Vygotsky: Jurnal Pendidikan Matematika dan Matematika
8 (1) February 2026, pp. 77 - 88
E-ISSN: 2656-5846 P-ISSN: 2656-2286
Journal Page is available to
https://jurnalpendidikan.unisla.ac.id/index.php/VoJ

Optimization of Sandblasting Project Scheduling at PT. Prima Saka Engineering Using the Hungarian Algorithm

Jihan Tria Marena[1*], Nia Nurfitria[1]

[1] Department of Mathematics, Universitas PGRI Ronggolawe, Indonesia

**Email Correspondence:* jihantria04@gmail.com

ARTICLE INFO

Article History

Received	:	18 Feb 2026
Revised	:	21 Feb 2026
Accepted	:	26 Feb 2026
Available Online	:	28 Feb 2026

Keywords:
Hungarian Algorithm
Assignment Problem
Optimization
Project Scheduling
Sandblasting

Please cite this article APA style as:
Marena, J. T. & Nurfitria, N. (2026). Optimization of Sandblasting Project Scheduling at PT. Prima Saka Engineering Using the Hungarian Algorithm. *Vygotsky: Jurnal Pendidikan Matematika dan Matematika*, 8(1), pp. 77-88.

ABSTRACT

This study employs the Hungarian Algorithm to optimize the sandblasting project scheduling at PT. Prima Saka Engineering. Five workers (P1-P5) with different specializations were assigned five tasks: surface preparation (T1), exterior sandblasting (T2), interior sandblasting (T3), primer application (T4), and final quality inspection (T5). The goal was to reduce overall completion time, with each worker being assigned to only one task. The methodical steps comprised matrix building, reduction, and optimality testing. The Hungarian Algorithm generated an optimal assignment with a minimal total time of 1,128 hours, saving 222 hours (16.4%) compared to the previous 1,350-hour method. This study demonstrates that the Hungarian Algorithm provides a mathematically optimal and practically applicable framework for strategic resource allocation and project management.

Vygotsky: Jurnal Pendidikan Matematika dan Matematika with CC BY NC SA license
Copyright © 2026, The Author (s)

1. Introduction

National construction projects play a strategis role in supporting economic growth and infrastructure development. Infrastructure is essential to a country's development, with the ultimate goal being to improve the wellbeing of all of its residents (Arindi et al., 2025). However, the construction industry frequently faces a number of issues, such as schedule delays and issues with material availability. These challenges necessitate a more precise and adaptable method of project management and planning.

Mathematical methods are becoming more and more significant in this environment. Mathematical concepts like computing, assessment, and statistical

E-ISSN: 2656-5846
P-ISSN: 2656-2286

analysis are crucial in business, management, and finance because they facilitate forecasting, lower uncertainty, and allow decision-making based on reliable data and analysis (Atmaja, 2024). Optimization is one branch of mathematics that makes a substantial contribution to operational efficiency, especially when it comes to assignment difficulties. The assignment issue is a particular instance of linear programming that focuses on finding the most effective way to distribute few resources across a number of jobs (Rahmawati et al., 2015). Finding the best distribution strategy is the main goal, which may be achieved by either increasing overall revenue or reducing overall expenses or time (Monica et al., 2025).

The Hungarian Algorithm is among the most popular and effective approaches for resolving assignment problems among the many others. By solving assignment difficulties, the Hungarian Algorithm is a powerful optimization method that helps companies boost income (Basriati & Lestari, 2017). In order to minimize overall expenses or time, this algorithm can identify the best ways to distribute resources among activities. The Hungarian Algorithm saves a significant amount of time and yields the best outcomes in many industrial planning scenarios (Yulistiana et al., 2015). It is computationally efficient and dependable for moderately sized problems because of its combinatorial optimization approach, which ensures an optimal solution in polynomial time.

The use of the Hungarian Algorithm for sandblasting project scheduling should produce the best way to match work teams with specific projects. This approach aims to reduce operating costs, increase resource utilization, and reduce the overall time needed to complete all tasks (Pratama et al., 2020). Since the Hungarian Algorithm does not need the formulation of objective functions and constraints in standard LP form, it is more precise and efficient for assignment problems than other optimization approaches such as the generic linear programming example simplex method. Metaheuristic methods such as evolutionary algorithms or simulated annealing can handle larger and more complex problems, but they often require longer computing times and parameter tuning, and they do not offer global optimality. The Hungarian Algorithm, on the other hand, provides a precise and reliable solution for the balanced assignment problem, which is particularly helpful when the tasks and resources are clearly defined, as in project scheduling.

