

Supplementary Report: Results of the Multistart Local Search Algorithms

Josu Ceberio, Ekhine Irurozki,
Alexander Mendiburu, and Jose A. Lozano ^{*†}

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Abstract

In this report we introduce the raw results obtained in the experimental study carried out in the paper *A Review of Distances for the Mallows and Generalized Mallows Estimation of Distribution Algorithms* submitted to the journal *Computational Optimization and Applications*. Particularly, we summarise the results obtained with the Multistart Local Search algorithms under the swap MLS_s , interchange (MLS_x) and insert (MLS_i) neighbourhoods on a benchmark of 200 instances of the Linear Ordering Problem (LOP), the Quadratic Assignment Problem (QAP), the Permutation Flowshop Scheduling Problem (PFSP) and the Travelling Salesman Problem (TSP).

^{*}J. Ceberio, E. Irurozki and J. A. Lozano are with the Intelligent Systems Group, Department of Computer Science and Artificial Intelligence, University of the Basque Country UPV/EHU, Donostia 20018, Gipuzkoa, Spain. {e-mail: josu.ceberio@ehu.es}

[†]A. Mendiburu is with the Intelligent Systems Group, Department of Computer Architecture and Technology, University of the Basque Country UPV/EHU, Donostia 20018, Gipuzkoa, Spain.

Table 1: Average results of 20 repetitions of MLS_s , MLS_x and MLS_i for the LOP instances. In addition, the best result found by any of the MLSs among the executions has been included in the table.

Instance	<i>Best</i>	MLS_s	MLS_x	MLS_i
Cebe.lop.n10.1	22121	2382	2384	2384
Cebe.lop.n10.2	35125	12328	12338	12338
Cebe.lop.n10.3	26130	3209	3210	3210
Cebe.lop.n10.4	454	6269	6269	6269
Cebe.lop.n10.5	243	10533	10543	10543
Cebe.lop.n20.1	36045	12657	13378	13413
Cebe.lop.n20.2	38612	10339	11500	11554
Cebe.lop.n20.3	39652	51996	54954	55160
Cebe.lop.n20.4	646	48622	50594	50661
Cebe.lop.n20.5	343	25520	27062	27186
Cebe.lop.n30.1	38901	32429	37013	37171
Cebe.lop.n30.2	51617	45074	50424	50872
Cebe.lop.n30.3	52054	52763	60132	60702
Cebe.lop.n30.4	907	89031	97154	97721
Cebe.lop.n30.5	371	101583	111864	112768
Cebe.lop.n40.1	46030	52273	60705	61201
Cebe.lop.n40.2	55634	62153	74933	75721
Cebe.lop.n40.3	67786	106976	129909	130813
Cebe.lop.n40.4	974	136511	163234	165301
Cebe.lop.n40.5	435	195900	223635	225015
Cebe.lop.n50.1	57329	85596	103550	104496
Cebe.lop.n50.2	61991	98413	119415	120643
Cebe.lop.n50.3	73178	167018	202557	204339
Cebe.lop.n50.4	1185	162386	199760	202015
Cebe.lop.n50.5	528	255466	305403	308404
Cebe.lop.n60.1	68212	123306	153258	154248
Cebe.lop.n60.2	63833	141462	177469	179276
Cebe.lop.n60.3	90607	205464	253395	256898
Cebe.lop.n60.4	1333	260468	328991	332221
Cebe.lop.n60.5	603	389194	472400	476333
Cebe.lop.n70.1	78039	138375	174892	176638
Cebe.lop.n70.2	77689	212266	266972	269771
Cebe.lop.n70.3	102016	262783	325504	328612
Cebe.lop.n70.4	1549	318988	400508	404570
Cebe.lop.n70.5	665	456555	567391	572680
Cebe.lop.n80.1	77762	166986	212109	214201
Cebe.lop.n80.2	82132	254962	324195	327039
Cebe.lop.n80.3	105084	344041	432209	436444
Cebe.lop.n80.4	1628	430422	544621	550122
Cebe.lop.n80.5	673	512096	649380	656339
Cebe.lop.n90.1	82572	219683	279755	282822
Cebe.lop.n90.2	86197	354236	461726	466397
Cebe.lop.n90.3	116834	421342	544351	551134
Cebe.lop.n90.4	1617	559950	713219	720868
Cebe.lop.n90.5	826278	659618	816242	824599
Cebe.lop.n100.1	372605	283944	368012	372164
Cebe.lop.n100.2	464031	354352	454564	460961
Cebe.lop.n100.3	768924	593717	760896	769631
Cebe.lop.n100.4	933718	711210	921580	932046
Cebe.lop.n100.5	841592	640986	829053	837007

