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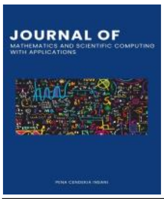

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# OPTIMIZATION OF DUTIES OF EMPLOYEES OF PT JALUR NUGRAHA

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**ABSTRACT**

Theassignment problem is one part of a linear program which generally includes n tasks that must be assigned to m workers, each of whom has different competencies in carrying out tasks. The Hungarian method is one method that can be used to solve this problem. The purpose of this study is to optimize employee assignments in terms of minimum operational time in completing work using the Hungarian method. From the results of research using the Hungarian method, time efficiency is obtained as much as 8 hours if employees in delivering goods on the NugrahaEkakurir (JNE) route are placed by the company, namely Ferdi assigned to Medan Tuntungan, Ichsan assigned to Medan Selayang, Riki was assigned to Medan Amplas, Fitriadi assigned to Medan Johor, Irvan was assigned to Delitua, Suryadi was assigned to Patumbak, Edward was assigned to PancurBatu, Citradi was assigned to Kutalimbaru, Audi was assigned to Medan Baru and Widiyanto was assigned to Sunggal.



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## 1. INTRODUCTION :

The world of business (business) and industry, management often faces problems related to the optimal assignment of various productive sources or personnel who have different levels of efficiency for different tasks. Assignment Problem), which is a special case of linear programming problems in general.

Linear programming is a general model that can be used in solving the problem of optimally allocating limited resources. The assignment problem is one part of linear programming that can be found in life around which is useful for obtaining the maximum level of profit or maximum cost in a company.

The assignment problem is a problem that has one optimization goal, namely maximizing or minimizing a resource (cost, distance or time) used to complete a task. Each employee has a different skill level, work experience and educational background and training. So that the cost of completing the same work by different employees is also different.

## 2. LITERATURE REVIEW :

### *Operation Research*

Operations research as a scientific method (scientific method) that allows managers to make decisions about the activities they handle on a quantitative basis (Morse and Kimbal, 1957).

Optimization is divided into 2 types, namely minimizing costs and maximizing profits. In general, optimization refers to mathematical programming techniques which usually discuss or refer to the course of research programs about the problems at hand.

Optimization is used to give the best result from the worst or the best, depending on the problem at hand. The optimization result may be the highest result (eg profit) or the lowest result (eg loss). Optimization requires a good strategy in making decisions in order to obtain optimum results.

***Linear Programming***

Linear Programming is a general model that can be used in solving problems of allocating limited resources optimally. This problem arises when someone is required to choose or determine the level of each activity to be carried out, where each activity requires the same resources while the number is limited.

Purpose Function:

Maximize / Minimize (in Aminuddin, 2005)

$$Z = c_1x_1 + c_2x_2 + c_3x_3 + ... + c_nx_n$$

Limiting resources (constraints/conditions)

$$a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + ... + a_{1n}X_n \leq b_1$$

$$a_{21}X_1 + a_{22}X_2 + a_{23}X_3 + ... + a_{2n}X_n \leq b_2$$

$$a_{m1}X_1 + a_{m2}X_2 + a_{m3}X_3 + ... + a_{mn}X_n \leq b_m$$

And

$$X_1 \geq 0, X_2 \geq 0, ..., X_n \geq$$

Where,

X : Decision variable

C : objective function parameter

b : capacity constraint

a : parameter of constraint function for decision variable

i : 1, 2, …, m

j : 1, 2, …,n

**Assignment Problems**

The assignment problem is a special case of linear programming problems in general. The assignment problem has one optimization goal, namely maximizing or minimizing a resource (revenue, cost, distance or time) used to complete the task.

Maximize / Minimize (in Aminuddin, 2005)

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

With limitations:

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

untuk$i$ = 1,2,…,n

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

Untuk $j$ = 1,2,…,n

And

$$X_{ij} \geq 0 \left(X_{ij} = X_{ij}^2\right)$$

Where $C_{ij}$ is the known constant.

