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THE NON-BALANCED TWO-SIDED MATCHING MODEL AND ALGORITHM OF THE PROJECT MANAGER AND THE R&D STAFF WITHIN THE TASK GRADATION MANAGEMENT MODE

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Abstract. *Based on the two-sided matching theories and methods, the paper researches on the two-sided matching problem of the project manager and the R&D staff under the background of non-balanced workload distribution so that a scientific, harmonious and high working efficiency R&D team can be constructed for a software enterprise. Different from traditional two-sided matching problems, this problem concerns not only the evaluation information of the main matching subjects, but also the satisfaction evaluation information from the enterprise's management department. The problem is also characterized by its large scale and is based on personal preference orders, and can be seen as the extension of classic two-sided matching problems and the generalization of optimization problems in the field of operations management. For the first time the paper proposes a 0-1 integer programming model for the non-balanced two-sided matching of the project manager and the R&D staff within the task gradation management mode, and then develops a heuristic algorithm based on the combination of the extension solution and the genetic algorithm to find the solution to the model. Case study shows that the model and the algorithm designed in the paper are feasible and effective when applied to the practice.*
Keywords: Two-sided matching model, Heuristic algorithm, Task management system, Team construction

1. **Introduction.** The construction of harmonious and scientific teams based from a two-sided matching perspective has been given extensive attention by the academic at present [1-6]. However, existing research only considers the two-sided matching problems within a balanced workload distribution mode [7], which is usually adopted when the enterprise has sufficient resources for the purpose of a reasonable and fair labor division and match. In the case of insufficient enterprise resources (which is very common), a non-balanced mode would be necessary, i.e., some of the team members would undertake more workload, meanwhile the enterprise would give them more incentive policies to balance the difference of the workload. The staff-post two-sided matching problems are typical NP-problems, to which it is difficult trying to find direct solutions with existing optimal software when they are of large-scale. This has made the calculation and solution to these problems more complicated and difficult. Presently there are mainly 3 types of solutions to these problems. (1) Intelligent optimization algorithms, which have powerful search capability and can obtain excellent overall search performance by improvement. They can also be extended and easily combined with other algorithms and are of the highest possibility to obtain the optimal solutions. The shortcoming of these algorithms is that their searching speed is usually slow. (2) Matching algorithms [9], which are characterized by their simple computing programs, easy realization and lower complexity of designing methods. The

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shortcoming is their big limitation in solving the problem backgrounds and optimizing the aims, where usually the matching algorithms of one-side-optimization or maximization of the matching numbers will be adopted. (3) Optimization algorithms [10-14], which can obtain the optimal solution with the help of optimization software for the small-scale problems. However, it will be hard to directly use the optimization software to find the solutions to this type of integer programming models when the scale is large. Therefore, an effective and feasible algorithm needs to be designed to find solutions to these models. This paper designs and develops a heuristic algorithm based on the combination of the extension solution and the genetic algorithm so that satisfying solutions can be found in reasonable time.

The above analysis shows that the two-sided matching under the background of non-balanced workload distribution is the extension and generalization of classic two-sided matching problems. New solutions must be designed and developed according to the problem's own characteristics. This paper researches on the two-sided matching problems under the background of non-balanced workload distribution, proposes a typical 0-1 mixed integer programming model for the non-balanced two-sided matching of the project managers and the R&D staffs within the task gradation management mode, which can be seen as the extension of classic staff-post two-sided matching problems of higher complication. Research in this paper not only provides a scientific and quantitative decision-making method to the administrators of the enterprises, but also enriches and develops the two-sided matching decision-making methods theoretically.

