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Automation of Seating Plan for Examinations using Round-Robin Policy

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Abstract: *This paper introduces a Python-based Graphical User Interface (GUI) application designed to automate the seating arrangement process for examinations, specifically catering to the needs of examination departments. Leveraging the openpyxl and pandas libraries for Excel file manipulation and creating Dataframes the application aims to replace the laborious manual process traditionally employed by colleges. The main objective is to reduce the time and effort invested by examination departments in seating arrangement tasks. The user-friendly GUI simplifies data input, while the application's algorithm automates seating assignments, ensuring that no two students writing same exam can't sit in same bench in optimal manner using excel and python . Results demonstrate a significant reduction in time spent on seating arrangement, with outputs including detailed room-wise seating sheets and comprehensive summaries listing roll numbers by regulation and branch. This innovative approach not only streamlines examination management but also enhances accuracy and efficiency. From this GUI we can add, edit and delete the halls in which the exams are being conducted. Further we input the excel sheet in which the roll numbers of students were there as per their branch and regulation as input and generates formatted excel sheets that generate seating arrangement . Formatting the font and size of rows and columns and wrapping the columns when required are done automatically.*

Keywords: Examination Seating Arrangement, Openpyxl, Pandas, Tkinter, Round-Robin.

I. INTRODUCTION

Seating arrangement play a pivotal role in maintaining order and fairness, especially during examinations, but the manual process of arranging seats can be cumbersome and prone to errors. This research paper delves into the development of an automated seating arrangement system using Python and the openpyxl library, aiming to streamline the process and reduce the workload for examination departments. The traditional manual approach to seating arrangement involves time-consuming tasks, such as posting detailed sheets near examination rooms, which can be replaced by an automated system. Leveraging a user-friendly Graphical User Interface (GUI), the application allows efficient way of inputting data to excel sheets for room no, rows and columns from user and check if the given rooms capacity is sufficient to allocate these students and further generate the seating arrangement by considering the primary goal of significantly reducing the time and effort expended by examination departments.

The automated system utilizes a round-robin seating algorithm to ensure a fair distribution of students and prevent individuals from the same group or regulation from sitting adjacent to each other. By taking roll number of student populations, the system can adapt to diverse regulations and academic years seamlessly. The generated outputs include detailed summary sheets for each examination room, visually representing the seating arrangement, and a comprehensive summary sheet categorizing students by roll numbers, groups, and regulations and room number. These outputs help students to check their room numbers and positions as well as Examination cell to make fast decisions during paper distribution. The introduction of an automated seating arrangement system marks a significant improvement in examination management. By harnessing the capabilities of Python and automation, this system not only enhances efficiency but also contributes to the creation of a fair, secure, and streamlined examination environment. The research and development of such systems hold immense potential for revolutionizing administrative processes in educational institutions.

II. LITERATURE SURVEY

Seating arrangement is on of the primary concerns in the colleges during the hectic examination schedules. Its a time taking manual process that makes the Examination cell much fussy. In order to reduce this various methods have been proposed previously. However these systems used various algorithms like using random allocation or taking alphabetical order. Later some researchers proposed to use genetic algorithm and graph theories.

Random allocation and alphabetical order seating methods, as used in prior studies, may not ensure equitable student allocation. These approaches lack consideration of factors such as student preferences and specific constraints. They can result in uneven distribution and potentially suboptimal arrangements, potentially disadvantaging students. More sophisticated algorithms are needed to address fairness and efficiency in seating arrangements. A genetic algorithm for seating arrangements assigns students to seats by evolving solutions over generations. It optimizes seating based on defined constraints and objectives. However, the algorithm can be complex to set up and fine-tune due to factors like encoding, fitness function design, and parameter choices. Additionally, it may require significant computational resources for large-scale seating arrangements. Later graph theories were used for seating arrangement using Hungarian algorithm. The Hungarian algorithm assigns students to seats optimally, minimizing conflicts, but its complexity can be high. It involves creating a cost matrix, applying the Hungarian algorithm, and backtracking to find the optimal arrangement, making it computationally demanding for large datasets. Further machine learning classification and clustering algorithms are being used which introduces complexity through data preprocessing, model selection, training, and evaluation. Data quality and feature design are critical, and the computational resources needed can be substantial, especially with large datasets. Balancing model complexity and interpretability is essential to ensure practical, effective seating solutions.