Table 2: Average results of 20 repetitions of MLS_s , MLS_x and MLS_i for the QAP instances. In addition, the best result found by any of the MLSs among the executions has been included in the table.

Instance	$Best$	MLS_s	MLS_x	MLS_i
Cebe.qap.n10.1	3971134	4121285	3971134	4023959
Cebe.qap.n10.2	191405	193277	191405	192284
Cebe.qap.n10.3	6588668	6642823	6588668	6671784
Cebe.qap.n10.4	149411	151750	149411	150753
Cebe.qap.n10.5	7833127	8104155	7833127	8124041
Cebe.qap.n20.1	17655023	28315701	19229218	27227695
Cebe.qap.n20.2	817479	849939	818404	845514
Cebe.qap.n20.3	23561217	34186776	23385676	32705018
Cebe.qap.n20.4	802798	830675	799334	826533
Cebe.qap.n20.5	28198973	36979059	27665130	36177022
Cebe.qap.n30.1	105682995	146193209	102189587	138925102
Cebe.qap.n30.2	1791398	1875079	1791481	1862871
Cebe.qap.n30.3	67061805	97443058	67445050	93790367
Cebe.qap.n30.4	1905605	1990774	1912073	1979459
Cebe.qap.n30.5	57519526	83458842	58421232	80302326
Cebe.qap.n40.1	156949623	233173972	158581188	221085180
Cebe.qap.n40.2	3222598	3358735	3209607	3337462
Cebe.qap.n40.3	145735702	197676443	141738216	189191580
Cebe.qap.n40.4	3358581	3499085	3346232	3480019
Cebe.qap.n40.5	133934433	181100007	129581196	174435238
Cebe.qap.n50.1	260406098	383021336	261530503	366899384
Cebe.qap.n50.2	5369433	5570466	5344357	5542224
Cebe.qap.n50.3	262145145	351238985	258163015	339824864
Cebe.qap.n50.4	5393073	5621538	5391308	5589773
Cebe.qap.n50.5	213713867	291756780	211818362	281223891
Cebe.qap.n60.1	457918667	642795467	457309507	620321424
Cebe.qap.n60.2	7769698	8086379	7771662	8043490
Cebe.qap.n60.3	344818390	468973153	342039736	452082312
Cebe.qap.n60.4	7877537	8199139	7865773	8150783
Cebe.qap.n60.5	321208245	437390187	316473949	420662452
Cebe.qap.n70.1	676724432	946762979	679785569	909035622
Cebe.qap.n70.2	10660152	11072046	10649645	11023014
Cebe.qap.n70.3	528926962	687341915	515969866	668674149
Cebe.qap.n70.4	10414034	10839472	10423590	10787982
Cebe.qap.n70.5	467101324	626637928	465574463	607316356
Cebe.qap.n80.1	881065952	1225492259	884631822	1177657323
Cebe.qap.n80.2	14032237	14615244	14055151	14525690
Cebe.qap.n80.3	697721421	909112924	692890785	884516046
Cebe.qap.n80.4	14132988	14698112	14144040	14629815
Cebe.qap.n80.5	639756786	843241980	633980684	814584983
Cebe.qap.n90.1	1177175998	1621742960	1184967487	1564932014
Cebe.qap.n90.2	17392931	18086932	17400782	18007078
Cebe.qap.n90.3	989650560	1282940150	994444462	1244565063
Cebe.qap.n90.4	17481164	18124625	17450058	18039153
Cebe.qap.n90.5	753545529	1022949215	769302510	988599448
Cebe.qap.n100.1	1495614972	2022312593	1481009132	2147483648
Cebe.qap.n100.2	22184316	22936037	22125684	22848003
Cebe.qap.n100.3	1158421359	1482774158	1147560025	1439058626
Cebe.qap.n100.4	21734674	22545376	21743485	22449673
Cebe.qap.n100.5	993190021	1318400557	986675799	1274256106