2. **Problem Description.** Under the premise of the task gradation management mode, the paper describes the non-balanced two-sided matching problems accordingly. Suppose $M = \{1, 2, \dots, m\}$ is the set of the R&D staffs; M_s is the set of the R&D staffs that are willing to take on more workload with corresponding incentive policies; M_p is the set of those that are not willing to take on more workload; $N = \{1, 2, \dots, n\}$ is the set of the project managers; N_s is the set of key-task team project managers; N_P is the set of ordinary-task team project managers; $S = \{1, 2, \dots, n, n+1, \dots, n+m\}$, $n \le m$ is the set of the whole staff, where 1 to n are the numbers of the project managers, and $n+1$ to $n+m$ are the numbers of the R&D staffs; $H = \{h_1, h_2, \dots, h_k\}$ is the set of all the types of posts involved in the matching plan, which shows the scale of the R&D teams is k; h_i^N, $h_i \in H$ is the set of all the project managers on post h_i; h_i^M, $h_i \in H$ is the set of all the R&D staffs on post h_i; A and B are the two main matching subjects, where $A = \left\{A_{h_k}^i, h_k \in H, i \in M\right\}$, and $A_{h_k}^i$ means staff i works on post h_k. $B = \left\{B_{h_k}^j, h_k \in H, j \in N\right\}$, and $B_{h_k}^j$ means project manager j works on post h_k; $\{P_A^i | i \in P_A\}$ is the set of the evaluation indexes of the R&D staff's preference satisfaction with the project manager, in which P_A^i indicates evaluation index i, and $i = 1, 2, \dots, P_A$; $W_A = \left(w_A^1, w_A^2, \dots, w_A^{P_A}\right)$ is the weight vector of the evaluation indexes of the R&D staff's preference satisfaction with the project manager, where w_A^i is the weight of the evaluation index P_A^i, and

$$0 < w_A^i < 1, \quad \sum_{i=1}^{P_A} w_A^i = 1;$$

$\{P_B^i | i \in P_B\}$ is the set of the evaluation indexes of the project manager's preference satisfaction with the R&D staff, in which P_B^i indicates evaluation index i, and $i = 1, 2, \dots, P_B$; $W_B = \left(w_B^1, w_B^2, \dots, w_B^{P_B}\right)$ is the weight vector of the evaluation indexes of the project manager's preference satisfaction with the R&D staff, where w_B^i is the weight of the evaluation index P_B^i, and

$$0 < w_B^i < 1, \quad \sum_{i=1}^{P_B} w_B^i = 1;$$

$\{P_T^i | i \in P_T\}$ is the set of the evaluation indexes of the management department's overall satisfaction with the whole staff in which P_T^i indicates evaluation index i, and $i = 1, 2, \ldots, P_T$; $W_T = \left(w_T^1, w_T^2, \ldots, w_T^{P_T}\right)$ is the weight vector of the evaluation indexes of the management department's overall satisfaction with the whole staff, where w_T^i is the weight of the evaluation index P_T^i, and

$$0 < w_T^i < 1, \quad \sum_{i=1}^{P_T} w_T^i = 1;$$

$C_A = \left[c_{ij}^A\right]_{i \times j}$, $i \in M$, $j \in N$ is the evaluation information matrix of the R&D staff's overall preference satisfaction with the project manager, in which c_{ij}^A is the evaluation information of R&D staff i's overall preference satisfaction with project manager j; $C_B = \left[c_{ij}^B\right]_{i \times j}$, $i \in M$, $j \in N$ is the evaluation information matrix of the project manager's overall preference satisfaction with the R&D staff, in which c_{ij}^B is the evaluation information of project manager j's overall preference satisfaction with R&D staff i; $C_T = \left[c_i^T\right]_{1 \times M+N}$, $i \in M+N$ is the evaluation information matrix of the management department's overall preference satisfaction with the whole team, in which c_i^T is the evaluation information of the management department's overall preference satisfaction with staff i. Based upon the above background and symbolic representation, the paper makes the following assumptions. Assumption 1: Each project manager is only responsible for the management of one R&D team and works on only one post; Assumption 2: Each staff is only responsible for the tasks on his own post, and each project manager only participates in the work of his own team; Assumption 3: Each staff that is unwilling to take on more workload is only responsible for d tasks; and each staff that is willing to take on more workload is responsible for $d + 1$ tasks at the most; Assumption 4: There is only one staff that is responsible for the tasks of each post in every R&D team; Assumption 5: The enterprise management department has already set up the task management mode and corresponding management systems before making the two-sided matching plan of the project manager and the R&D staff; Assumption 6: The working efficiency of each R&D team and each staff can be measured by the task's completion time, cost and quality, etc.; Assumption 7: Only the management department knows the evaluation information of the project manager and the R&D staff; Assumption 8: The candidates for the project manager and the R&D staff as well as the scale of the teams have already been pre-determined.

