

Testlib200	GFACS				DeepACO				NeuFACO			
	min	mean	max	avg time	min	mean	max	avg time	min	mean	max	avg time
a280	2670 (3.53%)	2674 (3.68%)	2682 (3.99%)	16.76	2653 (2.87%)	2665 (3.37%)	2673 (3.64%)	16.99	2642 (2.44%)	2646 (2.61%)	2663 (3.26%)	0.67
bier127	118368 (0.07%)	118368 (0.07%)	118368 (0.07%)	5.20	118368 (0.07%)	118450 (0.14%)	118575 (0.25%)	5.29	118368 (0.07%)	118368 (0.07%)	118368 (0.07%)	0.44
ch130	6182 (1.18%)	6186 (1.25%)	6203 (1.52%)	5.41	6184 (1.21%)	6195 (1.39%)	6208 (1.60%)	5.31	6177 (1.10%)	6188 (1.29%)	6232 (2.00%)	0.43
ch150	6631 (1.58%)	6638 (1.69%)	6646 (1.81%)	5.91	6639 (1.70%)	6652 (1.91%)	6678 (2.30%)	5.97	6609 (1.24%)	6619 (1.40%)	6634 (1.62%)	0.46
d198	15930 (0.95%)	15937 (1.00%)	15945 (1.05%)	10.50	15933 (0.97%)	15965 (1.18%)	15990 (1.33%)	10.49	15904 (0.79%)	15911 (0.83%)	15924 (0.91%)	0.58
eil101	702 (11.61%)	703 (11.91%)	706 (12.24%)	4.36	702 (11.61%)	706 (12.24%)	708 (12.56%)	4.33	702 (11.61%)	702 (11.67%)	703 (11.76%)	0.43
gil262	2557 (7.53%)	2567 (7.99%)	2573 (8.20%)	15.01	2566 (7.91%)	2574 (8.25%)	2582 (8.58%)	15.28	2542 (6.90%)	2550 (7.25%)	2558 (7.57%)	0.59
kroA100	21346 (0.30%)	21346 (0.30%)	21346 (0.30%)	4.41	21346 (0.30%)	21346 (0.30%)	21346 (0.30%)	4.33	21346 (0.30%)	21346 (0.30%)	21346 (0.30%)	0.52
kroB100	22185 (0.20%)	22197 (0.26%)	22225 (0.38%)	4.33	22185 (0.20%)	22210 (0.31%)	22236 (0.43%)	4.32	22185 (0.20%)	22201 (0.27%)	22243 (0.46%)	0.54
kroC100	20802 (0.26%)	20802 (0.26%)	20802 (0.26%)	4.35	20802 (0.26%)	20806 (0.28%)	20822 (0.35%)	4.36	20802 (0.26%)	20802 (0.26%)	20802 (0.26%)	0.51
kroD100	21347 (0.25%)	21373 (0.37%)	21403 (0.51%)	4.30	21347 (0.25%)	21410 (0.55%)	21429 (0.63%)	4.38	21347 (0.25%)	21347 (0.25%)	21347 (0.25%)	0.51
kroE100	22152 (0.38%)	22170 (0.47%)	22183 (0.52%)	4.32	22123 (0.25%)	22134 (0.30%)	22161 (0.42%)	4.36	22152 (0.38%)	22170 (0.46%)	22174 (0.48%)	0.52
kroA150	26609 (0.32%)	26648 (0.47%)	26729 (0.77%)	6.24	26609 (0.32%)	26629 (0.40%)	26673 (0.56%)	6.11	26609 (0.32%)	26609 (0.32%)	26609 (0.32%)	0.45
kroB150	26240 (0.42%)	26274 (0.55%)	26290 (0.61%)	6.12	26271 (0.54%)	26310 (0.69%)	26366 (0.90%)	6.15	26207 (0.29%)	26208 (0.30%)	26209 (0.30%)	0.46
kroA200	29529 (0.55%)	29551 (0.62%)	29609 (0.82%)	9.39	29518 (0.51%)	29613 (0.84%)	29677 (1.05%)	9.46	29480 (0.38%)	29480 (0.38%)	29480 (0.38%)	0.60
kroB200	29794 (1.21%)	29914 (1.62%)	30043 (2.06%)	9.40	29719 (0.96%)	29898 (1.57%)	30010 (1.95%)	9.56	29552 (0.39%)	29586 (0.51%)	29844 (1.38%)	0.60
lin105	14441 (0.43%)	14441 (0.43%)	14441 (0.43%)	4.61	14441 (0.43%)	14441 (0.43%)	14441 (0.43%)	4.47	14441 (0.43%)	14441 (0.43%)	14441 (0.43%)	0.42
pr107	44329 (0.06%)	44329 (0.06%)	44329 (0.06%)	4.48	44329 (0.06%)	44329 (0.06%)	44329 (0.06%)	4.53	44329 (0.06%)	44337 (0.08%)	44415 (0.25%)	0.42
pr124	59102 (0.12%)	59102 (0.12%)	59102 (0.12%)	4.91	59102 (0.12%)	59102 (0.12%)	59102 (0.12%)	4.94	59102 (0.12%)	59102 (0.12%)	59102 (0.12%)	0.48
pr136	96832 (0.06%)	96923 (0.16%)	97021 (0.26%)	5.39	96839 (0.07%)	96942 (0.18%)	97014 (0.25%)	5.33	96832 (0.06%)	96850 (0.08%)	96930 (0.16%)	0.49
pr144	58641 (0.18%)	58644 (0.18%)	58675 (0.24%)	5.81	58641 (0.18%)	58641 (0.18%)	58641 (0.18%)	5.98	58641 (0.18%)	58641 (0.18%)	58641 (0.18%)	0.67
pr152	73769 (0.12%)	73769 (0.12%)	73769 (0.12%)	6.25	73769 (0.12%)	73769 (0.12%)	73772 (0.12%)	6.28	73769 (0.12%)	73824 (0.19%)	73908 (0.31%)	0.46
pr226	80498 (0.16%)	80542 (0.22%)	80629 (0.32%)	12.06	80539 (0.21%)	80571 (0.25%)	80611 (0.30%)	12.04	80457 (0.11%)	80457 (0.11%)	80457 (0.11%)	0.58
pr264	49264 (0.26%)	49264 (0.26%)	49264 (0.26%)	14.95	49264 (0.26%)	49264 (0.26%)	49264 (0.26%)	15.34	49264 (0.26%)	49264 (0.26%)	49264 (0.26%)	0.63
pr299	48541 (0.73%)	48659 (0.97%)	48762 (1.18%)	20.72	48714 (1.09%)	48782 (1.23%)	48841 (1.35%)	20.30	48334 (0.30%)	48345 (0.32%)	48432 (0.50%)	0.68
rat195	2470 (6.33%)	2476 (6.62%)	2484 (6.93%)	8.28	2485 (6.97%)	2495 (7.43%)	2506 (7.88%)	8.38	2457 (5.77%)	2457 (5.78%)	2458 (5.81%)	0.58
rd100	7958 (0.61%)	7959 (0.63%)	7964 (0.68%)	4.35	7958 (0.61%)	7958 (0.61%)	7959 (0.62%)	4.34	7958 (0.61%)	7958 (0.61%)	7958 (0.61%)	0.53
ts225	126927 (0.22%)	127092 (0.35%)	127218 (0.45%)	11.24	126930 (0.23%)	127086 (0.35%)	127219 (0.45%)	11.35	126760 (0.09%)	126774 (0.10%)	126828 (0.15%)	0.63
tsp225	3958 (1.07%)	3969 (1.36%)	3986 (1.79%)	10.78	3970 (1.38%)	3975 (1.52%)	3987 (1.81%)	10.95	3954 (0.97%)	3959 (1.10%)	3979 (1.61%)	0.64
u159	42107 (0.06%)	42255 (0.42%)	42402 (0.77%)	6.47	42107 (0.06%)	42107 (0.06%)	42107 (0.06%)	6.39	42107 (0.06%)	42107 (0.06%)	42107 (0.06%)	0.52