**Hungarian Method**

According to Prawisentono (2005), the Hungarian method is a method that modifies the rows and columns in the effectiveness matrix until a single zero component appears in each row or column that can be selected as an assignment allocation. All assignment allocations made are optimal allocations, and when applied to the initial effectiveness matrix, they will give the minimum assignment results.

The Hungarian method has the following conditions:

1) The number of i must be equal to the number of j to be completed.

2) Each source only does one task.

3) If the number of sources is not equal to the number of tasks or vice versa, then a dummy woker or dummy job variable is added.
4) There are two problems that are solved, namely minimizing losses (cost, time, distance and so on) or maximizing profits. (Taha, 1996).

The steps for solving the Hungarian method are:

1) Modify the assignment table into the effectiveness matrix. Where this matrix is formed to facilitate the process of completing each step of the method that has been carried out.
2) Select the smallest value from each row, then perform subtraction operations from each value in the row with the smallest number that has been selected. Thus, it can be ensured that there is at least one element in each row of the matrix that has a value of zero and there is no element with a negative value.
3) Subtracting a column if there is a column that does not yet have an element of 0, namely selecting the smallest value from the column, then subtracting each column value with the smallest number that has been selected Thus, it can be ensured that there is at least one element in each row and each column of the matrix that has a value of zero and there are no elements with negative values.
4) Establishing the optimum assignment by drawing a number of horizontal and or vertical lines that pass through all cells with a value of 0. If the number of lines is the same as the number of rows/columns, then the assignment has been optimal. If not then it must be revised.
5) Revise the table by selecting the smallest value that is not crossed by a line and then subtracting all values that are not crossed by a line. Then added to the numbers contained in the line crossing. Go back to step 5.
6) The assignment is placed in a cell that has a value of 0. Where each number 0 is replaced with the number 1 but each column and row only has one number 1 as an assignment.
7) Calculate the total value of the solution obtained based on the elements of the initial matrix that have not been reduced in value so that the total optimum value is obtained.

**Time**

Time is the whole series of the past, present, and future. (ShihabM.Q: 2010). Time is divided into 3 groups namely past, present and future.

The working hours of employees on the Nugraha Ekakurir (JNE) Sisingamangaraja Track, Amplas Trade Center Warehouse Complex, Block F10, Medan, are at 08.00 – 18.00 and on weekdays, Monday – Sunday.

**A General Description Of The Company**

JNE is a shipping and logistics company headquartered in Jakarta, Indonesia. Its official name is Tiki Jalur Nugraha Ekakurir (Tiki JNE). JNE As a provider of delivery services for goods and documents that will be sent by customers to be sent to their destination via JNE.

This JNE company was founded on November 26, 1990 by Mr. H. Soeprapto Suparno. This company was started as a division of PT Citra Van Titipan Kilat (TIKI) to manage the international courier network. This company in Medan is located on Jl. Sisingamangaraja Warehousing Complex Amplas Trade Center Block F10,JNE in Medan City has 3 branches to be precise on Jl. Wahid Hasyim, Jl. Marelan, and Jl. Thamrin. JNE in Sisingamangaraja, Amplas Trade Center Warehouse Complex, Block F10, has 10 employees as couriers.

## 3 Research Methods

This research was carried out for approximately six months from January to June and the research site was at the Nugraha Ekakurir (JNE) Company Sisingamangaraja Warehousing Complex Amplas Trade Center Block F10, Medan.

The variable studied in the preparation of this thesis is the completion time of delivery of goods in 2019 on the Nugraha Ekakurir (JNE) Sisingamangaraja Track, Amplas Trade Center Warehouse Complex, Block F10, MEDAN.

As for the procedure of this research as follows:

1. Collecting data from JNE companies and supporting theories in the form of employee names, employee work areas and employee time in delivering goods.
2. Calculating Optimal Time

a. Compile the assignment table.