III. SYSTEM ANALYSIS

A. Existing System

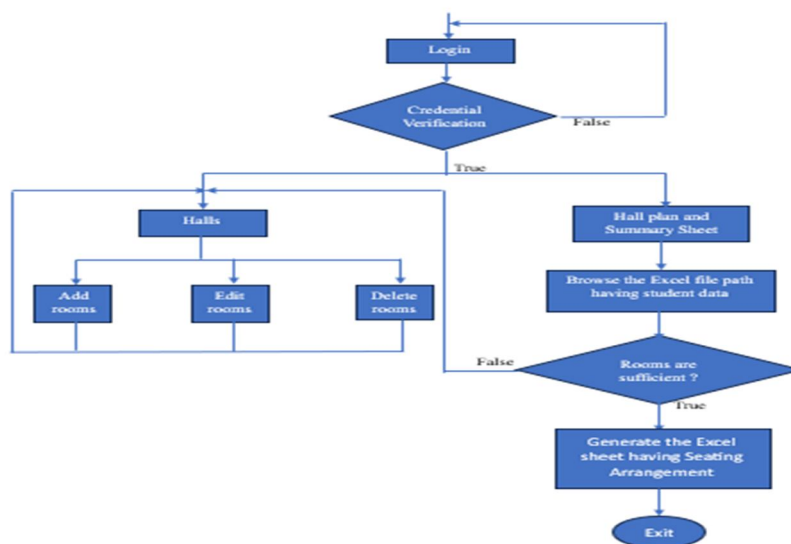
Existing systems are usually working with databases but its not convinient all the times to import the data into databases. Its very important to consider that some times that students might belong to different regulation and different branch. Existing systems usually are following manual or semi-automated process of seating arrangement. Most of the algorithms used in previous papers like genetic algorithm and hungarian algorithm are trying to improve optimality leaving behind the time and space complexity. Machine learning algorithms require much data to train the models which may not be efficient method in all the cases. Fairness and efficiency is decreasing in the case of random allocation and alphabetical order allocation. Considering these parameters in mind a new system was proposed as shown below.

B. Proposed System

The proposed system considers the roll numbers of students from different colleges that are stored in excel workbook in multiple pages. It uses round robin fashion by taking quanta value to be the number of rows in order to arrange the students to sit in their respective positions. It generate four output sheets mainly.

- 1) Sheet with room numbers, rows and columns
- 2) Sheet with the summary of each regulation ,branch and number of students writing exam on that day
- 3) Workbook containing multiple sheets named with room number and seating arrangemnet of each room.
- 4) Summary sheet of the workbook of seating arrangement

IV. SYSTEM ARCHITECTURE



V. MODULE DESCRIPTION

A. Login Module

It allows the examination department to enter the user name and password and if the username and password are correct then it enters to new window having Halls button and Halls and summary sheet button as shown in Figure 1. It provides security to application by not allow the unauthorized users to use this application.

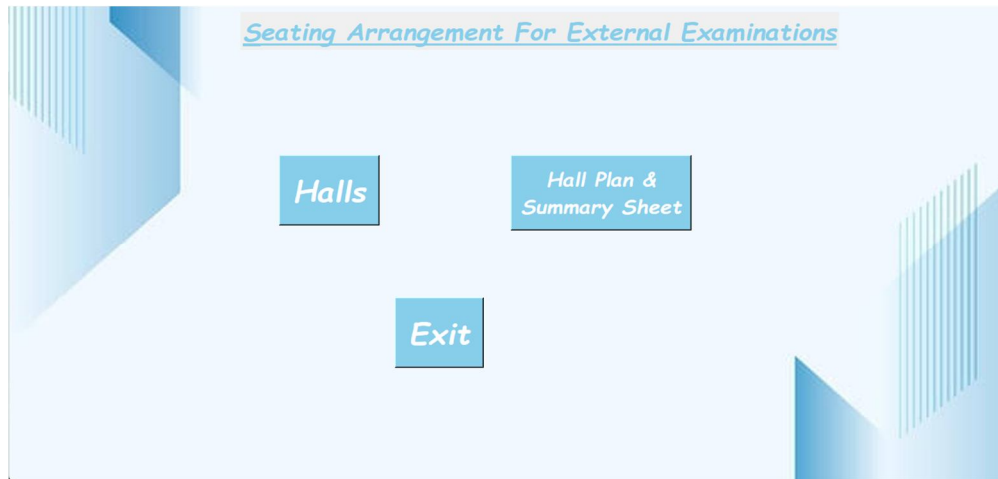


Figure 1-Home Page

B. Halls Module

It allows users to add new rooms and edit the room capacity if required and delete the rooms. This module helps in creating rooms.xlsx file that contains room number, rows and columns if it does not exist and further add the rooms data as shown in figure 2.

C. Halls and Summary Sheet Module

It takes the excel workbook with student roll numbers in multiple sheets as input from the local system as shown in figure 3 and figure 4 and generates three main files of seating arrangement mentioned as 2,3,4 in proposed system. The generated files are automatically saved and stored in local PC.