Testlib500	GFACS				DeepACO				NeuFACO			
	min	mean	max	avg time	min	mean	max	avg time	min	mean	max	avg time
d493	35779 (2.22%)	35841 (2.40%)	35929 (2.65%)	66.22	35974 (2.78%)	36116 (3.18%)	36249 (3.56%)	71.86	35338 (0.96%)	35453 (1.29%)	35513 (1.46%)	1.10
d657	50159 (2.55%)	50272 (2.78%)	50366 (2.97%)	140.31	50446 (3.14%)	50933 (4.13%)	51189 (4.66%)	140.61	49476 (1.15%)	49581 (1.37%)	49644 (1.50%)	1.35
fl417	12174 (2.64%)	12184 (2.72%)	12190 (2.77%)	50.21	12185 (2.73%)	12195 (2.82%)	12206 (2.91%)	54.33	12119 (2.18%)	12122 (2.20%)	12127 (2.24%)	0.99
lin318	42437 (0.97%)	42537 (1.21%)	42654 (1.49%)	25.93	42811 (1.86%)	42891 (2.05%)	42950 (2.19%)	25.03	42194 (0.39%)	42439 (0.98%)	42696 (1.59%)	0.83
p654	34748 (0.30%)	35070 (1.23%)	35143 (1.44%)	164.44	34512 (-0.38%)	35036 (1.13%)	35161 (1.50%)	162.94	34919 (0.80%)	34930 (0.83%)	34944 (0.87%)	1.31
pcb442	51469 (1.36%)	51606 (1.63%)	51690 (1.80%)	50.51	51818 (2.05%)	51940 (2.29%)	52037 (2.48%)	44.47	51232 (0.89%)	51593 (1.61%)	51969 (2.35%)	1.05
pr439	107911 (0.65%)	108104 (0.83%)	108196 (0.91%)	50.94	108332 (1.04%)	108585 (1.28%)	108799 (1.48%)	47.12	107469 (0.24%)	108129 (0.85%)	109522 (2.15%)	1.13
rat575	7226 (6.69%)	7246 (6.98%)	7266 (7.28%)	89.26	7378 (8.93%)	7399 (9.24%)	7413 (9.45%)	83.53	7190 (6.16%)	7209 (6.44%)	7233 (6.79%)	1.18
rd400	15620 (2.22%)	15659 (2.47%)	15696 (2.72%)	43.26	15816 (3.50%)	15894 (4.01%)	15937 (4.29%)	37.70	15521 (1.57%)	15586 (2.00%)	15648 (2.40%)	0.96
u574	37837 (2.53%)	37963 (2.87%)	38066 (3.15%)	94.13	38441 (4.16%)	38528 (4.40%)	38652 (4.73%)	88.98	37343 (1.19%)	37625 (1.95%)	37749 (2.29%)	1.16