In the table assignment of rows for the time of employees in the delivery of goods and the column for the destination.

b. Subtracts each row with the lowest time in a given time table from all times in that row. Mathematically it can be written, for each i then:

$$C_{ij} - \min (C_{ij}),\ j = 1,2,\ldots,n$$

c. Subtracts each column with the lowest time in each column in the table from all times in that column. Mathematically it can be written, for each i then:

$$Cij - \min (Cij),\ j = 1,2,\ldots,n$$

d. Check if the feasible solution is optimal. Checks are carried out by drawing vertical and horizontal lines that pass through the zero value. If the number of lines formed is equal to the number of rows/columns, the solution for the optimal operating cost has been obtained.

e. Make table revisions. If any of the columns do not contain zero entries.

f. If there are still entries that are not zero then return to step 5

g. Calculate the optimal value using the equation:

a. dengan menggunakan persamaan:

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

After getting the solution above, then proceed to the following steps:

h. Analyze the division of tasks with optimal time.

i. Results.

j. Conclusion

## 4 RESULTS AND DISCUSSION

**Research data**

This research was conducted at the Nugraha Ekakurir Line Company (JNE) Sisingamangaraja, Amplas Trade Center Warehouse Complex Block F10, Medan. each week can be seen from the following table:

**Table 4.1 Travel Time for Delivery of Goods for Each Employee**

| | | DESTINATION AREA (time in hours) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | J |
| EMPLOYEE | Ferdi | 5 | 5 | 4 | 6 | 6 | 4 | 7 | 7 | 6 | 5 |
| | Widyanto | 6 | 6 | 4 | 5 | 6 | 4 | 7 | 6 | 7 | 4 |
| | Fitriadi | 6 | 5 | 6 | 5 | 7 | 5 | 6 | 6 | 7 | 5 |
| | Audi | 7 | 6 | 5 | 6 | 6 | 5 | 7 | 8 | 6 | 5 |
| | Edward | 6 | 7 | 7 | 6 | 7 | 5 | 6 | 6 | 7 | 5 |
| | Suryadi | 7 | 6 | 5 | 5 | 7 | 4 | 6 | 6 | 6 | 4 |
| | Ichsan | 7 | 5 | 5 | 6 | 7 | 5 | 7 | 7 | 6 | 5 |
| | Citradi | 6 | 5 | 6 | 5 | 6 | 5 | 6 | 6 | 7 | 5 |
| | Riki | 6 | 7 | 4 | 5 | 7 | 4 | 6 | 6 | 7 | 5 |
| | Irfan | 7 | 6 | 5 | 6 | 6 | 5 | 6 | 7 | 6 | 5 |

Source: Nugraha Ekakurir (JNE) Company Amplas Trade Center

Information:

A = Medan Tuntungan B = Medan Selayang
C = Medan Amplas D = Medan Johor
E = Delitua F = Patumbak
G = Pancur Batu H = Kutalimbaru
I = Medan Baru J = Medan Sunggal

From the previous data, the completion time of employees in delivering goods to the destination area from January to June 2019 can be seen from the following table:

**Table 4.2 Employee Completion Time in Delivery of Goods**

| | | EMPLOYEE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ferdi | Widiyanto | Fitriadi | Audi | Edward | Suryadi | Ichsan | Citradi | Riki | Irvan |
| TYPE OF WORK | ( time in | A | 5 | 6 | 6 | 7 | 6 | 7 | 7 | 6 | 6 | 7 |
| | | B | 5 | 6 | 5 | 6 | 7 | 6 | 5 | 5 | 7 | 6 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | C | 5 | 5 | 7 | 6 | 8 | 6 | 6 | 7 | 5 | 6 |
| | D | 6 | 5 | 5 | 6 | 6 | 5 | 6 | 5 | 5 | 6 |
| | E | 6 | 6 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 6 |
| | F | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| | G | 7 | 7 | 6 | 7 | 6 | 6 | 7 | 6 | 6 | 6 |
| | H | 7 | 6 | 6 | 8 | 6 | 6 | 7 | 6 | 6 | 7 |
| | I | 6 | 7 | 7 | 6 | 7 | 6 | 6 | 7 | 7 | 6 |
| | J | 5 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |

Source: Nugraha Ekakurir (JNE) Company Amplas Trade Center

The average completion time of employees in delivering goods to their destination before using the Hungarian method can be seen in the following table:

