APPENDIX E

Report on False Dominants

False Dominants

For the intensely curious reader, we provide a statistical analysis of the number of "false dominants" produced in Part II of our empirical study from chapter 3. Recall that we have defined false dominants as solution vectors that were deemed non-dominated by their respective procedures and then later found to be dominated by a solution vector from some other procedure on the same problem. The fact that we are relegated to dealing with this concept is a direct result of our relaxed definition of Pareto dominance that we described in chapter 3. In the body of chapter 3, we did not report the statistical significance between the number of equivalence class layers in the final population of solution vectors for SAGA vs. Random or PSA vs. Random. In this section, we provide rationale for our approach to reporting the information on the subject test.

Throughout this study, we have emphasized that we are interested in the quality of the "soft frontier" produced by the final population of solution vectors. Recall that we measure quality in two ways, first the number of solutions in the non-dominated set and the number of equivalence class layers in the final population. In terms of quality, the value that can be gleaned from the second measure (number of equivalence class layers) is dependent upon the concept of false dominants. The rationale is that, if a solution method has a high propensity to produce false dominants then the quality of the final solution set is relatively poor, even if the final solution set is tightly fit to the set of false dominants. To measure this "phenomenon" we analyze the number of false dominants produced by each solution method and test for statistically significant differences between them. Table A-C1 shows the number of false dominants produced by each procedure and the corresponding pairwise differences.

TABLE A-C1

False Dominants for Random Test Suite

False Non-dominated Solutions				Differences In Matched Samples		
Problems	SAGA	PSA	Random	SAGA-PSA	PSA-Random	SAGA-Random
1	0	1	7	-1	-6	-7
2	0	0	6	0	-6	-6
3	0	1	4	-1	-3	-4
4	0	0	2	0	-2	-2
5	1	0	4	1	-4	-3
6	0	0	4	0	-4	-4
7	0	0	3	0	-3	-3
8	0	1	7	-1	-6	-7
9	0	1	5	-1	-4	-5
10	0	3	6	-3	-3	-6
11	0	1	6	-1	-5	-6
12	0	1	5	-1	-4	-5
13	0	0	3	0	-3	-3
14	0	1	2	-1	-1	-2
15	0	0	2	0	-2	-2
16	0	3	3	-3	0	-3
17	2	3	4	-1	-1	-2
18	0	1	3	-1	-2	-3
19	0	0	4	0	-4	-4

20	3	0	3	3	-3	0
21	1	1	4	0	-3	-3
22	0	1	3	-1	-2	-3
23	1	0	2	1	-2	-1
24	0	0	3	0	-3	-3
25	0	0	3	0	-3	-3
26	0	0	6	0	-6	-6
27	0	0	1	0	-1	-1
28	0	0	2	0	-2	-2
29	3	1	7	2	-6	-4
30	0	1	4	-1	-3	-4
Average	**0.367**	**0.7**	**3.933**	**-0.333**	**-3.233**	**-3.567**

Table A-C2 shows that statistically significant differences between exist PSA vs. Random and SAGA vs. Random. We can conclude that Random has a much higher propensity to produce false dominants relative to SAGA and PSA. While SAGA produced fewer false dominants on average in this sample, we can conclude that differences in the number of false dominants produced in SAGA vs. PSA is not statistically significant.

TABLE A-C2

False Dominants Test Results

Paired Procedures	t-value
SAGA vs. PSA	-1.542
PSA vs. Random	-10.705*
SAGA vs. Random	-10.888*

* t-values significant at the α=.005