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Matching Problem of Preference Model

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School of Computer Science and Technology January 10, 2020







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Matching Problem with Multi-Layer

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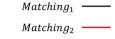
Four Evaluation Criter

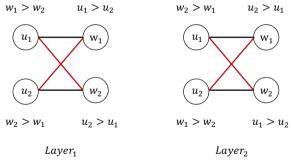
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- Matching
- Preference List
- Multi-Layer
- Cost- $rank_{u_1}^{(1)}(w_1)$



Four Evaluation Criteria

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- $egal\text{-}cost(M) := \sum_{\{u,w\} \in M} (rank_u(w) + rank_w(u))$
- $regret-cost(M) := \max_{i \in V(M)} rank_i(M(i))$
- equal-cost $(M) := \sum_{(u,w) \in M} |rank_u(w) rank_w(u)|$
- $balance\text{-}cost(M) := max\{\sum\limits_{(u,w)\in M} rank_u(w), \sum\limits_{(u,w)\in M} rank_w(u)\}$



Global Layer and α -Layer Minimum Cost

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- Global Layer
 For the global layer cost, the goal is to find a matching M whose sum of cost in each layer is less than D.
- α -Layer In addition, in terms of the α -layer cost, the goal is to find a matching M whose sum of cost in certain α layers chosen from the total I layers is less than D.



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Egalitarian Cost with Global Layer

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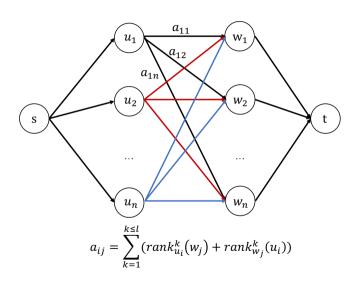
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- Cost Flow Algorithm
- No Negative Loop
- $O(n^3 \log n)$

1-IN-3SAT

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• INSTANCE A collection of clauses $C_1, ..., C_m, m > 1$; each C_i is a disjunction of exactly three literals.

- QUESTION
 Is there a truth assignment to the variables occurring so that exactly one literal is true in each C_i?
- Example $X = \{x_1, ..., x_5\}, C = \{C_1, C_2, C_3\}$ $C_1 = \{\overline{x_1}, \overline{x_2}, x_3\}, C_2 = \{\overline{x_1}, x_4, x_5\}, C_3 = \{\overline{x_2}, x_4, x_5\}$



Egalitarian Cost with α -Layer

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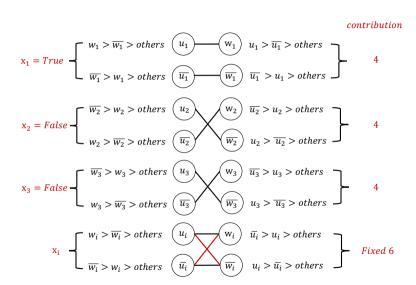
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NP-hard



Regret Cost with Global Layer

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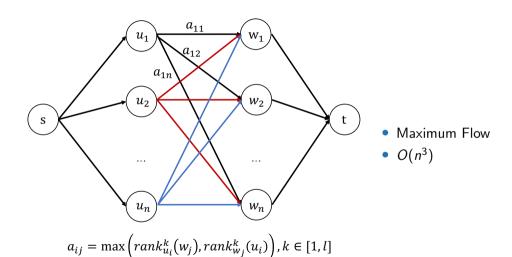
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Balance Cost with Global Layer

- Failed attempts on bipartite graph
- Reduce the partitioning problem to the generalized bipartite graph problem
- However, the generalized bipartite graph problem is NP-hard while the original may be not
- Still studying in the original problem



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Summary of the Four Matching Model

According to the four models described above, we could summarize our contributions to this Matching Problem of Preference Model.

Table: Complexity Analysis of the Four Matching Models

Global Layer	lpha-Layer
$O(n^3 log n)$	NP-hard
$O(n^3)$	NP-hard
$O(n^3 \log n)$	Studying
Studying	NP-hard
	$O(n^3 \log n)$ $O(n^3)$ $O(n^3 \log n)$



Q & A session

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Thank you!