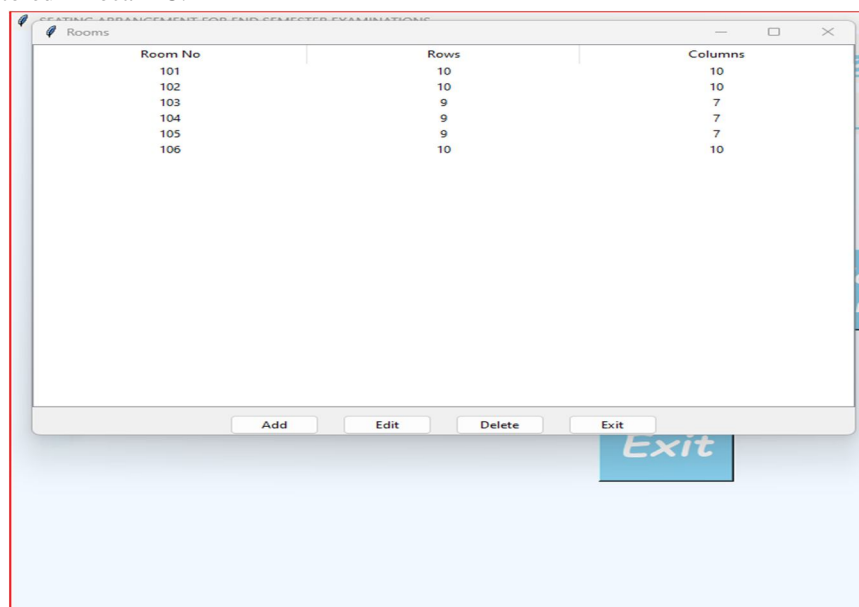


Figure 2-Seating Hall Management

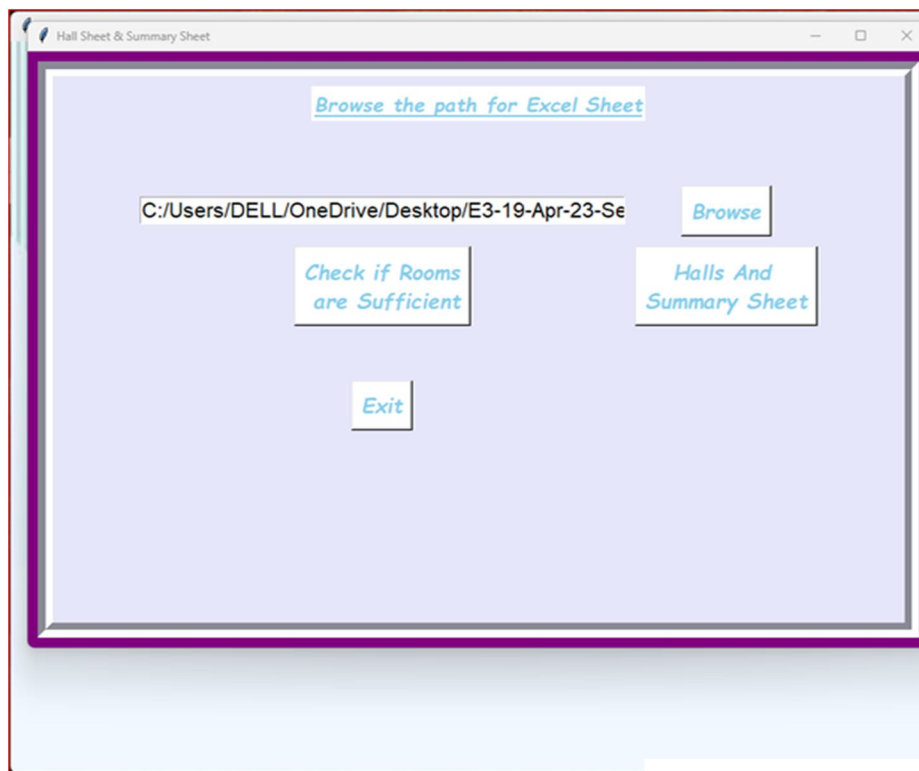


Figure 3 Candidate Browse Page

VI. METHODOLOGY

This project uses Python libraries like pandas and OpenPyxl as they are user friendly to format and manipulate the excel sheets. Pandas library is used to create dataframes and students roll numbers are filled in it in Round robin fashion once after checking if they don't belong to same branch. The GUI is created using Tkinter. The following python code is being used in this project.

