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Application of Assignment Model in PE Human Resources Allocation

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Abstract

The definition of Assignment Model and the Hungarian Method are introduced in this paper and through cases, the application of Assignment Model is elaborated. The Assignment Model is a classic integer linear programming model of 0-1 and it is widely applied in dealing with assignment allocation, personnel selection, the programming of transport system and other practical issues. In the field of PE, the point of assignment gives full play in selecting the proper athletes, assigning tasks and even in recruiting new staff by the human resources, so it is significant to introduce the assignment model to the sports system. However, it still remains a vacuum in applying the assignment model with cases in sports management. This paper applies the assignment model with cases to the sports management, which will provide theoretical foundation for the policy-makers to allocate human resources.

Keywords: Assignment Model；PE Human Resources Allocation；Hungarian Method

1. Assignment Model

1.1 Definition of Assignment Model

As a branch of linear programming, normally, it means: n jobs require n persons to complete, one person for one job, suppose the time for the i person to complete the j job is C_{ij}. The question is how to allocate to minimize the whole time to complete the n jobs.
0-1 variables are introduced for this issue:

$$X_{ij} = \begin{cases} 1 & \text{assign } A_i \text{ to accomplish task } B_j \\ 0 & A_i \text{ is not assigned to accomplish task } B_j \end{cases}$$

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The mathematical model can be established as:

$$Z = \sum_{i=1}^{n}\sum_{j}^{n} C_{ij}X_{ij}$$

Pmin

$$S.t \quad \sum_{i=1}^{n} X_{ij} = 1(j = 1, 2\cdots, n)$$ (Each person performs a task)

$$\sum_{i=1}^{n} X_{ij} = 1(j = 1, 2\cdots, n)$$ (Each task is performed by one person)

$X_{ij= 0 \text{ or } 1}$

Assume c=(C_{ij}), square matrix of order n, is the benefit matrix of the assignment model (P). If X_{ij}^{0} is the optimal solution, then $X = (X_{ij}^{0})$ is the optimal solution to (P). As a matter of fact the X is a permutation matrix, i.e. each line and row in this matrix has only one "1".

1.2 Hungarian Method of Assignment Model

The method of solving assignment models was put forth by Konig, a Hungarian Mathematician; hence the name Hungarian method which supplies fire steps to solve those models.

First, the minimum element is subtracted from each element of the benefit matrix C forming another matrix, and a new benefit matrix C' is formed by subtracting the minimum element from each element of that matrix.

Second, set up a distribution matrix D for the benefit matrix C, and work out per D.

Third, identify whether per D equals to 0, if so skip to step 5, and if not take the step 4, i.e. the number of optimal solutions to assignment model p is per D.

Fourth, check each line and row of C', and find out the line or the row with fewest "O". Ring the element "0", and if there are several 0 in this line or row, ring any one of them representing it with ⊙. The line or row containing the ⊙ should be ruled out. The following process will be carried on in the rest matrix until n ⊙s be found out. Assign 1 to n ⊙s and 0 to the rest elements; thus the optimal solution matrix will be obtained.

Fifth, all"0"elements in the benefit matrix must be covered by not more than n lines. Pick out the minimum element △ in the elements without being covered by lines and △ is to be subtracted from those elements. Also the element at the crossing of the covering lines should be added to△ and the rest of the elements remain unchanged. This step ends up with the benefit matrix C' and followed by step 2.

1.3 Analysis Results

In the optimal solution matrix finally reached, each line represents the person undertaking the task and each row for every task. The line and the row "I" embedded in the matrix represent respectively the task the person undertakes. In this context, the target value can be achieved optimal.

2. Case Analysis

Suppose there are 4 teachers in the mathematic group in PE department, they are capable of undertaking the 4 different courses. But because of different experience, they invest different time in preparing for the lessons, see table 2. To enable every teacher to be fully engaged in research, everybody is merely allowed to teach only one course, then how to arrange the 4 teachers so as to minimize the preparation time for lessons.

Table 1. Comparison of Different Preparation Time by 4 Teachers

Teacher	**Course**			
	1	***2***	***3***	***4***
1	2	10	9	7
2	15	4	14	8
3	13	14	16	11
4	4	15	3	9

2.1 Assignment Model

The model variable $C_{ij.}$ represents the j course by the i teacher.

Beneficial Matrix C= $$\begin{bmatrix} 2 & 10 & 9 & 7 \\ 15 & 4 & 14 & 8 \\ 13 & 14 & 16 & 11 \\ 4 & 15 & 13 & 9 \end{bmatrix}$$

So the target function is:

P min $$Z = \sum_{i=1}^{4} \sum_{j=1}^{4} C_{ij} X_{ij}$$

And the constraints are:

$$\sum_{j=1}^{m} X_{ij} = 1 (i = 1, 2, 3, 4)$$ (Each teacher for one course)

$$\sum_{j=1}^{m} X_{ij} = 1 (i = 1, 2, 3, 4)$$ (Only one teacher for one course)

$X_{ij.}$ equals 0 or 1.

2.2 Results and Analysis

C2= $$\begin{bmatrix} 0 & 6 & & 3 \\ 13 & & 5 & 0 \\ 4 & 3 & 0 & \\ & 9 & 2 & 3 \end{bmatrix}$$ X1= $$\begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$

Thus, the optimal scheme X_1 is: the 4th teacher for course 1, the 3rd teacher for course 4, the 2nd teacher for course 2 and the 1st teacher for course 3.

3. Conclusion

In the field of PE, the point of assignment gives full play in selecting the proper athletes, assigning tasks and even in recruiting new staff by the human resources. Traditionally speaking, such issues rely mainly on the policy-makers' experience, thus subjective and little objective comparison is produced. Hungarian Method can yield the accurate the optimal effect objectively. The assignment model can be applied when it involves n persons for n matters. Thus it carries extensive meanings to introduce the assignment model to the sports field.

References

[1]Su Jinlong.Linear Programming Theory and Model Application. Science Press, 2003.

[2]Huang Xiangbai.Sports Control Theory. Hunan Science and Technology Press, 1991.

[3]Dong Lunhong. Application of Data Envelopment Analysis in Sports Appraisal. Journal of Xi'an Institute of Physical Education.

[4]Lan Baixiong.Operational Research,Beijing: Tsinghua University Press, 1999.