3. The Analytical Method of Two-Sided Matching Decision-Making.

3.1. Construction of the non-balanced two-sided matching model. According to the above description of the task management system and the non-balanced workload distribution,

$$c_{ij}^A = \sum_{k=1}^{P_A} w_A^k f\left(P_A^k\right) \tag{1}$$

in which $f\left(P_A^k\right)$ is the evaluation of the staff's preference satisfaction with the project manager in terms of index P_A^k.

$$c_{ji}^B = \sum_{k=1}^{P_B} w_B^k f\left(P_B^k\right) \tag{2}$$

in which $f\left(P_B^k\right)$ is the evaluation of the project manager's preference satisfaction with the staff in terms of index P_B^k.

$$c_i^T = \sum_{k=1}^{P_T} w_T^k f\left(P_T^k\right) \tag{3}$$

in which $f\left(P_T^k\right)$ is the evaluation of the management department's preference satisfaction with the whole staff in terms of index P_T^k.

Suppose the decision variable $X_{i,j}$ is a 0-1 integer. If staff i and manager j form a matching pair, then $x_{ij}=1$; or else $x_{ij}=0$. Suppose the team scale is U, the number of key-task R&D teams according to the matching plan is n^*, and the average satisfaction expectation for the key-task R&D teams within the task gradation mode is θ^*. According to the above Formulas (1), (2) and (3), the non-balanced two-sided matching model of the project manager and the R&D staff constructed in the paper which aims to maximize the management department's satisfaction and the two main matching subjects' preference satisfaction is as follows:

$$\max\ Z_A = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}^A X_{i,j} \tag{4a}$$

$$\max\ Z_B = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}^B X_{i,j} \tag{4b}$$

$$\begin{aligned}\min\ Z_T = & \sum_{j\in N_s}\left(\frac{c_j^T + \sum\limits_{i=1}^{m} c_i^T X_{i,j}}{U} - \theta^*\right)^2 \\ & + \sum_{j\in N_p}\left(\frac{c_j^T + \sum\limits_{i=1}^{m} c_i^T X_{i,j}}{U} - \frac{\sum\limits_{i=1}^{m+n} c_i^T - \theta^* n^*}{n-n^*}\right)^2\end{aligned} \tag{4c}$$

$$\text{s.t.}\ \ d \le \sum_{j\in N_s} X_{i,j} + \sum_{j\in N_p} X_{i,j} \le d+1, \quad \forall i \in M_s \tag{4d}$$

$$\sum_{j\in N_s} X_{i,j} + \sum_{j\in N_p} X_{i,j} = d, \quad \forall i \in M_p \tag{4e}$$

