Automated Examination Seating Arrangement Using AI

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*Abstract*—   
In the realm of educational assessment, the allocation of students to examination rooms and benches while ensuring fairness, adherence to capacity constraints, and maximizing student satisfaction has remained a challenging problem. In this research paper, we propose an innovative solution that leverages the power of Genetic Algorithms (GAs) and Constraint Satisfaction Problems (CSPs) to optimize the seating arrangement process for college examinations . Our proposed system takes as input the classroom ID, the range of roll numbers of students to be accommodated, the number of benches in each classroom, and the capacity of each bench. The primary objective is to generate an optimal seating arrangement matrix that assigns students to specific positions in examination rooms, ensuring that capacity constraints are met and that no two students with the same examination are seated in close proximity. The Genetic Algorithm is employed to randomly generate roll numbers and allocate them to classrooms, simulating the process of natural selection and evolution. The algorithm iteratively refines seating arrangements over multiple generations, utilizing fitness functions that consider capacity constraints and fairness in seating distribution. To satisfy the constraint of maintaining a fair distance between students with the same examination, we employ Constraint Satisfaction Problem techniques. A dedicated constraint satisfaction mechanism is integrated into the genetic algorithm to ensure that students with identical exams are seated at an appropriate distance from each other, promoting an equitable examination environment. Our system's output is a seating arrangement matrix that provides the roll numbers of students assigned to their allotted positions in examination rooms. This matrix not only adheres to capacity constraints and fairness criteria but also maximizes student satisfaction by ensuring a balanced and efficient allocation of resources. Through extensive experimentation and evaluation, we demonstrate the effectiveness and efficiency of our proposed system in generating optimal seating arrangements for college examinations. The results show significant improvements in student satisfaction, equitable distribution, and adherence to capacity constraints compared to traditional manual seating allocation methods. In conclusion, our research presents a novel approach to the challenging problem of seating arrangement optimization for college examinations. By combining Genetic Algorithms and Constraint Satisfaction Problems, we have developed an intelligent system that not only ensures fairness and capacity adherence but also maximizes student satisfaction, ultimately enhancing the overall examination experience.

Keywords— Seating Allotment , Examination Hall , Student, roll number, Class room, Genetic Algorithm

# Introduction

The allocation of students to examination rooms and seating benches is a critical administrative task in the realm of higher education. It is a multifaceted challenge that involves optimizing various factors, including classroom capacity, adherence to fairness principles, and student satisfaction. A well-designed seating arrangement system not only ensures a smooth and organized examination process but also contributes to a fair and equitable assessment environment, which is paramount for academic integrity.In this era of advanced technology and artificial intelligence, traditional manual methods of seating allocation have become outdated and inefficient. The increasing complexity of academic schedules, diverse student populations, and evolving examination formats demand innovative solutions that can efficiently and equitably assign students to their examination locations.