Despite its advantages, the Hungarian Algorithm has drawbacks. It is designed to operate with balanced problems when the number of workers and jobs is equal. If the problem is unbalanced, dummy variables must be added, which may restrict its use in extremely unpredictable situations by influencing accuracy or the uncertainty of work length.

Schedule optimization is essential for PT. Prima Saka Engineering to ensure the efficient use of skilled workers in sandblasting projects. Five people with various skills must be assigned by the company to five projects, each with its own set of technical requirements and timeframes. Lack of a systematic assignment process may lead to inefficiencies, including misaligned worker task allocation, extended project durations, and increased operating costs.

The application of the Hungarian Algorithm to the scheduling of sandblasting projects is yet relatively unexplored, despite its widespread use in manufacturing, logistics, and educational scheduling. As far as the authors are aware, no previous study has specifically examined how PT. Prima Saka Engineering optimized the assignment of sandblasting tasks using the Hungarian Algorithm. This study aims

E-ISSN: 2656-5846
P-ISSN: 2656-2286

to bridge that gap by applying the technique to shorten the total project completion time while accounting for worker specialization and task characteristics. The results are expected to provide the company with a quantitative and systematic scheduling framework that supports strategic resource allocation and project management decision-making.

2. Method

An operations research strategy was employed to optimize the scheduling of sandblasting projects using the Hungarian method. The investigation was carried out by PT. Prima Saka Engineering, a company that provides surface preparation and coating services. The primary focus of this study is assigning workers to project tasks in order to shorten the total completion time.

2.1. Data Analysis

The data used in this study includes five project jobs with distinctive qualities and five people with a range of specializations. Surface preparation (P3), painting and coating (P4), manual sandblasting (P1), automatic sandblasting (P2), and quality control (P5) are the five groups into which the staff members are separated based on their areas of competence. The project's tasks include primer application (T4), interior and exterior sandblasting (T3), surface preparation (T1), and final quality inspection (T5).

2.1.1. Data Type and Source

The kind of secondary data used are estimates of how long it takes each employee to complete each task. These estimations were derived from the company's project papers and historical records. The choice to employ secondary data was influenced by a number of reasons.:

1. Time Efficiency: Primary data collection through direct observation or experimentation would require extended monitoring of ongoing sandblasting projects, which could take several months to complete. Given the time constraints of this research, secondary data provides a more feasible alternative.
2. Access Limitations: PT. Prima Saka Engineering operates on a project basis with varying schedules. Coordinating direct observations for all five workers across all five task types would require significant coordination and may disrupt ongoing operations.
3. Cost Considerations: Primary data collection would involve additional costs for equipment, monitoring, and personnel. The use of existing company records eliminates these expenses while still providing reliable estimates.
4. Data Availability: The company maintains comprehensive project records, including time estimates based on historical performance. These estimates have been validated through multiple project cycles and reflect realistic working times.

2.1.2. Data Structure

The data is arranged as an assignment matrix, where workers (P1–P5) are represented by rows and tasks (T1–T5) by columns. Each cell in the matrix contains the estimated time (in hours) required for a specific worker to complete a particular task. This matrix serves as the Hungarian Algorithm's input.

https://doi.org/10.30736/voj.v8i1.1335

E-ISSN: 2656-5846
P-ISSN: 2656-2286

2.2. Determining the Assignment Problem

Assignment issues are found using the following methods: Create a 5x5 assignment matrix that shows the amount of time spent on each task. To reduce a row, subtract each element from the lowest row value; to reduce a column, subtract each element from the least column value; and to cover all zero items with the fewest lines possible, either vertically or horizontally. (5) confirming optimality by comparing the number of lines with the matrix's order; (6) improving the values by subtracting the smallest value from the components not covered by the lines and adding it to the components at the line intersection; (7) calculating the shortest total time and choosing the best assignment from the available zero elements; and (6) repeating step (4) until the best choice is discovered.

2.3. Determining the Hungarian Algorithm

The Hungarian algorithm approach looks for the optimal worker-task allocation by cutting overall costs and time. The constraint function is then obtained and included in the assignment table,

$x_{ij} = 1$ if worker i is assigned to 1 of the jobs
$x_{ij} = 0$ if worker i is not assigned to any job.

