	0.0000	0.0000	0.0000	0.0000
$a_2$	0.0000	0.0000	0.0000	0.0000
$a_3$	0.0000	0.0000	0.0000	0.0000
$a_4$	0.0000	0.0496	0.0000	0.0000
$a_5$	0.0000	0.0000	0.0000	0.0000
$a_6$	0.0000	0.0000	0.0000	0.0000
$a_7$	0.0000	0.0000	0.0000	0.0000

(b) SET-NB Step 2..

Table XIX: (SET Step 2) Global discordance indexes  $d(a_i, b_h)$  and  $d(b_h, a_i)$ .

The global uncertainty indexes of SET method (Bayesian and Non-Bayesian versions) are listed in Table XX.

	$u(a_i, b_1)$	$u(b_1, a_i)$	$u(a_i, b_2)$	$u(b_2, a_i)$
$a_1$	0.0729	0.7385	0.4287	0.2281
$a_2$	0.2987	1.0000	1.0000	0.3114
$a_3$	0.0065	0.5161	0.4192	0.0602
$a_4$	0.0002	0.8305	0.0983	0.0342
$a_5$	0.3767	0.4652	0.9450	0.0845
$a_6$	0.0085	0.4629	0.5546	0.0103
$a_7$	0.0354	1.0000	0.7015	0.0492

(a) SET-B Step 2.

	$u(a_i, b_1)$	$u(b_1, a_i)$	$u(a_i, b_2)$	$u(b_2, a_i)$
$a_1$	0.0271	0.8229	0.2390	0.3155
$a_2$	0.2284	1.0000	1.0000	0.3731
$a_3$	0.0001	0.6250	0.2458	0.0270
$a_4$	0.0000	0.9316	0.0372	0.0059
$a_5$	0.5624	0.2418	0.9675	0.0281
$a_6$	0.0006	0.5307	0.5969	0.0009
$a_7$	0.0058	1.0000	0.7675	0.0146

(b) SET-NB Step 2..

Table XX: (SET Step 2) Global uncertainty indexes  $u(a_i, b_h)$  and  $u(b_h, a_i)$ .

- Results of SET-Step 3 (Probabilized outranking):

Profiles $b_h \rightarrow$ Outranking probas $\downarrow$	$b_0$	$b_1$	$b_2$	$b_3$
$P_{1h}$	1	0.9506	0.2661	0
$P_{2h}$	1	0.8506	0.1557	0
$P_{3h}$	1	0.9937	0.0718	0
$P_{4h}$	1	1.0000	0.1737	0
$P_{5h}$	1	0.5950	0.0447	0
$P_{6h}$	1	0.9908	0.0093	0
$P_{7h}$	1	0.9823	0.0351	0

(a) SET-B Step 3.

Profiles $b_h \rightarrow$ Outranking probas $\downarrow$	$b_0$	$b_1$	$b_2$	$b_3$
$P_{1h}$	1	0.9835	0.6212	0
$P_{2h}$	1	0.8858	0.1866	0
$P_{3h}$	1	0.9999	0.0550	0
$P_{4h}$	1	1.0000	0.0795	0
$P_{5h}$	1	0.2149	0.0145	0
$P_{6h}$	1	0.9996	0.0007	0
$P_{7h}$	1	0.9971	0.0095	0

(b) SET-NB Step 3.

Table XXI: (SET Step 3) Probabilities of soft outranking relations given by SET.

**Remark 1:** Due to space limitation constraint for the conference paper typesettings, the Table XXI-(a) was not included in [1]. Table XXI-(b) corresponds to Table X in [1] with slightly numerical changes because in [1] the values had been computed by a numerical sampling technique which is impossible to reproduce for the readers since it depends on choice of the number of samples used, the random seed used in the numerical sampling and the software. In this note, we give the exact values (rounded at their fourth digits) based on a simple geometrical analysis.

- Results of SET-Step 4 (Soft assignment):

The final soft (probabilistic) assignments obtained by SET method are listed in Table XXII.

	$C_1$	$C_2$	$C_3$	$\emptyset$
$a_1$	0.0362	<b>0.6977</b>	0.2529	$\delta_1 = 0.0131$
$a_2$	0.1261	<b>0.7182</b>	0.1324	$\delta_2 = 0.0233$
$a_3$	0.0059	<b>0.9224</b>	0.0713	$\delta_3 = 0.0005$
$a_4$	0.0000	<b>0.8263</b>	0.1737	$\delta_4 = 0.0000$
$a_5$	0.3869	<b>0.5685</b>	0.0266	$\delta_5 = 0.0181$
$a_6$	0.0091	<b>0.9815</b>	0.0092	$\delta_6 = 0.0001$
$a_7$	0.0171	<b>0.9478</b>	0.0345	$\delta_7 = 0.0006$

(a) SET-B Step 4.

	$C_1$	$C_2$	$C_3$	$\emptyset$
$a_1$	0.0062	0.3725	<b>0.6110</b>	$\delta_1 = 0.0102$
$a_2$	0.0929	<b>0.7205</b>	0.1653	$\delta_2 = 0.0213$
$a_3$	0.0001	<b>0.9449</b>	0.0550	$\delta_3 = 0.0000$
$a_4$	0.0000	<b>0.9205</b>	0.0795	$\delta_4 = 0.0000$
$a_5$	<b>0.7736</b>	0.2118	0.0031	$\delta_5 = 0.0114$
$a_6$	0.0005	<b>0.9987</b>	0.0007	$\delta_6 = 0.0000$
$a_7$	0.0029	<b>0.9876</b>	0.0095	$\delta_7 = 0.0000$

(b) SET-NB Step 4.

Table XXII: (SET Step 4) Soft Assignment matrix  $[P(a_i \rightarrow C_h)]$  given by SET-B and SET-NB.

**Remark 2:** For the same reasons as the ones explained in Remark 1, Table XXII-(a) was not included in [1], and Table XXII-(b) corresponds to Table XI in [1] with slightly numerical changes.

## REFERENCES

- [1] J. Dezert, J.M. Tacnet, *Soft ELECTRE TRI outranking method based on belief functions*, in Proceedings of Fusion 2012 International Conference on Information Fusion, Singapore, 9–12 July 2012.
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