**Table 4.3 Minimum Settlement Time Before Using the Hungarian Method**

| **Destination Area** | **Time** |
|---|---|
| Medan Tuntungan | 6,3 jam |
| Medan Selayang | 5,8 jam |
| Medan Amplas | 6,1 jam |
| Medan Johor | 5,5 jam |
| Delitua | 6,5 jam |
| Patumbak | 4,6 jam |
| Pancur Batu | 6,4 jam |
| Kutalimbaru | 6,5 jam |
| Medan Baru | 6,5 jam |
| Sunggal | 4,8 jam |
| **Minimum Total Time** | **59 jam** |

**Information:**

The time used is calculated from each employee in delivering goods to their destination with one delivery with a total of 115 to 170 goods. The time of each delivery of goods for each employee is seen from the average time of delivery of goods to the destination.

Based on table 4.2, to solve the assignment problem optimization on the Nugraha Ekakurir (JNE) Path, the problem is formulated in the form of linear programming first:

a. Forming a Mathematical Model

Based on table 4.2, the following equation is obtained:

Minimize $Z = \sum_{i=1}^{m} \sum_{j=1}^{n} C_{ij} X_{ij}$ (Aminuddin, 2005)

$$Z = \sum_{i=1}^{10} \sum_{j=1}^{10} C_{ij} X_{ij}$$

With Z stating the total time of delivery of goods and Cij is the time required by employee i to complete the delivery of goods to location j. Based on the above equation can be formulated into linear programming as follows:

Minimize

$Z = 5X_{1,1} + 6X_{1,2} + 6X_{1,3} + 7X_{1,4} + 6X_{1,5} + 7X_{1,6} + 7X_{1,7} + 6X_{1,8} + 6X_{1,9} + 7X_{1,10} + 5X_{2,1} + 6X_{2,2} + 5X_{2,3} + 6X_{2,4} + 7X_{2,5} + 6X_{2,6} + 5X_{2,7} + 5X_{2,8} + 7X_{2,9} + 6X_{2,10} + 4X_{3,1} + 4X_{3,2} + 6X_{3,3} + 5X_{3,4} + 7X_{3,5} + 5X_{3,6} + 5X_{3,7} + 6X_{3,8} + 4X_{3,9} + 5X_{3,10} + 6X_{4,1} + 5X_{4,2} + 5X_{4,3} + 6X_{4,4} + 6X_{4,5} + 5X_{4,6} + 6X_{4,7} + 5X_{4,8} + 5X_{4,9} + 6X_{4,10} + 6X_{5,1} + 6X_{5,2} + 7X_{5,3} + 6X_{5,4} + 7X_{5,5} + 7X_{5,6} + 7X_{5,7} + 6X_{5,8} + 7X_{5,9} + 6X_{5,10} + 4X_{6,1} + 4X_{6,2} + 5X_{6,3} + 5X_{6,4} + 5X_{6,5} + 4X_{6,6} + 5X_{6,7} + 5X_{6,8} + 4X_{6,9} + 5X_{6,10} + 7X_{7,1} + 7X_{7,2} + 6X_{7,3} + 7X_{7,4} + 6X_{7,5} + 6X_{7,6} + 7X_{7,7} + 6X_{7,8} + 6X_{7,9} + 6X_{7,10} + 7X_{8,1} + 6X_{8,2} + 6X_{8,3} + 8X_{8,4} + 6X_{8,5} + 6X_{8,6} + 7X_{8,7} + 6X_{8,8} + 6X_{8,9} + 7X_{8,10} + 6X_{9,1} + 7X_{9,2} + 7X_{9,3} + 6X_{9,4} + 7X_{9,5} + 6X_{9,6} + 6X_{9,7} + 7X_{9,8} + 7X_{9,9} + 6X_{9,10} + 5X_{10,1} + 4X_{10,2} + 5X_{10,3} + 5X_{10,4} + 5X_{10,5} + 4X_{10,6} + 5X_{10,7} + 5X_{10,8} + 5X_{10,9} + 5X_{10,10}$