Table 3: Average results of 20 repetitions of MLS_s , MLS_x and MLS_i for the PFSP instances. In addition, the best result found by any of the MLSs among the executions has been included in the table.

Instance	<i>Best</i>	MLS_s	MLS_x	MLS_i
Cebe.pfsp.n10.m10.1	7741	7763	7741	7741
Cebe.pfsp.n10.m10.2	8212	8218	8212	8212
Cebe.pfsp.n10.m10.3	7740	7770	7740	7740
Cebe.pfsp.n10.m10.4	7638	7638	7638	7638
Cebe.pfsp.n10.m10.5	8088	8100	8088	8088
Cebe.pfsp.n20.m10.1	20091	21208	20161	20071
Cebe.pfsp.n20.m10.2	19285	20662	19447	19294
Cebe.pfsp.n20.m10.3	19701	20897	19830	19689
Cebe.pfsp.n20.m10.4	19658	20922	19733	19642
Cebe.pfsp.n20.m10.5	21836	22985	21961	21817
Cebe.pfsp.n30.m10.1	38258	41552	38618	38371
Cebe.pfsp.n30.m10.2	38125	41263	38337	38111
Cebe.pfsp.n30.m10.3	38239	41259	38379	38227
Cebe.pfsp.n30.m10.4	37720	40921	38047	37949
Cebe.pfsp.n30.m10.5	40105	42880	40391	40221
Cebe.pfsp.n40.m10.1	60844	66926	61080	60747
Cebe.pfsp.n40.m10.2	63659	68708	63800	63919
Cebe.pfsp.n40.m10.3	60099	66355	60633	60298
Cebe.pfsp.n40.m10.4	66125	70988	66252	66220
Cebe.pfsp.n40.m10.5	63541	68638	63659	63331
Cebe.pfsp.n50.m10.1	90680	98952	91088	90955
Cebe.pfsp.n50.m10.2	90831	100428	91679	91412
Cebe.pfsp.n50.m10.3	88816	98217	89698	89445
Cebe.pfsp.n50.m10.4	89317	97876	89740	89573
Cebe.pfsp.n50.m10.5	92763	101157	93267	93201
Cebe.pfsp.n60.m10.1	120014	134751	121169	120667
Cebe.pfsp.n60.m10.2	121648	136050	122401	122447
Cebe.pfsp.n60.m10.3	121471	134721	122143	121760
Cebe.pfsp.n60.m10.4	122981	135714	124032	123908
Cebe.pfsp.n60.m10.5	128953	142106	129455	129726
Cebe.pfsp.n70.m10.1	159178	178169	160758	160451
Cebe.pfsp.n70.m10.2	163214	183990	164947	164827
Cebe.pfsp.n70.m10.3	157560	175066	158181	158071
Cebe.pfsp.n70.m10.4	164948	184555	165764	165623
Cebe.pfsp.n70.m10.5	165475	183120	166056	166598
Cebe.pfsp.n80.m10.1	200142	225218	200769	201732
Cebe.pfsp.n80.m10.2	195254	217875	195738	196464
Cebe.pfsp.n80.m10.3	199263	225476	201778	202032
Cebe.pfsp.n80.m10.4	193008	219728	194480	194821
Cebe.pfsp.n80.m10.5	208180	229377	208199	208061
Cebe.pfsp.n90.m10.1	244772	279084	246437	247344
Cebe.pfsp.n90.m10.2	246614	279098	247443	248269
Cebe.pfsp.n90.m10.3	247882	280456	249405	250654
Cebe.pfsp.n90.m10.4	249724	280618	250408	250969
Cebe.pfsp.n90.m10.5	253354	282639	253668	254949
Cebe.pfsp.n100.m10.1	301487	339928	302776	303478
Cebe.pfsp.n100.m10.2	301631	339839	302895	303586
Cebe.pfsp.n100.m10.3	299787	339448	300459	301619
Cebe.pfsp.n100.m10.4	308706	347487	308777	310723
Cebe.pfsp.n100.m10.5	296978	332163	296620	297019

