Ant Colony Optimization with Local Search for Dynamic Traveling Salesman Problems – Supplementary Material

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VII. Pheromone Evaporation Parameter Tuning

We have varied the evaporation rate value as follows: $\rho \in \{0.0, 0.2, 0.4, 0.6, 0.8\}$. The experimental results of $\mathcal{MM}$AS with the *US* operator are shown in Table IV. The same experiments were performed considering other local search operators (e.g., *2–Opt* and *3–Opt*) with the same behaviour and thus, are not reported here. This shows that the evaporation rate does not depend on the particular local search operator used. The results show the importance of the evaporation rate because when no evaporation is used (e.g., $\mathcal{MM}$AS($\rho = 0.0$)) the performance is significantly worse. In addition, the results are consistent since for almost all DTSPs (especially asymmetric) a higher evaporation rate leads to better performance. In fact, a higher evaporation rate corresponds to faster adaptation, which is essential when addressing dynamic environments [1]. Therefore, the evaporation rate for all "memetic" $\mathcal{MM}$AS algorithms is set to $\rho = 0.8$ for the experiments in the paper.

TABLE IV: Experimental results regarding the solution quality (offline performance) of $\mathcal{MM}\text{AS}_{US}$ with different evaporation rates

Symmetric Travelling Salesman Problem												
Algorithms & DTSPs	`kroA100.tsp`				`kroA150.tsp`				`kroA200.tsp`			
$f = 10$, $m \Rightarrow$	0.1	0.25	0.5	0.75	0.1	0.25	0.5	0.75	0.1	0.25	0.5	0.75
$\mathcal{MM}\text{AS}_{US}(\rho = 0.0)$	22462	23770	26601	30879	28138	29694	33138	38139	31269	32949	36902	42513
$\mathcal{MM}\text{AS}_{US}(\rho = 0.2)$	22224	23626	26522	30778	27897	29576	33081	38141	30858	32778	36817	42522
$\mathcal{MM}\text{AS}_{US}(\rho = 0.4)$	22200	23577	26483	30754	27779	29507	33066	38094	30737	32671	36803	42499
$\mathcal{MM}\text{AS}_{US}(\rho = 0.6)$	22187	23567	26475	30741	27773	29484	33036	38093	30704	32646	36778	42473
$\mathcal{MM}\text{AS}_{US}(\rho = 0.8)$	22186	23552	26465	30726	27744	29494	33045	38076	30722	32635	36772	42451
$f = 100$, $m \Rightarrow$	0.1	0.25	0.5	0.75	0.1	0.25	0.5	0.75	0.1	0.25	0.5	0.75
$\mathcal{MM}\text{AS}_{US}(\rho = 0.0)$	22490	23760	26583	30878	28160	29694	33122	38186	31270	32925	36893	42557
$\mathcal{MM}\text{AS}_{US}(\rho = 0.2)$	22166	23522	26415	30682	27767	29457	32982	38022	30671	32578	36693	42373
$\mathcal{MM}\text{AS}_{US}(\rho = 0.4)$	22157	23515	26420	30660	27727	29438	32973	37997	30633	32555	36690	42344
$\mathcal{MM}\text{AS}_{US}(\rho = 0.6)$	22173	23512	26411	30658	27733	29434	32959	37994	30667	32569	36668	42345
$\mathcal{MM}\text{AS}_{US}(\rho = 0.8)$	22162	23523	26405	30646	27754	29432	32970	37994	30686	32575	36667	42345
Asymmetric Travelling Salesman Problem												
Algorithms & DTSPs	`kroA100.atsp`				`kroA150.atsp`				`kroA200.atsp`			
$f = 10$, $m \Rightarrow$	0.1	0.25	0.5	0.75	0.1	0.25	0.5	0.75	0.1	0.25	0.5	0.75
$\mathcal{MM}\text{AS}_{US}(\rho = 0.0)$	22481	24120	27386	31951	28479	30526	34694	40623	31763	34211	38991	45599
$\mathcal{MM}\text{AS}_{US}(\rho = 0.2)$	22317	23985	27419	31947	28158	30363	34715	40711	31368	34076	38978	45815
$\mathcal{MM}\text{AS}_{US}(\rho = 0.4)$	22272	23852	27339	31802	28001	30297	34703	40618	31242	33960	38960	45761
$\mathcal{MM}\text{AS}_{US}(\rho = 0.6)$	22240	23851	27303	31813	27967	30161	34655	40574	31139	33902	38821	45682
$\mathcal{MM}\text{AS}_{US}(\rho = 0.8)$	22241	23781	27212	31701	27998	30132	34509	40529	31071	33803	38807	45597
$f = 100$, $m \Rightarrow$	0.1	0.25	0.5	0.75	0.1	0.25	0.5	0.75	0.1	0.25	0.5	0.75
$\mathcal{MM}\text{AS}_{US}(\rho = 0.0)$	22292	23941	27352	31786	28224	30426	34741	40658	31434	34134	39027	45663
$\mathcal{MM}\text{AS}_{US}(\rho = 0.2)$	22155	23570	26754	31014	27796	29793	33961	39746	30910	33364	38162	44854
$\mathcal{MM}\text{AS}_{US}(\rho = 0.4)$	22148	23532	26687	30945	27816	29707	33815	39582	30874	33239	37964	44664
$\mathcal{MM}\text{AS}_{US}(\rho = 0.6)$	22165	23544	26643	30896	27831	29723	33755	39501	30821	33203	37934	44597
$\mathcal{MM}\text{AS}_{US}(\rho = 0.8)$	22145	23565	26641	30881	27820	29696	33733	39463	30841	33215	37890	44562

References

[1] M. Mavrovouniotis and S. Yang, "Adapting the pheromone evaporation rate in dynamic routing problems," in *Applications of Evolutionary Computation*, ser. LNCS, vol. 7835, 2013, pp. 606–615.

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