Mathematical model for equation 1 assignment problems(Azmi & Kartika, 2025),

$$Z = \sum_{i=1}^{m} \sum_{j=1}^{n} x_{ij} c_{ij} \quad (1)$$

with obstacles,

$$\sum_{i=1}^{m} x_{ij} = 1 \; ; j = 1, 2, \ldots, m \quad (2)$$

$$\sum_{j=1}^{n} c_{ij} = 1 \; ; i = 1, 2, \ldots, n \quad (3)$$

Description,
Z : Objective function for which the optimal value is sought
n : Number of tasks to be completed
x_{ij} : Assignment from i to j
C_{ij} : Allocation parameter from i to j
i : employee i
j : Tasks or job j

2.4. Project Scheduling

Scheduling includes deciding when a work should be finished and assigning resources, like personnel, tools, or space, for certain operations (Sallaby & Kanedi, 2020). Making the most of the available resources to get the greatest results is the main objective of scheduling (Nufus, 2024). Project scheduling is the process of planning to complete a project on time and within the budget allotted. (Nanda et al., 2023).

E-ISSN: 2656-5846
P-ISSN: 2656-2286

2.5. Assignment Problem

Assignment problems are a specific situation in linear programming, which concentrates on distributing resources across several jobs (Rahmawati et al., 2015). The primary objective of this task is to determine the best distribution plan, either by increasing overall revenue or decreasing overall expenses (Monica et al., 2025).

2.6. Sandblasting

Sandblasting involves blowing a stream of abrasive particles, usually made of silica sand or steel grit, at high speed onto a surface. The goal of this technique is to get rid of surface contaminants like rust, paint, and oil (Purnamayasa, 2024). This process serves to remove rust and corrosion, clean old paint, create a surface profile for coating, and prepare the surface before painting. Many issues come up during the sandblasting process, such as damaged water inverters, broken nozzle hoses, and machines with reduced speed loss, which reduces effectiveness (Kurniawan et al., 2024).

2.7. Project Management

According to George R. Terry, management is a specific process that involves planning, organizing, and deploying human resources along with other resources in order to achieve predefined objectives (Asnuddin et al., 2018). Project management, on the other hand, is the application of planning, organizing, directing, and controlling resources to achieve specific goals within predetermined time, cost, and quality constraints.

2.8. Optimization

The objective of the computer work known as optimization is to identify the optimal solution from a set of potential solutions while adhering to many predetermined constraints (Devita & Wibawa, 2020). The optimization involves utilizing designated algorithms to enhance efficiency or minimize operational expenses required to accomplish the specific project.

3. Results and Discussion

This section displays the results of PT. Prima Saka Engineering's sandblasting project scheduling optimization utilizing the Hungarian Algorithm. Five project tasks and the anticipated working times for five personnel with different specialties were included in the secondary data from corporate project reports that were used for the research.

3.1. Problem Formulation

The following is how the assignment problem for this study was constructed. There is only one worker allocated to each task,

$$\sum_{j=1}^{5} x_{ij} = 1,\ i = 1, 2, \ldots., 5 \tag{4}$$

There is only one worker allocated to each task,

$$\sum_{i=1}^{5} c_{ij} = 1\ ; j = 1, 2, \ldots., 5 \tag{5}$$

https://doi.org/10.30736/voj.v8i1.1335

E-ISSN: 2656-5846
P-ISSN: 2656-2286

Constraint in binary,

$$x_{ij} \in (0,1), \forall i \quad (6)$$

3.2. Data Presentation

Based on company data, the estimated working times for each worker on each task are presented in **Table 1.** This table lists the codes and specializations of five employees who worked on a sandblasting project at PT. Prima Saka Engineering. Worker A (P1) is an expert in manual sandblasting, which entails using sandblasting equipment by hand and calls for specific abrasive jet direction skills.

Table 1. Worker Data

Name	Specialization	Worker Code
A	Manual Sandblasting	P1
B	Automatic Sandblasting	P2
C	Surface Preparation	P3
D	Painting and Coating	P4
E	Quality Control	P5

Using an automated system that may boost productivity over wide areas, Worker B (P2) specializes in automatic sandblasting. Worker C (P3) is an expert in surface preparation, which entails getting surfaces ready for sandblasting. After sandblasting, Worker D (P4) applies priming and protective coatings as part of his painting and coating expertise. In the meantime, Worker E (P5) is in charge of quality control, making sure that output satisfies predetermined criteria. Since each worker has unique skills and processing times for every kind of task, these specialized differences are the main factors taken into account while generating the assignment matrix.

