Hybrid Iterative Tabu Search

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1 Introduction

The quadratic assignment problem (QAP) is one of the most studied NP-hard problems. It is applied for many fields such as : electronic, transport and industry. Works on some significant applications of QAP can be found in [1][2][3][4][5]. The QAP was first introduced by Koopmans and Beckmann [6] to model a facility location problem. The objective is to minimize the cost assignment of facilities to locations considering the flow of materials between facilities and the distance between locations.

2 Hybrid Iterative Tabu Search algorithm

In this work, we propose an algorithm called Hybrid Iterative Tabu Search (HITS). This algorithm combines an Iterative Tabu Search (ITS) with different learning mechanism to escape from stagnancy. A set of 11 well-known benchmark instances from the QAPLIB (*http* : *//www.seas.upenn.edu/qaplib/inst.html*) [9] was experimented. The instances are between 20 and 100 and compared to the three best proposition of [8]. Using the same number of objective function evaluations, table 1 presents the main results of the comparison. Only the quality of solution is considered since we did not use the same performance machine to compute the execution times and the time is computed in second.

We can see that HITS outperforms all the variants of [8] in terms of several deviation over the 11 instances. The global average of HITS is 0.297% against 0.304 % for divTS which is the best variant of [8]. Two other variants are proposed on [8] (RDTS and RRTS). The average

TAB. 1 – Our Results

Instances(11)	**BKS**	**HITS**		**TTMTS**		**BSFTS**		**divTS**	
		deviation	times	deviation	times	deviation	times	deviation	times
sko100a	152002	**0.006**	688.09	0.026	134.53	0.024	132.80	0.027	129.22
sko100b	153890	**0.004**	685.137	0.011	124.84	0.010	113.02	0.008	106.55
sko100c	147862	**0.003**	760.389	0.008	113.95	0.010	107.90	0.006	126.69
sko100d	149576	**0.002**	760.451	0.016	129.23	0.011	121.98	0.027	123.45
sko100e	149150	0.013	760.258	**0.007**	130.14	0.011	115.62	0.009	108.84
sko100f	149036	**0.007**	760.59	0.021	118.90	0.012	127.00	0.023	110.28
tai40a	3139370	**0.175**	47.283	0.284	5.22	0.311	4.81	0.222	5.16
tai50a	4938796	**0.597**	91.768	0.700	10.07	0.685	10.46	0.725	10.23
tai60a	7205962	**0.623**	159.017	0.820	25.92	0.752	20.65	0.718	25.69
tai80a	13515450	0.782	379.385	0.817	69.21	0.841	54.61	**0.753**	52.74
tai100a	21052466	**0.765**	769.194	0.846	145.26	0.848	129.73	0.825	142.06
Average		**0.297**	525.23	0.323	91.55	0.320	85.33	0.304	85.54

of RDTS is 0.408% and the average of RRTS is 0.337%. HITS get better results for all the 11 instances except for tai80a and sko100e. For tai80a divTS gets the best results with 0.753% and our proposition came second after this variant. For sko100e TTMTS and RRTS gets the best results with 0.007% against 0.013% for our algorithm.

Other instances of size 27, 45 and 75 from the Taillard repository [1] are experimented. These instances are rarely solved in the literature. The HITS algorithm gets the best known solution (BKS) all the time for the 40 instances of size 27 and 45. For the 20 instances experimented on size 75, HITS gets results between 0% (for tai75e20) and 3.425% (for tai75e08).

3 Conclusion

In this proposition, we have presented and validated the HITS approach to solve the QAP. An ITS has been implemented using a set of adaptive mechanism to escape from stagnancy. Good results are proposed and compared to works from the literature.

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