Constraint function:Employee constraint:

$X_{1,1} + X_{1,2} + X_{1,3} + X_{1,4} + X_{1,5} + X_{1,6} + X_{1,7} + X_{1,8} + X_{1,9} + X_{1,10} = 1$

$X_{2,1} + X_{2,2} + X_{2,3} + X_{2,4} + X_{2,5} + X_{2,6} + X_{2,7} + X_{2,8} + X_{2,9} + X_{2,10} = 1$

$X_{3,1} + X_{3,2} + X_{3,3} + X_{3,4} + X_{3,5} + X_{3,6} + X_{3,7} + X_{3,8} + X_{3,9} + X_{3,10} = 1$

$X_{4,1} + X_{4,2} + X_{4,3} + X_{4,4} + X_{4,5} + X_{4,6} + X_{4,7} + X_{4,8} + X_{4,9} + X_{4,10} = 1$

$X_{5,1} + X_{5,2} + X_{5,3} + X_{5,4} + X_{5,5} + X_{5,6} + X_{5,7} + X_{5,8} + X_{5,9} + X_{5,10} = 1$

$X_{6,1} + X_{6,2} + X_{6,3} + X_{6,4} + X_{6,5} + X_{6,6} + X_{6,7} + X_{6,8} + X_{6,9} + X_{6,10} = 1$

$X_{7,1} + X_{7,2} + X_{7,3} + X_{7,4} + X_{7,5} + X_{7,6} + X_{7,7} + X_{7,8} + X_{7,9} + X_{7,10} = 1$

$X_{8,1} + X_{8,2} + X_{8,3} + X_{8,4} + X_{8,5} + X_{8,6} + X_{8,7} + X_{8,8} + X_{8,9} + X_{8,10} = 1$

$X_{9,1} + X_{9,2} + X_{9,3} + X_{9,4} + X_{9,5} + X_{9,6} + X_{9,7} + X_{9,8} + X_{9,9} + X_{9,10} = 1$

$X_{10,1} + X_{10,2} + X_{10,3} + X_{10,4} + X_{10,5} + X_{10,6} + X_{10,7} + X_{10,8} + X_{10,9} + X_{10,10} = 1$

Kendala lokasi:

$X_{1,1} + X_{2,1} + X_{3,1} + X_{4,1} + X_{5,1} + X_{6,1} + X_{7,1} + X_{8,1} + X_{9,1} + X_{10,1} = 1$

$X_{1,2} + X_{2,2} + X_{3,2} + X_{4,2} + X_{5,2} + X_{6,2} + X_{7,2} + X_{8,2} + X_{9,2} + X_{10,2} = 1$

$X_{1,3} + X_{2,3} + X_{3,3} + X_{4,3} + X_{5,3} + X_{6,3} + X_{7,3} + X_{8,3} + X_{9,3} + X_{10,3} = 1$

$X_{1,4} + X_{2,4} + X_{3,4} + X_{4,4} + X_{5,4} + X_{6,4} + X_{7,4} + X_{8,4} + X_{9,4} + X_{10,4} = 1$

$X_{1,5} + X_{2,5} + X_{3,5} + X_{4,5} + X_{5,5} + X_{6,5} + X_{7,5} + X_{8,5} + X_{9,5} + X_{10,5} = 1$

$X_{1,6} + X_{2,6} + X_{3,6} + X_{4,6} + X_{5,6} + X_{6,6} + X_{7,6} + X_{8,6} + X_{9,6} + X_{10,6} = 1$

$X_{1,7} + X_{2,7} + X_{3,7} + X_{4,7} + X_{5,7} + X_{6,7} + X_{7,7} + X_{8,7} + X_{9,7} + X_{10,7} = 1$

$X_{1,8} + X_{2,8} + X_{3,8} + X_{4,8} + X_{5,8} + X_{6,8} + X_{7,8} + X_{8,8} + X_{9,8} + X_{10,8} = 1$

$X_{1,9} + X_{2,9} + X_{3,9} + X_{4,9} + X_{5,9} + X_{6,9} + X_{7,9} + X_{8,9} + X_{9,9} + X_{10,9} = 1$

$X_{1,10} + X_{2,10} + X_{3,10} + X_{4,10} + X_{5,10} + X_{6,10} + X_{7,10} + X_{8,10} + X_{9,10} + X_{10,10} = 1$

b. Assignment Problem Optimization Process Using the Hungarian Method

1) Determine the smallest number (entry) from each row in table 4.2, then subtract all numbers (entry) in that row with the smallest number (entry).