Table 2. Assignment Data

Job Description	Area (m^2)	*Deadline (Hours)*	Task Code
Surface Preparasi (griding)	500	30	T1
Exterior Sandblasting Area	300	25	T2
Interior Sandblasting Area	400	35	T3
Primer Application	350	28	T4
Final Quality Inspection	200	15	T5

The location, deadline, and task code for each of the five primary categories of work in the sandblasting process series are shown in Table 2's project assignment data. The largest work that helps to prepare the surface prior to the sandblasting process is Task T1, Surface Preparation (grinding), which spans an area of 500 m^2 and has a 30-hour deadline. Task T2, Exterior Sandblasting Area, has a 25-hour deadline and spans a 300-square-meter area. Its goal is to remove dirt, rust, and old layers from exterior surfaces.

Due to the intricacy of the work in the interior region, Task T3, Interior Sandblasting region, has the longest time allotment. It has a 400 m^2 area and a 35-hour deadline. Task T4, Primer Application, has a 28-hour deadline and covers an area of 350 m^2. It entails applying a primer layer as a basic protection following sandblasting. Task T5, Final Quality Inspection, is the last inspection step to make

E-ISSN: 2656-5846
P-ISSN: 2656-2286

sure that all work satisfies the necessary quality standards. It spans an area of 200 m² and has a 15-hour deadline. This information serves as the foundation for creating the assignment matrix, which serves as the primary input for the Hungarian Algorithm.

Table 3. Work Time Data (in hours)

Worker	Assignment				
	T1	**T2**	**T3**	**T4**	**T5**
P1	240	360	300	420	185
P2	270	243	428	480	300
P3	210	420	270	360	330
P4	360	480	450	210	460
P5	370	330	345	320	165

The main input for the Hungarian Algorithm's assignment matrix generation is the estimated processing time (in hours) for each worker and job combination, which is shown in Table 3. This information, which comes from the company's past project records, shows each employee's true capacity to finish every kind of task. Task T5 (Final Quality Inspection) took worker P1 (Manual Sandblasting) the least amount of time (185 hours), however task T4 (Primer Application) took the longest (420 hours). At 243 hours, worker P2 (Automatic Sandblasting) completed task T2 (Exterior Sandblasting) with the highest efficiency, which is consistent with his expertise in running automated machinery.

At under 210 hours, Worker P3 (Surface Preparation) performed exceptionally well on task T1 (Surface Preparation/Grinding), demonstrating the fit between his area of expertise and the nature of the work. Given his proficiency in applying protective coatings, worker P4 (Painting and Coating) completed job T4 (Primer Application) in the minimum amount of time (210 hours). In the meantime, Worker P5 (Quality Control) finished T5 (Final Quality Inspection) the quickest, taking 165 hours—the shortest time in the whole matrix. In order to systematically reduce the project's overall completion time, assignment optimization using the Hungarian Algorithm is required, as Table 3 generally demonstrates that there is considerable difference in time amongst workers for the same activity.

3.3. Implementation of the Hungarian Algorithm

The Hungarian Algorithm was implemented through the following sequential steps:

Step 1: Create the Assignment Matrix

The working time data was simplified by dividing all values by 10 to facilitate calculations, resulting in the reduced assignment matrix shown in **Table 4**.

Table 4. Reduced assignment matrix

Worker	Assignment				
	T1	**T2**	**T3**	**T4**	**T5**
P1	24	36	30	42	18,5
P2	27	24,3	42,8	48	30
P3	21	42	27	36	33
P4	36	48	45	21	46
P5	37	33	34,5	32	16,5

https://doi.org/10.30736/voj.v8i1.1335

E-ISSN: 2656-5846
P-ISSN: 2656-2286

Step 2: Row Reduction
For each row, the smallest value was identified and subtracted from all elements in that row.

Table 5. Row Reduction Results

Worker	Assignment				
	T1	T2	T3	T4	T5
P1	5,5	17,5	11,5	23,5	0
P2	2,7	0	18,5	23,7	5,7
P3	0	21	6	15	12
P4	15	27	24	0	25
P5	20,5	16,5	18	15,5	0

Step 3: Column Reduction
After row reduction, column T3 had no zero value. The smallest value in column T3 was 6.0, which was subtracted from all elements in that column.

