

Count Characteristics

Table 1: Count characteristics for the landscapes of all 40 benchmark problems: number of optima per objective, number of local efficient sets, connected sets and dominance layers, as well as the ratio of Pareto dominant local efficient sets.

ID	Shape	Optima		Local Eff. Sets	Conn. Sets	Dom. Layer	% Pareto Sets
		f_1	f_2				
1	Ellipse	1	1	1	1	1	1.000
2	Ellipse	1	2	3	2	2	0.667
3	Ellipse	1	2	4	2	2	0.500
4	Ellipse	1	2	2	2	2	0.500
5	Ellipse	1	3	4	3	3	0.250
6	Ellipse	1	5	13	6	5	0.231
7	Ellipse	1	2	5	3	2	0.600
8	Ellipse	1	4	14	11	4	0.357
9	Ellipse	2	2	8	5	3	0.250
10	Ellipse	2	2	7	4	3	0.571
11	Ellipse	2	2	4	3	3	0.250
12	Ellipse	2	3	11	10	5	0.091
13	Ellipse	2	5	24	12	5	0.167
14	Ellipse	2	2	5	5	3	0.400
15	Ellipse	2	1	3	2	2	0.667
16	Ellipse	3	2	12	8	5	0.167
17	Ellipse	3	2	13	10	4	0.462
18	Ellipse	3	2	9	6	4	0.333
19	Ellipse	3	3	19	14	7	0.158
20	Ellipse	3	5	29	19	7	0.138
21	Sphere	1	1	1	1	1	1.000
22	Sphere	1	2	2	2	2	0.500
23	Sphere	1	2	5	2	2	0.600
24	Sphere	1	2	3	2	2	0.667
25	Sphere	1	3	3	3	3	0.333
26	Sphere	1	5	9	5	5	0.111
27	Sphere	1	2	5	2	2	0.600
28	Sphere	1	4	13	4	4	0.308
29	Sphere	2	2	5	4	4	0.200
30	Sphere	2	2	10	4	4	0.300
31	Sphere	2	2	6	3	3	0.500
32	Sphere	2	3	9	4	4	0.333
33	Sphere	2	5	16	8	6	0.188
34	Sphere	2	2	4	3	3	0.250
35	Sphere	2	1	3	2	2	0.667
36	Sphere	3	2	12	6	5	0.083
37	Sphere	3	2	17	6	6	0.176
38	Sphere	3	2	8	4	4	0.375
39	Sphere	3	3	12	5	4	0.250
40	Sphere	3	5	29	13	6	0.172

Length Characteristics

Table 2: Length characteristics for the landscapes of all 40 benchmark problems: total length of all local efficient sets, percentage of the lengths of global efficient sets, and the ratio of the latter by the analogous percentage among the count characteristics. The analogous three characteristics are given for the fronts.

ID	Shape	Local Eff. Sets			Local Fronts		
		Total	Pareto Sets Length-%	stand.	Total	Pareto Fronts Length-%	stand.
1	Ellipse	0.157	1.000	1.000	1.134	1.000	1.000
2	Ellipse	0.301	0.525	0.788	1.497	0.521	0.781
3	Ellipse	1.102	0.585	1.170	2.519	0.697	1.394
4	Ellipse	0.870	0.557	1.114	2.521	0.678	1.356
5	Ellipse	0.967	0.448	1.792	2.699	0.542	2.167
6	Ellipse	2.463	0.460	1.993	4.213	0.419	1.815
7	Ellipse	3.212	0.800	1.334	2.742	0.664	1.107
8	Ellipse	3.980	0.692	1.936	4.395	0.469	1.314
9	Ellipse	0.753	0.210	0.840	2.476	0.315	1.259
10	Ellipse	1.116	0.546	0.956	2.919	0.596	1.043
11	Ellipse	1.193	0.406	1.624	3.192	0.536	2.143
12	Ellipse	1.632	0.266	2.921	3.345	0.437	4.809
13	Ellipse	2.017	0.257	1.543	5.091	0.321	1.925
14	Ellipse	1.141	0.249	0.621	3.192	0.490	1.226
15	Ellipse	0.637	0.173	0.259	1.063	0.459	0.689
16	Ellipse	0.864	0.183	1.099	3.504	0.222	1.334
17	Ellipse	1.602	0.609	1.319	4.123	0.613	1.328
18	Ellipse	5.664	0.814	2.441	4.179	0.390	1.170
19	Ellipse	1.777	0.216	1.370	4.759	0.295	1.871
20	Ellipse	2.216	0.148	1.075	5.603	0.221	1.602
21	Sphere	0.134	1.000	1.000	1.192	1.000	1.000
22	Sphere	0.700	0.352	0.704	2.534	0.636	1.272
23	Sphere	0.935	0.548	0.914	2.961	0.543	0.905
24	Sphere	0.641	0.565	0.847	2.296	0.646	0.969
25	Sphere	0.708	0.609	1.827	2.327	0.595	1.784
26	Sphere	1.229	0.346	3.113	3.679	0.456	4.105
27	Sphere	0.722	0.728	1.213	2.102	0.754	1.256
28	Sphere	1.677	0.331	1.075	4.342	0.381	1.240
29	Sphere	1.412	0.174	0.872	3.886	0.415	2.075
30	Sphere	1.410	0.364	1.212	4.134	0.389	1.295
31	Sphere	0.640	0.516	1.032	2.378	0.536	1.072
32	Sphere	0.829	0.477	1.432	2.884	0.476	1.428
33	Sphere	1.483	0.321	1.710	4.515	0.364	1.939
34	Sphere	0.668	0.341	1.363	2.081	0.474	1.897
35	Sphere	0.828	0.648	0.972	2.338	0.689	1.033
36	Sphere	1.812	0.136	1.630	4.977	0.324	3.888
37	Sphere	1.821	0.282	1.595	5.554	0.289	1.639
38	Sphere	0.886	0.373	0.993	2.876	0.443	1.182
39	Sphere	1.003	0.395	1.578	3.431	0.400	1.601
40	Sphere	1.819	0.249	1.444	5.520	0.297	1.721