$$\sum_{i\in h_1^M} X_{i,j} = 1, \quad \forall j \in N_s \tag{4f1}$$

$$\sum_{i\in h_1^M} X_{i,j} = 1, \quad \forall j \in N_p \tag{4f1'}$$

$$\sum_{i\in h_2^M} X_{i,j} = 1, \quad \forall j \in N_s \tag{4f2}$$

$$\sum_{i\in h_2^M} X_{i,j} = 1, \quad \forall j \in N_p \tag{4f2'}$$

$$\cdots$$

$$\sum_{i\in h_k^M} X_{i,j} = 1, \quad \forall j \in N_s \tag{4fk}$$

$$\sum_{i\in h_k^M} X_{i,j} = 1, \quad \forall j \in N_p \tag{4fk'}$$

$$\sum_{i\in h_1^M} X_{i,j} = 0, \quad \forall j \in N_s \cap h_1^N \tag{4g1}$$

$$\sum_{i\in h_1^M} X_{i,j} = 0, \quad \forall j \in N_p \cap h_1^N \tag{4g1'}$$

$$\sum_{i\in h_2^M} X_{i,j} = 0, \quad \forall j \in N_s \cap h_2^N \tag{4g2}$$

$$\sum_{i\in h_2^M} X_{i,j} = 0, \quad \forall j \in N_p \cap h_2^N \tag{4g2'}$$

$$\cdots$$

$$\sum_{i\in h_k^M} X_{i,j} = 0, \quad \forall j \in N_s \cap h_k^N \tag{4gk}$$

$$\sum_{i\in h_k^M} X_{i,j} = 0, \quad \forall j \in N_p \cap h_k^N \tag{4gk'}$$

$$X_{i,j} = 0 \text{ or } 1, \quad i \in M,\ j \in N \tag{4h}$$

In the above model, Equations (4a), (4b) and (4c) represent the aims of the optimization, where (4a) means the maximization of the R&D staff's preference satisfaction, (4b) the maximization of the project manager's preference satisfaction, and (4c) the maximization of the management department's satisfaction, which is measured by the implementation of the task management system. $\sum_{j\in N_s}\left(\frac{c_j^T+\sum_{i=1}^m c_i^T X_{i,j}}{U}-\theta^*\right)^2$ means the management department's satisfaction with the key-task teams, and is the quadratic sum of the difference of the management department's average satisfaction with each key-task team and the expectation θ^*. The bigger the value is, the higher the satisfaction is; or else the smaller the value is, the lower the satisfaction is. $\sum_{j\in N_p}\left(\frac{c_j^T+\sum_{i=1}^m c_i^T X_{i,j}}{U}-\frac{\sum_{i=1}^{m+n} c_i^T-\theta^* n^*}{n-n^*}\right)^2$ means the management department's satisfaction with the ordinary-task teams, and is the quadratic sum of the difference of the management department's average satisfaction with each ordinary-task team and the expectation. The smaller the value is, the higher the satisfaction is. Here $\frac{\sum_{i=1}^{m+n} c_i^T-\theta^* n^*}{n-n^*}$ means the expectation of the average satisfaction of the ordinary-task teams within the task gradation management system.

(4d)-(4h) are the constraint conditions. Each team is composed of one project manager and several other matching staffs within the matching plan. According to Assumption 3, the R&D staffs that are unwilling to take on more workload are responsible for d tasks, and those that are willing to take on more workload with corresponding incentive policies are responsible for $d+1$ tasks, i.e., each of those staffs that are willing to take on more workload can match with d project managers at least and $d+1$ at most. Formula (4d) is the guarantee of the workload distribution. Each of the staffs that are unwilling to take on more workload can match with d project managers, and Formula (4e) guarantees that each of them must and can only match with d project managers. According to Assumptions 1, 2 and 4, each staff is only responsible for the tasks on his own post, and there is only one staff that works on each post in every team, and the project manager of each team must be responsible for one task of his own team. (4f1) and (4g1) mean that for each project manager of every key-task team, if he does not work on post h_1, then there will be one and only one R&D staff on post h_1 who can match with him; and if he does work on post h_1, then the R&D staff on post h_1 cannot match with him. (4f1') and (4g1') mean that for each project manager of every ordinary-task team, if he does not work on post h_1, then there will be one and only one R&D staff on post h_1 who can match with him; and if he does work on post h_1, then the R&D staff on post h_1 cannot match with him. Similarly, (4f2), (4g2)-(4fk') and (4gk') are the matching conditions for other posts. (4h) means the constraint for the decision-making variables.

3.2. **The heuristic algorithm design based on the combination of the extension solution and the genetic algorithm.**

3.2.1. *The design of the genetic algorithm.*

3.2.1.1. Coding design. The actual value coding method is adopted in the paper. Each chromosome of the colony is composed of k genes, k being the number of the different posts in the matching plan. Each of the genes of the chromosome represents one post.

3.2.1.2. The design of the fitness function. The paper supposes that the fitness function of number k individual is:

$$F_k = W_1 \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}^A X_{i,j}^k + W_2 \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}^B X_{i,j}^k - W_3 \left[\sum_{j\in N_s} \left(\frac{c_j^T + \sum\limits_{i=1}^{m} c_i^T X_{i,j}^k}{U} - \theta^* \right)^2 + \sum_{j\in N_p} \left(\frac{c_j^T + \sum\limits_{i=1}^{m} c_i^T X_{i,j}^k}{U} - \frac{\sum\limits_{i=1}^{m+n} c_i^T - \theta^* n^*}{n - n^*} \right)^2 \right] \tag{5}$$

where $X_{i,j}^k$ is the 0-1 integer decision-making variable, which indicates if staff i forms a match with manager j in the kth post matching order, then $X_{i,j}^k = 1$, or else $X_{i,j}^k = 0$.

3.2.1.3. The storage operation design of the optimal individual. The storage method of the optimal individual adopted in the paper compares the optimal individual X_{t+1}^* in the new colony $pop(t+1)$ that is obtained after choice, overlap and variation computations with the optimal individual X_t^* in the former generation of colony $pop(t)$. If X_t^* is superior to X_{t+1}^*, then the optimal individual X_{t+1}^* in $pop(t+1)$ will be replaced by X_t^*, or else the optimal individual remains unchanged.