Method	Testlib200		Testlib500		Test200		Avg cost	Test500		
	Avg gap (%)	Avg time (s)	Avg gap (%)	Avg time (s)	Avg gap (%)	Avg time (s)		Avg gap (%)	Avg time (s)	Avg cost
DeepACO	1.55	7.91	3.45	75.66	0.97	9.44	10.80	1.98	64.16	17.03
GFACS	1.48	7.88	2.51	77.52	0.84	9.40	10.78	0.60	71.37	16.80
NeuFACO	1.25	0.53	1.95	1.11	0.16	0.65	10.71	0.74	0.56	16.83

	N	#	DeepACO	GFACS	NeuFACO(ours)
TSPLib	100–299	30	1.71%	1.25%	1.21%
	300–699	10	4.26%	2.70%	2.60%
	700–1499	12	7.01%	4.08%	3.88%
TSP	100–299	10	2.50%	3.27%	2.69%
	300–699	10	3.75%	4.22%	3.71%
	700–1001	128	4.64%	5.07%	4.32%

Method	TSP500			TSP1000		
	Obj.	Gap(%)	Time	Obj.	Gap(%)	Time
Concorde	16.55	–	10.7s	23.12	–	108s
LKH-3	16.55	0.02	31.7s	23.14	0.10	102s
AM*	21.46	29.07	0.6s	33.55	45.10	1.5s
POMO*	20.57	24.40	0.6s	32.90	42.30	4.1s
+EAS	18.25	10.29	300s	30.77	33.06	600s
+SGBS	18.86	13.98	318s	28.58	23.61	605s
DIMES*	17.01	2.78	11s	24.45	5.75	32s
SO*	16.94	2.40	15s	23.77	2.80	26s
Pointerformer*	17.14	3.56	14s	24.80	7.90	40s
ACO	17.38	5.04	14s	24.76	7.09	57s
DeepACO	16.84	1.77	15s	23.78	2.87	66s
GFACS	16.80	1.56	15s	23.72	2.63	66s