Connected Sets / Fronts Characteristics

Table 3: Connected sets / fronts characteristics for the landscapes of all 40 benchmark problems: Number and total length of local efficient sets that are connected to a Pareto set, as well as their respective proportions among all local efficient sets. The analogous four characteristics are given for the fronts.

ID	Shape	Connected Sets				Connected Fronts			
		Total		Percentage		Total		Percentage	
		#	Len.	#	Len.	#	Len.	#	Len.
1	Ellipse	1	1.000	1.000	6.379	1	1.000	1.000	0.882
2	Ellipse	2	0.525	0.667	1.745	2	0.521	0.667	0.348
3	Ellipse	2	0.585	0.500	0.531	2	0.697	0.500	0.277
4	Ellipse	1	0.557	0.500	0.641	1	0.678	0.500	0.269
5	Ellipse	1	0.448	0.250	0.463	1	0.542	0.250	0.201
6	Ellipse	3	0.460	0.231	0.187	3	0.419	0.231	0.099
7	Ellipse	4	0.920	0.800	0.287	3	0.664	0.600	0.242
8	Ellipse	6	0.702	0.429	0.176	5	0.469	0.357	0.107
9	Ellipse	2	0.210	0.250	0.279	2	0.315	0.250	0.127
10	Ellipse	4	0.546	0.571	0.489	4	0.596	0.571	0.204
11	Ellipse	1	0.406	0.250	0.340	1	0.536	0.250	0.168
12	Ellipse	1	0.266	0.091	0.163	1	0.437	0.091	0.131
13	Ellipse	5	0.281	0.208	0.139	4	0.321	0.167	0.063
14	Ellipse	2	0.249	0.400	0.218	2	0.490	0.400	0.154
15	Ellipse	2	0.173	0.667	0.271	2	0.459	0.667	0.432
16	Ellipse	2	0.183	0.167	0.212	2	0.222	0.167	0.063
17	Ellipse	6	0.609	0.462	0.380	6	0.613	0.462	0.149
18	Ellipse	4	0.870	0.444	0.154	3	0.390	0.333	0.093
19	Ellipse	3	0.216	0.158	0.122	3	0.295	0.158	0.062
20	Ellipse	5	0.170	0.172	0.077	4	0.221	0.138	0.039
21	Sphere	1	1.000	1.000	7.444	1	1.000	1.000	0.839
22	Sphere	1	0.352	0.500	0.503	1	0.636	0.500	0.251
23	Sphere	5	1.000	1.000	1.070	5	1.000	1.000	0.338
24	Sphere	3	1.000	1.000	1.560	3	1.000	1.000	0.436
25	Sphere	1	0.609	0.333	0.860	1	0.595	0.333	0.256
26	Sphere	1	0.346	0.111	0.281	1	0.456	0.111	0.124
27	Sphere	5	1.000	1.000	1.385	5	1.000	1.000	0.476
28	Sphere	11	0.810	0.846	0.483	13	1.000	1.000	0.230
29	Sphere	1	0.174	0.200	0.123	1	0.415	0.200	0.107
30	Sphere	9	0.946	0.900	0.671	9	0.977	0.900	0.236
31	Sphere	6	1.000	1.000	1.563	6	1.000	1.000	0.421
32	Sphere	5	0.668	0.556	0.806	5	0.675	0.556	0.234
33	Sphere	5	0.591	0.312	0.398	5	0.642	0.312	0.142
34	Sphere	1	0.341	0.250	0.510	1	0.474	0.250	0.228
35	Sphere	3	1.000	1.000	1.208	3	1.000	1.000	0.428
36	Sphere	1	0.136	0.083	0.075	1	0.324	0.083	0.065
37	Sphere	9	0.732	0.529	0.402	9	0.727	0.529	0.131
38	Sphere	6	0.722	0.750	0.814	6	0.827	0.750	0.288
39	Sphere	5	0.552	0.417	0.550	5	0.567	0.417	0.165
40	Sphere	15	0.550	0.517	0.303	16	0.793	0.552	0.144