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(ETS) () (MOSS)

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(JIT)

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PMSP-E/T
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PMSP-E/T

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s.t.

$$c_i + e_i - t_i = d_i \quad \forall i \quad ()$$

$$\sum_{i=0}^N \sum_{k=1}^K x_{ijk} = 1 \quad \forall j \quad ()$$

$$\sum_{i=0}^N x_{ijk} = y_{jk} \quad \forall j, k \quad ()$$

$$\sum_{j=1}^K x_{ijk} \leq y_{ik} \quad \forall i, k \quad ()$$

$$\sum_{k=1}^K y_{ik} = 1 \quad \forall i \quad ()$$

$$c_j - c_i + W(1 - x_{ijk}) \geq p_{jk} + s_{ijk} \quad \forall i, j, i \neq j \quad ()$$

$$c_i \geq s_{0ik} \times y_{ik} + p_{ik} \times y_{ik} \quad \forall i, k \quad ()$$

$$y_{ik} \in \{0,1\} \quad \forall i, k \quad ()$$

$$x_{ijk} \in \{0,1\} \quad \forall i, j, k; i \neq j \quad ()$$

$$c_i, t_i, e_i \geq 0 \quad \forall i \quad ()$$

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$$()$$

$j = (i \ n) \dots$
 $(k = K) \dots$
 i
 i
 i

j
 k
 i
 i

j
 i
 k
 k

y_{jk}
 x_{ijk}
 i
 k
 j
 i

$\} = x_{ijk}$
 $\} = B_v$

n
 m

$$\min z_1 = \sum_{i=1}^N \alpha_i e_i \quad ()$$

$$\min z_2 = \sum_{i=1}^N \beta_i t_i \quad ()$$

$\delta > 0$ \bar{x} $()$

δ \bar{x} \bar{x}_1 \bar{x} $()$

\bar{x} $() ()$ $()$

\bar{x} \bar{x}_1 \bar{x} **MOSS**

$()$ $()$ $($

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Surrogate constraint problem

$()$

$$\begin{aligned}
 & : \quad \bar{x}_2 \quad \bar{x}_1 \\
 & f_i(\bar{x}_1) \leq f_i(\bar{x}_2) \quad i=1, \dots, q \quad () \\
 & f_i(\bar{x}_1) \prec f_i(\bar{x}_2) \quad \exists i=1, \dots, q \quad ()
 \end{aligned}$$

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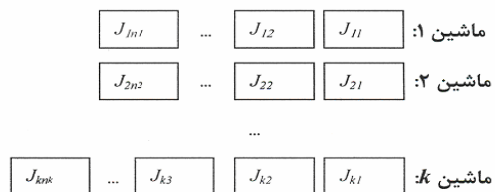
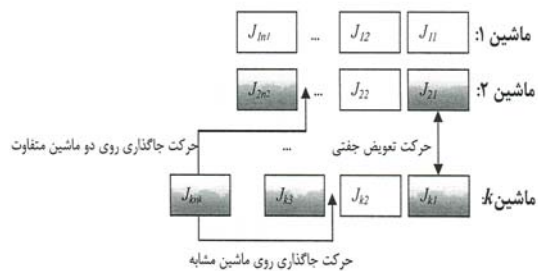
()

k

n_k

n

()



J_{kl} کار انجام شده در موقعیت l از ماشین k
 m_k تعداد کارهای انجام شده روی ماشین k

N

N

α

α×N

$\alpha \times N$

N

$N, \alpha \times N$

$N,$

j-1 i
j-1 i

$k \times n^{1.5} / (m-0.5)$

/ k

Lingo 8

$\varepsilon,$

$$\zeta = \sum_{i=1}^k \frac{|f_i - F_i|}{w_i} \quad ()$$

i f_i ()

w_i i F_i

N

i

w_i

i

η

$$\eta = \zeta_B - \zeta_A \quad ()$$

B

A ()

$\eta \leq 0$

A B

$\eta \leq 0$

A B

Aspiration

$\eta \geq 0$

A

B

Arch-Size

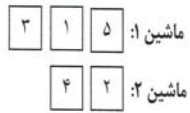
A

$\eta \geq 0$

A

()

landa



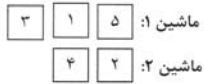
حل کمکی (۵-۱, ۲-۲, ۱-۱, ۳-۱, ۴-۲)



حل اولیه (۳-۱, ۵-۲, ۲-۲, ۴-۱, ۱-۱, ۲-۲)



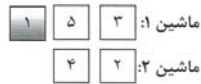
حل مرحله ۲ (۳-۱, ۵-۱, ۲-۲, ۴-۲, ۱-۲)



حل نهایی (۵-۱, ۲-۲, ۱-۱, ۳-۱, ۴-۲)



حل مرحله ۱ (۳-۱, ۵-۱, ۲-۲, ۴-۱, ۱-۲)



حل مرحله ۳ (۳-۱, ۵-۱, ۲-۲, ۴-۲, ۱-۱)

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RefSet₂

()

$$b^*(b-1)/2$$

Mcuox

local-iteration

ϖ

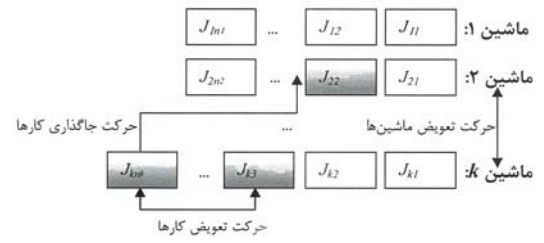
N

$$\varpi = N$$

$$\varpi > N$$

$$\varpi < N$$

$$N - \varpi$$



()