The time matrix for this problem is a 10 x 10 matrix.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **5** | 6 | 6 | 7 | 6 | 7 | 7 | 6 | 6 | 7 |
| **5** | 6 | 5 | 6 | 7 | 6 | 5 | 5 | 7 | 6 |
| **4** | 4 | 6 | 5 | 7 | 5 | 5 | 6 | 4 | 5 |
| 6 | **5** | 5 | 6 | 6 | 5 | 6 | 5 | 5 | 6 |
| **6** | 6 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 6 |
| **4** | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| 7 | 7 | **6** | 7 | 6 | 6 | 7 | 6 | 6 | 6 |
| 7 | **6** | 6 | 8 | 6 | 6 | 7 | 6 | 6 | 7 |
| **6** | 7 | 7 | 6 | 7 | 6 | 6 | 7 | 7 | 6 |
| 5 | **4** | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |

For the first row subtract 5, the second row subtract 5, the third row subtract 4, the fourth row subtract 5, the fifth row subtract 6, the sixth row subtract 4, the seventh row subtract 6, the eighth row subtract 6, the ninth row subtract 6, the tenth row subtract 4.

$$\begin{bmatrix} 0 & 1 & 1 & 2 & 1 & 2 & 2 & 1 & 1 & 2 \\ 0 & 1 & 0 & 1 & 2 & 1 & 0 & 0 & 2 & 1 \\ 0 & 0 & 2 & 1 & 3 & 1 & 1 & 2 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 2 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \end{bmatrix}$$

2) Checks whether each column has a zero (entry) number. Because the ten columns of the matrix already contain the number (entries - entries) zero. The matrix results are as follows:

$$\begin{bmatrix} \mathbf{0} & 1 & 1 & 2 & 1 & 2 & 2 & 1 & 1 & 2 \\ \mathbf{0} & 1 & \mathbf{0} & 1 & 2 & 1 & \mathbf{0} & \mathbf{0} & 2 & 1 \\ \mathbf{0} & \mathbf{0} & 2 & 1 & 3 & 1 & 1 & 2 & \mathbf{0} & 1 \\ 1 & \mathbf{0} & \mathbf{0} & 1 & 1 & \mathbf{0} & 1 & \mathbf{0} & \mathbf{0} & 1 \\ \mathbf{0} & \mathbf{0} & 1 & \mathbf{0} & 1 & 1 & 1 & \mathbf{0} & 1 & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & 1 & 1 & 1 & \mathbf{0} & 1 & 1 & \mathbf{0} & 1 \\ 1 & 1 & \mathbf{0} & 1 & \mathbf{0} & \mathbf{0} & 1 & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ 1 & \mathbf{0} & \mathbf{0} & 2 & \mathbf{0} & \mathbf{0} & 1 & \mathbf{0} & \mathbf{0} & 1 \\ \mathbf{0} & 1 & 1 & \mathbf{0} & 1 & \mathbf{0} & \mathbf{0} & 1 & 1 & \mathbf{0} \\ 1 & \mathbf{0} & 1 & 1 & 1 & \mathbf{0} & 1 & 1 & 1 & 1 \end{bmatrix}$$

3) Closing all zero values using a minimum of vertical/horizontal lines. If the number of lines is equal to the number of rows or columns, then the assignment is optimal. If the number of lines is not equal to the number of rows or columns, then proceed to the next step.

