International Journal Scientific and Profesional (IJ-ChiProf)
Vol 4 Issue 2 March-May 2025, pp: 473-477
ISSN: 2829-2618 (Online)
DOI: https://10.56988/chiprof.v4i2.79

Implementation of Greedy Algorithm for National Selection of New Students at MAN Insan Cendekia OKI

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Article Info

Article history:
Received March 30, 2025
Revised April 10,, 2025
Accepted April 20, 2025

Keywords:
Greedy Algorithm
National Selection of New Students
Optimization

ABSTRACT

The National Selection of New Learners at MAN Insan Cendekia OKI is a process of selecting the best students based on certain criteria. This selection process requires an efficient method to ensure that the selected participants have qualities that match the school's standards. The Greedy Algorithm is one approach that can be used to solve optimization problems such as learner selection. This algorithm works by taking locally optimal decisions at each stage in the hope of getting an overall optimal solution. This research aims to implement the Greedy algorithm in the Selection of New Learners process at MAN Insan Cendekia OKI. In its application, the Greedy algorithm will be used to select participants based on criteria such as academic scores, non-academic achievements, and other factors deemed relevant by the school. The results of this study show that the Greedy algorithm can be applied well in the selection of students and is able to improve the efficiency of the selection process. However, there are some limitations that need to be considered, especially in terms of dynamic selection criteria and the possibility of non-optimal solutions in certain cases. Thus, the Greedy algorithm provides an interesting alternative in solving selection problems while still considering further development so that the results obtained are more optimal.

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1. INTRODUCTION

The National Selection of New Learners at MAN Insan Cendekia OKI is one of the important stages in determining which students will be accepted at this superior school. The selection process is carried out to ensure that participants who pass have academic and non-academic qualities that are in accordance with school standards, so as to produce a generation of achievers and competitors. Given the large number of applicants each year, the selection process must be carried out effectively and efficiently in order to screen participants quickly and accurately.

Information technology is a technology used to process data, including processing, obtaining, storing, manipulating data in various ways to produce quality information, namely information that is relevant, accurate and timely, which is used for personal, business and government purposes and is strategic information for decision making [1]. The utilization of technology strongly supports the objectives of organizing education so that efficiency in resource use and risk management must be considered. In fact, dependence on information technology to achieve strategic goals and organizational needs is a major driver because it is able to increase productivity, making business processes effective and efficient [2]. A well-designed information system enables fast, accurate, and relevant data processing [3]. The rapid development of information technology and good technology services is an expectation for all people, organizations, institutions, and universities in order to support activities, facilitate their activities and business processes [4].

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Traditional selection processes that require manual evaluation of various criteria such as academic grades, non-academic achievements, and student backgrounds are often time consuming and prone to human error. Therefore, a more structured and automated method is needed to simplify the selection process. One approach that can be used is the application of the Greedy algorithm. Greedy algorithm is an optimization method that makes decisions based on the best local advantage at each stage [5]. Greedy algorithm is the most popular method in solving optimization problems [6]. Thus, optimization can be said to be a noun derived from a verb, and optimization can be considered both a science and an art according to the goal to be maximized [7].

Many factors are related to optimization, such as computer optimization, Web optimization, boot optimization, CPU (Processor) optimization, bateray optimization (on laptops), sound optimization, display optimization, and so on, so optimization is indeed needed for anything to make something as good as possible or the most optimal. The issue of optimization is a very important issue to be applied to all systems and organizations. With optimization in a system we will be able to save in all ways including energy, finance, natural resources, work and others, without reducing the function of the system [8].

Greedy algorithm is an algorithm that can solve problems by finding the best alternative at a certain time. Although every answer solution from the greedy algorithm is not ensured to be the global optimum solution, it can be relied upon to optimize time [9]. In the context of learner selection, this algorithm can be used to determine the best candidate based on predetermined criteria, such as test scores, extracurricular achievements, and other relevant factors. The Greedy algorithm was chosen because of its ability to provide solutions quickly and efficiently in a relatively short computational time, although the results obtained are not necessarily globally optimal.

This study aims to implement the Greedy algorithm in the selection process of new students at MAN Insan Cendekia OKI. This study will also evaluate the performance of the algorithm in terms of speed, accuracy, and its ability to select the best participants according to the existing criteria. By applying this algorithm, it is expected that the selection process can run more efficiently and transparently, and provide more objective results.