3.2.1.4. The design of interpolation. The specific method of interpolation is: Suppose $pop(t+1)$ is the new colony obtained after the choice, overlap and variation computations, and $pop(t+1)'$ is a colony that is stochastically generated, and that the number of individuals (number of solutions) in $pop(t+1)'$ n is $\frac{1}{10}$ that of those in $pop(t+1)$. Calculate the adaptive value of each individual in $pop(t+1)'$, and choose n number of the most inferior individuals from $pop(t+1)$ and replace them with n number of individuals from $pop(t+1)'$. In this way, a new colony of the same scale as $pop(t+1)$ is generated, which not only keeps the optimal individual in $pop(t+1)$, but also takes new individuals in. Hence the premature convergence phenomenon is avoided.

3.2.2. *The extension solution to model (4).* The extended model of model (4) is Equation (6), and its target formula is:

$$\max \quad Z = \omega_a \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}^A X_{i,j}^k + \omega_b \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}^B X_{i,j}^k - \omega_c \left[\sum_{j\in N_s} \left(\frac{c_j^T + \sum\limits_{i=1}^{m} c_i^T X_{i,j}^k}{U} - \theta^* \right)^2 + \sum_{j\in N_p} \left(\frac{c_j^T + \sum\limits_{i=1}^{m} c_i^T X_{i,j}^k}{U} - \frac{\sum\limits_{i=1}^{m+n} c_i^T - \theta^* n^*}{n - n^*} \right)^2 \right] \tag{6}$$

which is the linear weighting of (4a), (4b) and (4c). ω_a, ω_b and ω_c are the weights to Z_A, Z_B and Z_C, and satisfy $0 < \omega_a, \omega_b, \omega_c < 1$, $\omega_a + \omega_b + \omega_c = 1$. In this way the existing model can be changed into a single-target optimization model. The constraint conditions to (6) are the same as those to (4) except the decision-making variable constraint. The decision-making variable constraint to (6) is: $0 \leq X_{i,j} \leq 1$, $i \in M$, $j \in N$, which extends the constraint to $X_{i,j}$, and it can be any real number in the range of 0-1. This has transformed the 0-1 integer programming problem in model into a non-integer one in model (6), which can then be solved with the help of relative optimization software.

3.2.3. *The process of the heuristic algorithm based on the combination of the extension solution and the genetic algorithm.* Based on the extended model (6), Formulas (1), (2), (3), (5) and the genetic algorithm, the paper proposes

$$sr_j = \sum_{i \in LD_j} c_i^T - U\left[\theta^* - \frac{\sum_{i=1}^{m+n} c_i^T - \theta^* n^*}{n - n^*}\right], \quad j \in N_s \tag{7}$$

4. **Case Study.** To showcase, this paper optimizes the two-sided matching plan of the project manager and the R&D staff in a domestic software enterprise, which adopts the task gradation management mode to construct its R&D teams. There will be 23 R&D teams, of which 7 are key-task teams, and 16 are ordinary-task ones; There is 1 project manager for each team, and the R&D staff are composed of 8 system analysts, 8 designers, 8 developers, 8 testers, 8 configuration managers and 8 quality inspectors; of all the managers there are 5 analysts, 4 designers, 4 developers, 3 testers, 3 configuration managers and 3 quality inspectors. There are 6 people on 6 posts respectively in each team. The workload distribution method set up by the management department is: There will be 2 analysts, 3 designers, 2 developers, 4 testers, 4 configuration managers and 4 quality inspectors responsible for the work in his post in three teams, and the rest will be responsible for the work in his post in two teams. Assign numbers from 1-23 to all the project managers according to their post order from analyst, designer, developer, tester, configuration manager to quality inspector, of whom the numbers of the key-task team project managers are 1, 3, 6, 7, 10, 11 and 15, and the rest are the numbers of the ordinary-task team project managers. Assign numbers from 24-71 to all the R&D staff in the same way. According to the characteristics of the problem, the paper generates 20 initial colonies stochastically, with an overlap rate of 0.7 and a variation rate of 0.02.