$$\begin{bmatrix} \mathbf{0} & 1 & 1 & 2 & 1 & 2 & 2 & 1 & 1 & 2 \\ 0 & 1 & 0 & 1 & 2 & 1 & \mathbf{0} & 0 & 2 & 1 \\ 0 & 0 & 2 & 1 & 3 & 1 & 1 & 2 & \mathbf{0} & 1 \\ 1 & 0 & \mathbf{0} & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & \mathbf{0} \\ 0 & 0 & 1 & 1 & 1 & \mathbf{0} & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & \mathbf{0} & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 2 & 0 & 0 & 1 & \mathbf{0} & 0 & 1 \\ 0 & 1 & 1 & \mathbf{0} & 1 & 0 & 0 & 1 & 1 & 0 \\ 1 & \mathbf{0} & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \end{bmatrix}$$

4) The matrix in step 3 shows that the number of lines covering all 0 numbers (entries) is the same as the number of rows/columns, so the assignment is optimal. Therefore, it is possible to determine the assignment, starting from the row/column which only has one value of 0.
   The solution/decision obtained is
   $X_{1,1} = X_{2,7} = X_{3,9} = X_{4,3} = X_{5,10} = X_{6,6} = X_{7,5} = X_{8,8} = X_{9,4} = X_{10,2} = 1$

By adjusting the decision result variable (xij), the total optimal time (minimum) needed by employees to deliver goods to the 10 destination locations is obtained, namely:

$Z = X_{1,1} + X_{2,7} + X_{3,9} + X_{4,3} + X_{5,10} + X_{6,6} + X_{7,5} + X_{8,8} + X_{9,4} + X_{10,2}$
$= 5 + 5 + 4 + 5 + 6 + 4 + 6 + 6 + 6 + 4$
$= 51$ jam

Based on the results of calculations using the Hungarian method, the optimal total time is 51 hours, with the assignment settings as follows:

**Table 4.4. Total Time Results Using the Hungarian Method**

| **Employee** | **Destination Location** | **Time (hours)** |
|---|---|---|
| Fredi | Medan Tuntungan | 5 jam |
| Ichsan | Medan Selayang | 5 jam |
| Riki | Medan Amplas | 4 jam |
| Fitriadi | Medan Johor | 5 jam |
| Irvan | Delitua | 6 jam |
| Suryadi | Patumbak | 4 jam |
| Edward | Pancurbatu | 6 jam |
| Citradi | Kutalimbaru | 6 jam |
| Audi | Medan Baru | 6 jam |
| Widiyanto | Sunggal | 4 jam |
| **Optimum total time** | | **51 jam** |

**Discussion**

By using the Hungarian method, the minimum total employee time in delivering goods to the destination location is obtained, starting from compiling an assignment table where the destination area is the row and the employee is the column. There are 10 locations of delivery of goods and there are also 10 employees who are specifically assigned to deliver goods to the destination location. The time needed by the company before using the Hungarian method resulted in the total time of delivering goods to the destination location on the Nugraha Ekakurir Line (JNE) which was 59 hours, while using the Hungarian method the total time of delivery of goods to the destination location was 51 hours. Where the optimal placement of employee assignments is Ferdi is assigned to Medan Tuntungan with 5 hours, Ichsan is assigned to Medan Selayang with 5 hours, Riki is assigned to Medan Amplas with 4 hours, Fitriadi is assigned to Medan Johor with 5 hours, Irvan is assigned to Delitua with 6 hours, Suryadi assigned to Patumbak with 4 hours, Edward was assigned to Pancur Batu with 6 hours, Citradi was assigned to Kutalimbaru with 6 hours, Audi was assigned to Medan Baru with 6 hours and Widiyanto was assigned to Sunggal with time 4 hours. Then the efficiency is obtained as much as 8 hours.

## 5 CONCLUSION:

From the results of the study, the problem obtained was that the time it took for employees to deliver goods to their destination at the Lintas Nugraha Ekakurir (JNE) company before using the Hungarian method the total time was 59 hours, while after using the Hungarian method, the total time was 51 hours. So the time efficiency is obtained as much as 8 hours. So the calculation of the time needed by employees in delivering goods to the destination location is more optimal using the Hungarian method when compared to the time before using the Hungarian method.

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