Method	CVRP500			CVRP1000		
	Obj.	Gap(%)	Time	Obj.	Gap(%)	Time
PyVRP	62.96	–	21.0m	119.29	–	1.4h
LKH-3	63.07	0.18	18.6m	119.52	0.20	2.1h
POMO	68.69	9.08	2s	145.74	22.14	3s
+EAS	64.76	2.85	5.0m	126.25	5.83	10.0m
+SGBS	65.44	3.93	5.2m	127.90	7.21	10.1m
Sym-NCO	68.81	9.28	2s	141.82	18.86	3s
+EAS	64.63	2.65	5.0m	125.58	5.27	10.0m
+SGBS	65.40	3.87	5.2m	127.53	6.90	10.1m
ACO	64.62	2.63	36s	122.82	2.96	1.3m
DeepACO	64.49	2.43	36s	122.15	2.40	1.3m
GFACS	64.19	1.95	36s	121.80	2.11	1.3m

	N	#	DeepACO	GFACS	NeuFACO
TSP Lib	100–299	30	1.50%	1.44%	1.39%
			13.70s	13.75s	0.22s
	300–699	10	3.43%	2.46%	2.06%
			143.92s	150.49s	0.48s
	700–1499	12	4.86%	3.99%	2.98%
			1047.59s	1141.24s	1.03s
TSP Random	200	64	1.91%	1.83%	1.74%
			16.78s	16.84s	0.32s
	500	64	2.92%	1.45%	1.48%
			118.67s	140.87s	0.77s
	1000	32	4.53%	2.66%	2.19%
			652.46s	731.17s	2.01s

Dataset	N	#	DeepACO		GFACS		NeuFACO	
			Gap(%)	Time(s)	Gap(%)	Time(s)	Gap(%)	Time(s)
TSP Lib	100 – 299	30	1.50	13.70	1.44	13.75	1.39	0.22
	300 – 699	10	3.43	143.92	2.46	150.49	2.06	0.48
	700 – 1499	12	4.86	1047.59	3.99	1141.24	2.98	1.03
TSP Random	200	64	1.89	16.86	1.80	17.36	1.66	0.28
	500	64	3.03	119.58	1.54	136.14	1.50	0.74
	1000	32	4.44	652.46	2.57	731.17	2.19	1.98

Method	TSPLib200		TSPLib500		TSPLib1000	
	Gap(%)	Time	Gap(%)	Time	Gap(%)	Time
DeepACO	1.50	13.70s	3.43	143.92s	4.86	1047.59s
GFACS	1.44	13.75s	2.46	150.49s	3.99	1141.24s
NeuFACO	1.39	0.22s	2.06	0.48s	2.98	1.03s

Method	TSP200		TSP500		TSP1000	
	Gap(%)	Time	Gap(%)	Time	Gap(%)	Time
DeepACO	1.89	16.86s	3.03	119.58s	4.44	652.46s
GFACS	1.80	17.36s	1.54	136.14s	2.57	731.17s
NeuFACO	1.66	0.28s	1.50	0.74s	2.19	1.98s

Method	TSP500			TSP1000		
	Obj.	Gap(%)	Time	Obj.	Gap(%)	Time
Concorde	16.55	–	10.7s	23.12	–	108s
LKH-3	16.55	0.02	31.7s	23.14	0.10	102s
AM	21.46	29.07	0.6s	33.55	45.10	1.5s
POMO	20.57	24.40	0.6s	32.90	42.30	4.1s
+EAS	18.25	10.29	300s	30.77	33.06	600s
+SGBS	18.86	13.98	318s	28.58	23.61	605s
DIMES	17.01	2.78	11s	24.45	5.75	32s
SO	16.94	2.40	15s	23.77	2.80	26s
Pointerformer	17.14	3.56	14s	24.80	7.90	40s
ACO	17.38	5.04	14s	24.76	7.09	57s
DeepACO	16.84	1.77	15s	23.78	2.87	66s
GFACS	16.80	1.56	15s	23.72	2.63	66s
NeuFACO	16.38	1.52	32.6s	23.34	1.16	41s