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Appendix

List of symbols

Statistics and statistic tests

$(\text{error})_{ij}$	residual error
$(\widetilde{p}\widetilde{t})_{ij}$	combined contribution (interaction) of a level of the problem factor and a level of the treatment factor.
α	significance level
$cv(...)$, $cv^{lower}(...)$, $cv^{upper}(...)$	critical values
d_i	difference value between a matched pair
f_{ij}, f_{ijk}	response variables
$F(...)$	distribution function
H_0	null hypothesis
H_a	alternate hypothesis
μ	sample mean
$N()$	normal distribution
P	probability
ρ	correlation coefficient
R_i	rank value
$R+$, $R-$	sum of ranks
s, s_1^2, s_2^2	standard deviations
σ	variance
t	test statistic
t_{n-1}	t-distribution with $n-1$ degrees of freedom
v_1, v_2	degrees of freedom (DF)
W	test statistic
X, Y	(random) samples
$x_1,...,x_n$	sample of observations
$\overline{x}$	sample mean
$\hat{x}$	median
Z	test statistic

Algorithms (general)

$F(S)$	objective function
F^{BC}	best-case solution value

F^{LB}	lower bound
F^{UB}	upper bound
F^{WC}	worst-case solution value
FOP	set of feasible operations
$h(\rho, P)$	vectorized results of an algorithmic instance applied on a problem instance
$nb\_iterations$	number of iterations
nb_levels	number of levels
$N(S)$	neighborhood of a solution S
op	heuristic operation
OP	set of all heuristic operations
$\Omega(P)$	solution space
(P)	optimization problem
$P \in (P)$	problem instance
r_i	performance criterion rank
ρ	algorithmic instance
R	set of real values
S, S'	solutions
$S*$	optimal solution
S^{CURR}	current solution
S^{START}	start solution
td	tabu tenure
w_i	performance criterion weight
w_{ij}	relative performance criterion value
$X \subseteq \Omega$	feasible part of a solution space
$z = (P, \rho, h(\rho, P))$	vector representing an algorithmic application
Z	set of all $z = (P, \rho, h(\rho, P))$

<u>Ant systems</u>

α, β	weighting factors for the prioritizing rule
L_k	tour length of ant k
m	number of ants
Q	constant trail factor
ρ	evaporation parameter
t	number of levels

Algorithmic evaluation[1]

$dev^{AV}(...)$	average deviation
$dev^{B}(...)$	best deviation
$dev^{W}(...)$	worst deviation
$f^{AV}(...)$	average solution
$f^{B}(...)$	best solution
$f^{W}(...)$	worst solution
$i = 1..I$	number of problem instances p_i
$j = 1..J$	number of heuristic treatments t_j
μ, μ_X, μ_Y	mean values
p_i	problem instance
$r = 1..R$	number of computation runs
$rank^{AV}(...)$	average rank
$rank^{B}(...)$	best rank
$rank^{W}(...)$	worst rank
$t(...)$	run time
t_j	heuristic treatment

Optimization problems

a) Knapsack problem

c_i	capacity units of item i
C	capacity
$i = 1..I$	number of items
v_i	value of item i
x_i	number of item i

b) Quadratic assignment problem

$C = [c_{ij}]_{nxn}$	distance matrix
$N = \{1,...,n\}$	set of objects
π	permutation
$T = [t_{ij}]_{nxn}$	flow matrix

[1] For the evaluation of numerical results a variety of different figures is used that cannot be listed here completely.

c) Steiner tree problem in graphs

$G=(V,E)$	graph
p^*	vertex
Q	set of basic vertices
S	set of Steiner vertices
v^*	vertex
V	set of vertices
w	start vertex

d) Traveling salesman problem

$C=[c_{ij}]_{nxn}$	distance matrix
$G=(V,E)$	graph
e	edge in a graph
E	set of edges
$N=\{1,...,n\}$	set of cities