Table 6. Column Reduction Results

Worker	Assignment				
	T1	T2	T3	T4	T5
P1	5,5	17,5	5,5	23,5	0
P2	2,7	0	12,5	23,7	5,7
P3	0	21	0	15	12
P4	15	27	18	0	25
P5	20,5	16,5	12	15,5	0

Step 4: Line Drawing for Zero Coverage
The minimum number of lines required to cover all zero elements was drawn. Since the number of lines (4) was less than the matrix order (5), the solution was not yet optimal.

Table 7. Lines Drawing Results (First Iteration)

Worker	Assignment				
	T1	T2	T3	T4	T5
P1	5,5	17,5	5,5	23,5	0
P2	~~2,7~~	~~0~~	~~12,5~~	~~23,7~~	~~5,7~~
P3	~~0~~	~~21~~	~~0~~	~~15~~	~~12~~
P4	~~15~~	~~27~~	~~18~~	~~0~~	~~25~~
P5	20,5	16,5	12	15,5	0

Step 5: Matrix Improvement
Subtracted from all uncovered elements, added to elements at line intersections

Table 8. Improved Matrix

Worker	Assignment				
	T1	T2	T3	T4	T5
P1	~~0~~	~~12~~	~~0~~	~~18~~	~~0~~
P2	2,7	0	12,5	23,7	11,2
P3	~~0~~	~~23,7~~	~~0~~	~~15~~	~~17,5~~
P4	~~15~~	~~29,7~~	~~18~~	~~0~~	~~30,5~~

E-ISSN: 2656-5846
P-ISSN: 2656-2286

P5	~~15~~	~~11~~	~~6,5~~	~~10~~	~~0~~

Step 6: Optimality Check
Five lines were required to cover all zeros, which equals the matrix order, indicating that an optimal solution had been achieved.

Table 9. Optimal assignment results

Worker	Assignment				
	T1	**T2**	**T3**	**T4**	**T5**
P1	0	12	0	18	0
P2	2,7	0	12,5	23,7	11,2
P3	0	23,7	0	15	17,5
P4	15	29,7	18	0	30,5
P5	15	11	6,5	10	0

Based on **Table 9**, the optimal minimum time is obtained, namely:

$$Z = \sum_{i=1}^{m}\sum_{j=1}^{n} x_{ij}c_{ij} \tag{7}$$

$$Z = 300 + 243 + 210 + 210 + 65$$
$$Z = 1.128$$

3.4. Interpretation of Results
The optimal assignment yields the following interpretations:
1. The findings of the optimal assignment indicate that, given a 300-hour working time, manual sandblasting (P1) is the most effective method for completing the interior sandblasting task (T3).
2. The results of the optimal assignment indicate that, with a working time of 243 hours, automatic sandblasting (P2) is the most effective method for completing the outside sandblasting task (T2).
3. The findings of the optimal assignment indicate that, with a working time of 210 hours, surface preparation (P3) is the most effective method for completing the surface preparation (grinding) task (T1).
4. According to the results of the ideal assignment, painting and coating (P4) is the best option for completing the primer application task (T4) in 210 hours.
5. According to the results of the optimal assignment, quality control (P5) is best suited to complete the sandblasting control area task in 165 hours.

This interpretation allows PT. Prima Saka Engineering to determine how the optimization outcomes of the Hungarian Algorithm technique produce systematic and measurable scheduling solutions.

4. Conclusions
This study successfully optimized the scheduling of sandblasting projects at PT. Prima Saka Engineering by applying the Hungarian Algorithm to the assignment problem involving five personnel with different specializations and five project assignments. P1 (Manual Sandblasting) was assigned to T3 (Interior Sandblasting) for 300 hours, P2 (Automatic Sandblasting) to T2 (Exterior Sandblasting) for 243 hours, P3 (Surface Preparation) to T1 (Surface Preparation) for 210 hours, P4 (Painting and Coating) to T4 (Primer Application) for 165 hours, and P5 (Quality

E-ISSN: 2656-5846
P-ISSN: 2656-2286

Control) to T5 (Final Quality Inspection) in order to reach a minimum total completion time of 1,128 hours.

Compared to the company's previous assignment approach, which, based on previous project data, needed around 1,350 hours, the Hungarian Algorithm saved 222 hours, or 16.4%, of time, suggesting a significant boost in efficiency. These findings provide PT. Prima Saka Engineering with a systematic and quantitative scheduling technique that can support strategic resource allocation and decision-making in project management. Future research could look at how the Hungarian Algorithm can be combined with other optimization strategies or used to more complex scenarios with additional restrictions like resource availability, budgetary limitations, or uncertainty factors.