# RELATED WORK

Examination Hall Seating Management System is developed for the college to simplify the allocation of halls automatically to students during exams. It facilitates to access the examination information of a particular student in a particular department. The information is sorted information alphabetically, which will be provided by the teacher for a respective department. This system is also help in finding the examination eligibility criteria of a student of the particular department.A new sub-rule algorithm for arrangement of examination room based on the proportion of examinee is proposed. The method may control the examinee distribution and all arrangement procedure, avoiding the neighbor examinee coming from same school, and the arrangement result is very idea and uniform.[11]. The Exam Hall Seating Arrangement System[1], as proposed aims to streamline the seating allocation process for students, providing them with hassle-free access to seating information. Student data, provided by faculty or exam coordinators, is stored alphabetically and can be updated by administrators to accommodate changes in student details or exam schedules .Using Leveraging cloud computing technology, a system was developed that automatically assigns seats to students and allocates exam halls for faculty supervision. This computerized approach optimally assigns students to halls based on hall capacity and the number of students. Additionally, supervisors can easily exchange their duties using this system.The Exam Hall Seating Arrangement System[2], developed offers features such as hall ticket generation and semester-wise result access for enrolled students and faculty. Users can access these services by logging in with their IDs and passwords . Furthermore, in "Seating Arrangement Tools for Examinations" by Ashti Fatima Alam, a project using C/C++, while addressing seating arrangements, faced issues with efficiency and user-friendliness. Research conducted at a public institution in the southeastern US revealed that students who occupied seats at the end of rows with individual chairs tended to score higher than those seated in the middle rows[4]. This study also noted that girls tended to score higher than boys in this environment, where students were allowed to bring necessary items like books, jackets, and handbags to create a comfortable learning environment. The evolution of seating arrangements over the decades has shown a shift from traditional row setups in the 70s to more student-centered seating arrangements, driven by a growing interest in the impact of seating on student performance[5,6]. A model and algorithm are presented to tackle the complex challenge of solving the exam seating problem in I-shaped seat allocation systems[7]. The system relies on two crucial types of input data: Room information, including room IDs and column and row dimensions, and Exam information, containing subject IDs and student numbers. A fundamental constraint is imposed, ensuring that the total number of students does not exceed the available seating capacity, with any surplus seats being quantified. The algorithm proceeds through a series of meticulous steps for each examination time slot. Initially, it computes the total number of seats and students by aggregating data from room and exam information, and identifies rooms that can remain vacant if there is an excess of seats. The core of the approach lies in distributing columns to subjects, necessitating calculations for the number of columns and row capacities for each column. To mitigate the risk of academic dishonesty through copying, the system enforces a minimum one-column distance between students with the same query set, while also determining the maximum viable column size and its capacity for each subject. Subsequently, columns are assigned to subjects using a combination of column sizes, sometimes requiring extra seats for optimal allocation. Subject diversity, encompassing distinct column sizes and student numbers, is harmoniously integrated with room identities represented by column and row numbers, ensuring that students with the same subject are separated by a minimum one-column distance. Upon the completion of column and room distribution, the system furnishes a comprehensive and efficient seating solution for the examination, effectively addressing the exam seating problem within the context of the I-shaped seat allocation system.The proposed system involves the development of an Android application with a PHP backend, utilizing multiple interrelated databases containing information on students, teachers, and classrooms[8]. During exam periods, the university sends a PDF, which is converted and subject to algorithmic verification. If the conditions are met, automatic seat allocation takes place, using algorithms like natural selection. Allocation includes student counts, block sizes, and paper codes, while staff allocation is carried out without assigning staff from the same department. Notifications are sent to both staff and students, informing them of their allocated blocks, thereby eliminating the need to search for buildings. This project employs databases as a means to store and manage information efficiently, independent of the applications that access it. The system streamlines processes in educational institutions, particularly during examination periods, improving efficiency and reducing workloads for administrators. It offers advantages such as speed, reliability, and robust functionality, making it a valuable tool for event management across different user profiles. The solution to the exam seating problem employs constraint programming and genetic algorithms (GAs)[10]. Constraint programming tackles this issue by resolving variables, their possible values, and constraints, much like the timetabling problem. GAs, known for their effectiveness in addressing complex and highly constrained problems, have been widely applied in university timetabling and exam seating challenges due to their robustness. GAs mimic nature's survival and adaptation principles by creating populations of chromosomes, with the population size determining the number of chromosomes. The process begins with a random initial population, and through crossovers and mutations, new individuals are generated to improve chromosome diversity and enhance solutions. Natural selection, guided by a fitness function, transfers the best individuals to subsequent generations, with the process continuing until a fitness value of zero or a maximum generation limit is reached. Crossovers and mutations ensure structural diversity within chromosomes, preventing stagnation in the search for optimal solutions.

##### References

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1. PHP COOK BOOK, ODavid Sklar and Adam Trachtenberg,Reilly Publications, 2002 Edition
2. Ashti Fatima Alam , Seating Arrangemnet Tools for Examinations, International Journal Of engineering Applied science and technology
3. VOL:1 2016 Prof S.S.Aravinth, G. Pavithra, Exam Hall Seating Arrangement System Using PHP, Ap/Cse Knowledge Institute Of TechnologyVOL:1 2014
4. http://www.w3schools.com/php/default.asp
5. Algorithm for efficient seating plan for centralized exam system Prosanta Kumar Chaki ; Shikha Anirban 2016 International Conference on Computational Techniques in Information and Communication Technologies (ICCTICT)
6. Automatic Exam Seating & Teacher Duty Allocation System Apurva Inamdar ; Anand Gangar ; Arun Gupta ; Varsha Shrivastava 2018 Second International Conference on Inventive Communication and Computational Technologies(ICICCT)
7. Efficient Seat Allocation Process in College Exam System Muhammad Ramees C. K 1 , Sherin Eliyas2 1MCA, 2Assistant Professor Hindustan Institute of Technology and Science,Chennai.
8. Automatic and Efficient Allocation for Examination Seats using Android Application A.V.Allin Geo, R. Kavitha, R. Velvizhi, S. Sangeetha International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-9S3, July 2019.
9. P. K. Chaki and S. Anirban, "Algorithm for efficient seating plan for centralized exam system," 2016 International Conference on Computational Techniques in Information and Communication Technologies (ICCTICT*)*, New Delhi, India, 2016, pp. 320-325, doi: 10.1109/ICCTICT.2016.7514601
10. F. Agalday and A. Nizam , "Performance Improvement of Genetic Algorithm Based Exam Seating Solution by Parameter Optimization", Journal of Innovative Science and Engineering, vol. 6, no. 2, pp. 220-232, Dec. 2022, doi:10.38088/jise.1006070