Through this research, it will be analyzed whether the Greedy algorithm can be an effective solution in the selection of students at MAN Insan Cendekia OKI and how this method can be further optimized to improve the quality of selection results.

2. RESEARCH METHOD

2.1. Research Model

This research uses a Greedy algorithm-based selection optimization model. This algorithm is used to determine the best candidate based on predetermined selection criteria. In the context of Selection of New Learners at MAN Insan Cendekia OKI, the Greedy algorithm works by selecting the best solution at each stage of the selection process by referring to academic scores, non-academic achievements, and other relevant factors. This model is applied with an experimental approach, where the Greedy algorithm is implemented in a learner selection system and compared with manual selection methods or other rules that have been applied [10].

2.2. Theory

The Greedy algorithm is one of the methods in algorithm theory that aims to find optimal solutions efficiently, although in some cases the solutions found are only locally optimal, not globally. Greedy theory states that by choosing the best current step (greedy choice), we will get to the best overall solution. In the context of learner selection, these steps include selecting the student with the best score at each iteration until the quota is met.

Greedy algorithms are often suitable for optimization problems that have a special structure, where the best local solution also leads to the best global solution [11]. This theory becomes the foundation in applying the algorithm for Selection of New Learners selection in this study.

2.3. Hypotheses

The hypotheses tested in this study are as follows:

a. H1: Greedy Algorithm can increase time efficiency in the selection process of students compared to the manual selection method.
b. H2: Greedy Algorithm is able to provide comparable or better selection results compared to the manual selection method in terms of the quality of the selected learners.
c. H3: Greedy Algorithm can be effectively applied in Selection of New Learners at MAN Insan Cendekia OKI with accurate and relevant selection results against predetermined criteria.

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2.4. Analysis

The analysis in this study was carried out with two approaches, namely quantitative and computational analysis. Data obtained from the implementation of the Greedy algorithm will be analyzed with descriptive statistical techniques to measure the speed, efficiency, and accuracy of the algorithm. Testing is done by comparing the Greedy algorithm selection results with manual selection results. The parameters measured include:

a. Algorithm execution speed: Measures the time required to complete the selection process.
b. Accuracy of selection results: Comparing the selection results with the quality standards of previously accepted students.
c. Algorithm efficiency: Measures the efficiency of using computational resources, especially in terms of time and space complexity.

2.5. Design and Implementation

Table 1. Implementation Stages of Greedy Algorithm in National Selection of New Learners

Stage	Description	Expected Results
Data Collection	Collect participant data from SNPDB registration, including academic and non-academic scores.	Complete data of all participants
Algorithm Design	Design the Greedy algorithm by adjusting the selection criteria.	Greedy algorithm ready to be implemented
Algorithm Implementation	Implement the algorithm in the selection software.	Algorithm applied to automatic selection system
Testing and Evaluation	Comparing algorithm results with manual selection.	Measurement of selection speed and accuracy

Design and implementation of Greedy algorithm in National Selection of New Learners selection process which describes the implementation of Greedy algorithm in various optimization contexts [12].

3. RESULTS AND DISCUSSION

3.1. Greedy Algorithm Implementation Results

The implementation of the Greedy algorithm in the National Selection of New Learners at MAN Insan Cendekia OKI shows significant results in terms of time efficiency and ease in the selection process. This algorithm successfully selects students with the highest academic scores and non-academic achievements quickly and efficiently. Based on the data collected, the Greedy algorithm was able to complete the selection process for hundreds of participants in a shorter time compared to the manual selection method.

Specifically, the selection process that usually takes up to several days can be completed in minutes with the Greedy algorithm. The use of this algorithm reduces the processing time by 70%, as seen in data-based simulations of the previous year's National Selection of New Learners registration. This speed of execution is in accordance with the characteristics of the Greedy algorithm which prioritizes the best local steps without having to perform repeated calculations [13].

3.2. Selection Accuracy and Quality

The results of the selection performed by the Greedy algorithm compared to the manual selection method show comparable results in terms of the quality of the selected learners. This algorithm is able to select participants with the highest academic scores at each stage, according to the predetermined criteria. Evaluation of the selected students showed that 95% of the students selected by the Greedy algorithm were also selected in the manual selection, indicating that the algorithm works well in the context of academic selection.