Author Contributions

The first author was tasked with the collection, processing, and analysis of the data, in addition to composing the scientific article. The second author provided criticism and recommendations to enhance the study, its analysis, and the manuscript as a whole.

Declaration of Competing Interest

The authors have declared no indications of potential conflicts of interest.

References

Arindi, S. R., Wijimulawiani, B. S., Fadlli, M. D., & Barat, N. T. (2025). *Peran Infrastukrur Kontruksi Terhadap Ekonomi NTB Dengan Pendekatan Input-Output*. *7*(1), 85–93.

Asnuddin, S., Tjakra, J., & Sibi, M. (2018). Penerapan Manajemen Konstruksi Pada Tahap Controlling Proyek.(Studi Kasus: Bangunan Laboratorium Fakultas Teknik Universitas Sam Ratulangi Manado). *Jurnal Sipil Statik*, *6*(11), 895–906.

Atmaja, I. M. D. (2024). Logika berpikir manusia dalam konteks etnomatematika dan konsep matematika. *Prosiding Mahasaraswati Seminar Nasional Pendidikan Matematika*, *3*(1), 2–23.

Azmi, K., & Kartika, D. (2025). Simulasi Assignment Problem Untuk Distribusi Tugas Optimal Menggunakan Algoritma Hungarian Dan Python. *MATHunesa: Jurnal Ilmiah Matematika*, *13*(3), 189–195.

Basriati, S., & Lestari, A. (2017). Penyelesaian masalah penugasan menggunakan metode hungarian dan pinalti (Studi Kasus: CV. Surya Pelangi). *Jurnal Sains Matematika Dan Statistika*, *3*(1), 75–81.

Devita, R. N., & Wibawa, A. P. (2020). *Teknik-teknik optimasi knapsack problem*. *2*(1), 35–40.

Kurniawan, R. W., Hidayat, H., & Jufriyanto, Moh. (2024). Analisis Efektivitas Kinerja Mesin Sandblasting Manual Dan Otomatis Menggunakan Metode Overall Equipment Effectiveness (OEE) Dan Fault Tree Analysis (FTA). *INTECOMS: Journal of Information Technology and Computer Science*, *7*(6), 2219–2227. https://doi.org/10.31539/intecoms.v7i6.12467

Monica, A., Simanjuntak, A., & Prasetya, S. E. (2025). *Optimasi Penugasan Menggunakan Metode Hungarian Maksimasi untuk Meningkatkan Efektivitas Alokasi Sumber Daya (Seimbang dan Tidak Seimbang)*. *September*.

Nanda, M. P., Kurniawati, M., & Riswanto, S. (2023). *Penggunaan Metode Project Evaluation Review Technique (PERT) Dalam Evaluasi Perencanaan*. *17*(3), 163–

E-ISSN: *2656-5846*
P-ISSN: *2656-2286*

173. https://doi.org/10.24002/jts.v17i3.7181

Nufus, H. (2024). *Penjadwalan Pekerjaan pada Manajemen Waktu dan Sumber Daya Menggunakan Algoritma Greedy*. *1*(2), 53–59.

Pratama, D. T., Kurniawan, H. S., & Hungarian, M. (2020). *Optimasi Masalah Penugasan Menggunakan Metode Hungarian untuk Meminimalkan Waktu Produksi*. *1*(1).

Purnamayasa, P. A. (2024). *Uji Karakteristik Permukaan pada Pembersihan Benda Uji Menggunakan Sanblating dan Vaporblasting*. Politeknik Negeri Bali.

Rahmawati, E., Satyahadewi, N., & Frans, F. (2015). *Optimalisasi Masalah Penugasan Menggunakan Metode Hungarian (Studi kasus pada PT Pos Indonesia (Persero) Pontianak)*. *04*(3), 363–370.

Sallaby, A. F., & Kanedi, I. (2020). *Perancangan Sistem Informasi Jadwal Dokter Menggunakan Framework Codeigniter*. 48–53.

Yulistiana, M., Chaerani, D., & Lesmana, E. (2015). *Penerapan Metode Hungarian dalam Penentuan Penjadwalan Matakuliah Optimal (Studi Kasus : Departemen Matematika Universitas Padjadjaran Semester Ganjil 2013-2014)*. *11*(1), 45–64.

E-ISSN: *2656-5846*
P-ISSN: *2656-2286*