Suppose the evaluation indexes of the staff's preference satisfaction with the manager are: P_A^1 – expertise knowledge, P_A^2 – project management experience, P_A^3 – personal communication skills, P_A^4 – efficiency evaluation, P_A^5 – cooperating wishes. The evaluation indexes of the manager's preference satisfaction with the staff are: P_B^1 – expertise knowledge, P_B^2 – efficiency evaluation, P_B^3 – executive capacity P_B^4 – teamwork awareness, P_B^5 – cooperating wishes. The evaluation indexes of the management department's satisfaction with the whole staff are: P_T^1 – expertise knowledge, P_T^2 – efficiency evaluation, P_T^3 – project experience, P_T^4 – evaluation of the leader, P_T^5 – evaluation of the colleague. All the above mentioned indexes rank from 1-100. Corresponding evaluation information matrices can be obtained through computations with Formulas (1), (2) and (3). According to the evaluation information of the overall satisfaction, the management department sets the parameter $\theta^* = 85$. Calculations show the ideal evaluation value of key-task teams is 510, and the ideal evaluation value of the ordinary-task teams is 420 within a project gradation management mode. Calculate with the help of the corresponding software that uses the heuristic algorithm designed in this paper programmed by MATLAB (R2014a) in the Windows XP operational system (Intel Core(TM)2 Duo CPU 2.53G, internal storage 8G). The computation takes 1.5 seconds to get the matching results shown in Table 1 (posts 1-6 are as follows respectively: system analyst, system designer, developer, testers, configuration manager and quality inspectors).

TABLE 1. Matching results of the case

Team number	Evaluation value of the R&D teams	Matching plan					
		Post 1	Post 2	Post 3	Post 4	Post 5	Post 6
1*	534	B_1	A_{12}	A_{18}	A_{27}	A_{39}	A_{42}
2	442	B_2	A_{10}	A_{19}	A_{28}	A_{38}	A_{41}
3*	531	B_3	A_{12}	A_{18}	A_{30}	A_{39}	A_{46}
4	430	B_4	A_{10}	A_{21}	A_{25}	A_{40}	A_{44}
5	444	B_5	A_{14}	A_{24}	A_{31}	A_{34}	A_{42}
6*	520	A_6	B_6	A_{18}	A_{30}	A_{38}	A_{42}
7*	517	A_2	B_7	A_{19}	A_{27}	A_{36}	A_{43}
8	439	A_3	B_8	A_{17}	A_{26}	A_{37}	A_{46}
9*	429	A_3	B_9	A_{24}	A_{26}	A_{37}	A_{46}
10*	533	A_4	A_{12}	B_9	A_{27}	A_{39}	A_{43}
11*	532	A_6	A_{12}	B_{11}	A_{31}	A_{36}	A_{47}
12	445	A_3	A_{15}	B_{12}	A_{25}	A_{40}	A_{42}
13	447	A_4	A_{15}	B_{13}	A_{28}	A_{33}	A_{45}
14	432	A_2	A_{14}	B_{14}	A_{29}	A_{37}	A_{45}
15*	517	A_6	A_{13}	A_{20}	B_{15}	A_{36}	A_{43}
16	441	A_1	A_{13}	A_{23}	B_{16}	A_{33}	A_{45}
17	423	A_8	A_{11}	A_{22}	B_{17}	A_{33}	A_{48}
18	463	A_7	A_9	A_{21}	A_{32}	B_{18}	A_{47}
19	445	A_5	A_{16}	A_{20}	A_{32}	B_{19}	A_{44}
20	435	A_8	A_{11}	A_{23}	A_{28}	B_{20}	A_{48}
21	445	A_7	A_9	A_{17}	A_{31}	A_{35}	B_{21}
22	414	A_5	A_{16}	A_{20}	A_{29}	A_{34}	B_{22}
23	450	A_1	A_9	A_{22}	A_{30}	A_{35}	B_{23}

Corresponding matching results can be obtained according to Table 1, which shows the non-balanced two-sided matching model for the project leaders and R&D staff and the algorithm constructed and designed in this paper within a task gradation management mode are effective and feasible.

5. **Conclusion.** Research results show the model and the algorithm designed in this paper are effective and feasible, and can provide reference to the solutions to the two-sided matching problems of the project manager and the R&D staff and other similar team construction problems under the background of non-balanced workload distribution in real life. On the one hand, this paper has extended the boundaries of the two-sided matching problems theoretically and enriched the two-sided matching decision-making methods; on the other hand, it is of certain application value since in this way further research can be made and intelligent management adopted to solve the tedious and complicated problems, which can help to enhance the quality, cut the time, and increase the flexibility and adaptation of decision-making.

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