However, there were some cases where the Greedy algorithm was not able to produce a globally optimal solution, especially in the case of participants with non-academic achievements that were not detected at the initial stage of selection. This is due to the nature of the Greedy algorithm that only focuses on the best decision at each step, without considering long-term solutions or combinations between criteria [14].

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3.3. Evaluation of Algorithm Efficiency

In terms of computational efficiency, the Greedy algorithm performed very well compared to the manual selection method. The time taken to complete the selection process is significantly faster. The table below shows the speed comparison between manual selection and the Greedy algorithm at different numbers of participants:

Tabel 2. Speed Comparison of Greedy Algorithm and Manual Selection

Selection Method	Number of Participants	Execution Time (Minutes)
Manual	100	120
Greedy Algorithm	100	5
Manual	500	300
Greedy Algorithm	500	10

From the table, it can be seen that the Greedy algorithm is able to complete the selection of participants in a much shorter time compared to the manual method, especially when the number of selected participants increases. Greedy algorithm is suitable for optimization problems that have strong local solutions [15]. However, there are some limitations found, especially in terms of the flexibility of the algorithm. The Greedy algorithm does not always provide optimal results in situations where there is a dependency between one selection criterion and another. For example, participants who have moderate academic grades but have outstanding non-academic achievements may not be selected by this algorithm if the academic grade criterion has a higher weight in the initial stage of selection.

Based on the results of this study, it can be concluded that the Greedy algorithm can provide a fast and efficient solution for the selection process of students at MAN Insan Cendekia OKI. This algorithm is very suitable for selection problems with clear and separate criteria, such as academic scores and non-academic achievements. However, keep in mind that this algorithm has limitations in terms of global optimality, especially if there are complex relationships between criteria. The implication of this study is that the use of Greedy algorithm can help schools to speed up the selection process of students with a large number of applicants, but it is still necessary to consider using other methods, such as dynamic programming algorithm or a combination of methods, to ensure more optimal results in more complex cases. This is in line with the recommendation of Cormen et al. (2009, 380), who suggest using a combination of methods for more complicated optimization problems.

4. CONCLUSION

This research has successfully implemented the Greedy algorithm in the process of National Selection of New Learners at MAN Insan Cendekia OKI. The results show that the Greedy algorithm is able to improve the efficiency of the selection process by speeding up execution time and reducing manual complexity. This algorithm can select the best participants based on selection criteria such as academic scores and non-academic achievements quickly and precisely. The speed of this algorithm is proven to be able to complete the selection of hundreds of participants in a much shorter time compared to the manual selection method. The use of this algorithm also managed to minimize human error in the selection process, which can occur due to manual data processing.

In terms of accuracy, the Greedy algorithm managed to provide selection results that were comparable to the manual method, although there were some cases where the resulting solution was not fully optimal, especially when the selection criteria were complex or interdependent. For example, in the case of participants with very high non-academic achievements but below average academic grades, the Greedy algorithm tends to give priority to participants with high academic grades first, which may lead to some participants with special abilities being overlooked. This highlights the limitation of the Greedy algorithm which is local optimality, i.e. making optimal decisions at each step without considering the final result which may be better overall (global optimality).

Nonetheless, the Greedy algorithm still provides a reasonably effective solution to selection problems with a discrete criterion structure, especially in the context of selection that favors one main criterion. The application of this algorithm has reduced the administrative burden and allowed the selection team to focus on other aspects of the admission process, such as data verification or interviews. The effectiveness of the algorithm also suggests that algorithm-based approaches could be applied more widely in educational institutions to improve the quality and transparency of the selection process.

For future work, some things that can be further developed are:

a. Use of Other Algorithms: To improve the quality of selection results, it is worth considering the use of other algorithms such as dynamic programming or a combination of algorithms to handle interdependent or more complex selection criteria.
b. Modification of Greedy Algorithm: The Greedy Algorithm can be improved by adding dynamic criteria weights or re-iterating some selection stages to produce a more globally optimal solution.
c. Application to Other Selection: This algorithm can also be implemented in other selections, such as scholarship selection or admission to other top schools, with modifications according to the applicable criteria.

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