Table 4: Average results of 20 repetitions of MLS_s , MLS_x and MLS_i for the TSP instances. In addition, the best result found by any of the MLSs among the executions has been included in the table.

Instance	<i>Best</i>	MLS_s	MLS_x	MLS_i
Cebe.tsp.n10.1	143	143	143	143
Cebe.tsp.n10.2	17745	17745	17745	17745
Cebe.tsp.n10.3	23339	23339	23339	23339
Cebe.tsp.n10.4	27260	27260	27260	27260
Cebe.tsp.n10.5	433	435	433	433
Cebe.tsp.n20.1	250	306	252	251
Cebe.tsp.n20.2	23114	33789	24003	24099
Cebe.tsp.n20.3	36047	49107	38206	38987
Cebe.tsp.n20.4	26130	41980	28754	28326
Cebe.tsp.n20.5	473	641	480	478
Cebe.tsp.n30.1	267	428	264	257
Cebe.tsp.n30.2	41414	61267	38733	38492
Cebe.tsp.n30.3	46671	74342	42859	41324
Cebe.tsp.n30.4	46973	83960	47097	45093
Cebe.tsp.n30.5	731	1102	709	681
Cebe.tsp.n40.1	399	650	384	363
Cebe.tsp.n40.2	43460	79439	43585	42219
Cebe.tsp.n40.3	57580	113103	58463	55891
Cebe.tsp.n40.4	64369	110309	62066	58792
Cebe.tsp.n40.5	1053	1620	1018	965
Cebe.tsp.n50.1	487	865	462	433
Cebe.tsp.n50.2	54971	104293	53054	49617
Cebe.tsp.n50.3	69139	133655	64519	59635
Cebe.tsp.n50.4	87677	155238	81605	76285
Cebe.tsp.n50.5	1125	2040	1067	1024
Cebe.tsp.n60.1	524	1023	510	477
Cebe.tsp.n60.2	66151	132000	65434	60564
Cebe.tsp.n60.3	77986	167832	71853	67010
Cebe.tsp.n60.4	87918	182458	83385	78329
Cebe.tsp.n60.5	1387	2535	1329	1255
Cebe.tsp.n70.1	621	1208	590	556
Cebe.tsp.n70.2	78017	161687	77642	72396
Cebe.tsp.n70.3	78950	195870	81611	72041
Cebe.tsp.n70.4	102442	219867	101204	96838
Cebe.tsp.n70.5	1586	2989	1491	1405
Cebe.tsp.n80.1	682	1466	708	655
Cebe.tsp.n80.2	88301	180596	86511	82124
Cebe.tsp.n80.3	91450	229760	91595	84097
Cebe.tsp.n80.4	117773	254103	116439	108113
Cebe.tsp.n80.5	1692	3513	1712	1632
Cebe.tsp.n90.1	769	1655	762	711
Cebe.tsp.n90.2	91236	205751	89549	82661
Cebe.tsp.n90.3	98573	256604	96816	88936
Cebe.tsp.n90.4	128819	293345	126431	116812
Cebe.tsp.n90.5	1927	3994	1877	1726
Cebe.tsp.n100.1	778	1850	799	724
Cebe.tsp.n100.2	88685	233509	98160	89154
Cebe.tsp.n100.3	101363	289505	106687	97762
Cebe.tsp.n100.4	128048	323150	135569	123556
Cebe.tsp.n100.5	1775	4356	1868	1708