() RefSet₁

() RefSet₂

b₂ b₁

$$|Refset| = b \leq b_1 + b_2$$

b₁

RefSet₁

RefSet₁

RefSet₁

b₂

$$SUMP = \sum_{i=1}^m \left(\frac{\sum_{j=1}^n P_{ij}}{n} \right)$$

()

xp

RD

F ()

/ RD / F

m n

[]

[]

spacing

[]

spacing

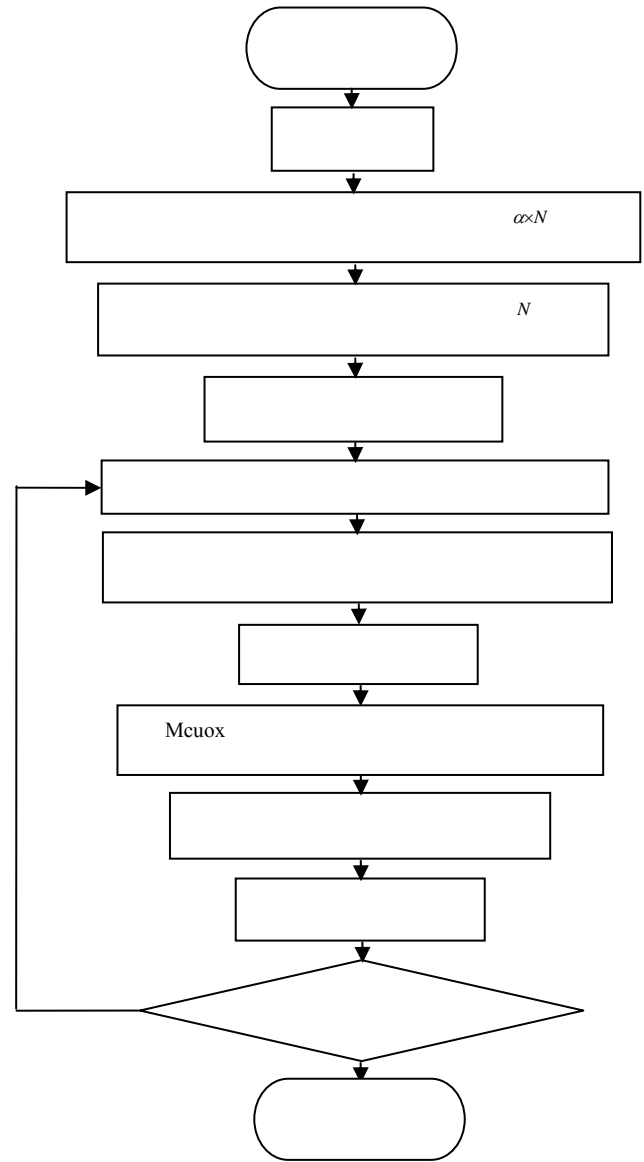
$$s = \left[\frac{1}{n-1} \sum_{i=1}^n (\bar{d} - d_i)^2 \right]^{1/2}$$

()

d_i

\bar{d}

d_i



[,] :

[,] :

[,] :

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[[SUMP/2)(1-F-RD/2)] [(SUMP/2)(1-F+RD/2)]]

$$D = \sqrt{\sum_{i=1}^n \max(\|x_i^i - y_i^i\|)} \quad ()$$

m	n	
2	10	1
4	10	2
2	20	3
4	20	4

		spacing				
ETS	MOS S	ETS	MOS S	ETS	Moss	
58.11	302.5	385	77.4	9.2	21.5	1
24.9	116.1	85.5	14.4	10.8	30.7	2
100.6	326.5	806	382	12.6	76.3	3
68.06	149.3	313	112	12.2	68.8	4

N

Arch_Size

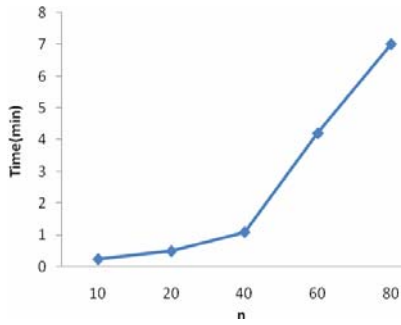
ε

landa

b₂ b₁

m	n	
4	40	1
6	40	2
4	60	3
6	60	4
4	80	5
6	80	6

()



N ➤
 ε ➤
 Arch_Size ➤
 λ ➤
 b_2 b_1 ➤
 ()

()

		spacing				
ETS	MOS _S	ETS	MOS _S	ETS	MOS _S	
177.3	150	1327	158	9.4	153	1
135.7	189	601	30	18.5	122	2
184	284	1034	679	18.9	143	3
90.8	212	1200	68	16.4	114	4
275.7	362	278	129	6.1	189	5
240.4	258	1499	471	18.3	103	6

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1 - Unrelated Parallel Machines

3 - Multi-Objective Scatter Search

5 - Just-In-Time

7 - Pareto Archive

9 - Multi-Component Uniform Order-Based Crossover

2 - Sequence-Dependent Setup Times

4 - Elite Tabu Search

6 - Non-Dominated Solutions

8 - Dynamic Ideal Point