A. Pseudocode

For each room in the list of rooms:

Extract room number, number of rows, and number of columns

If there are multiple unique branch names in the student list:

Create an empty dataframe with the specified number of rows and columns

Divide the columns into odd and even columns

Calculate the number of odd and even columns

Initialize counters 'i' and 'j' to 0

For each odd column and row:

Assign students from the odd list to the odd positions in dataframe if available, else set to None

Increment 'i'

For each even column and row:

Assign students from the even_list to the even positions in dataframe if available, else set to None

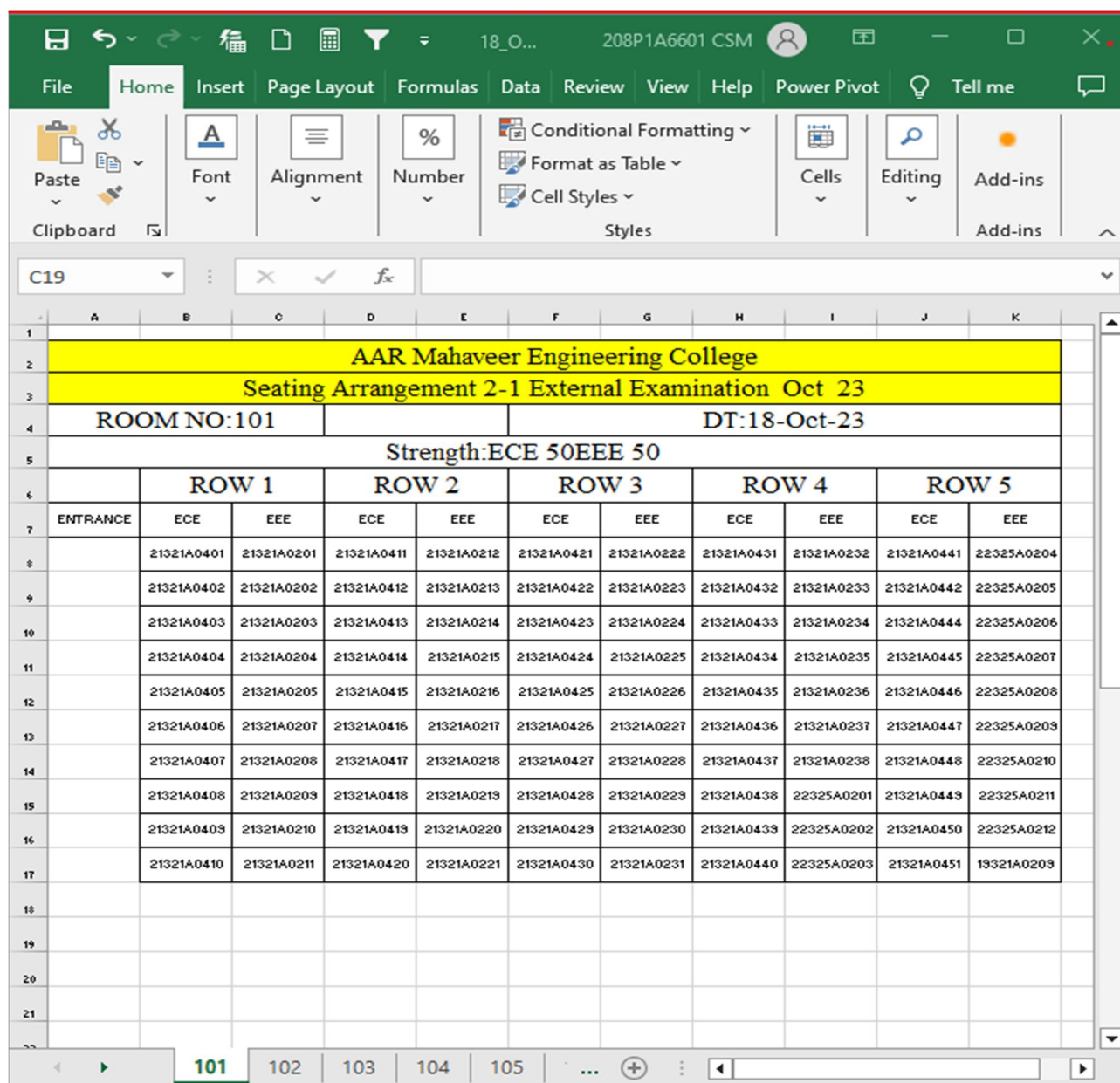
Increment 'j'

The provided pseudo code implements a round-robin seating arrangement for multiple rooms. It iterates through each room, creating a seating grid with rows and columns. Students are assigned seats in an alternating manner, first in odd-numbered columns and then in even-numbered columns, ensuring that different branches are seated together. If there are more students than available seats, the remaining seats are marked as "None."

Libraries that are used in this project are as follows:

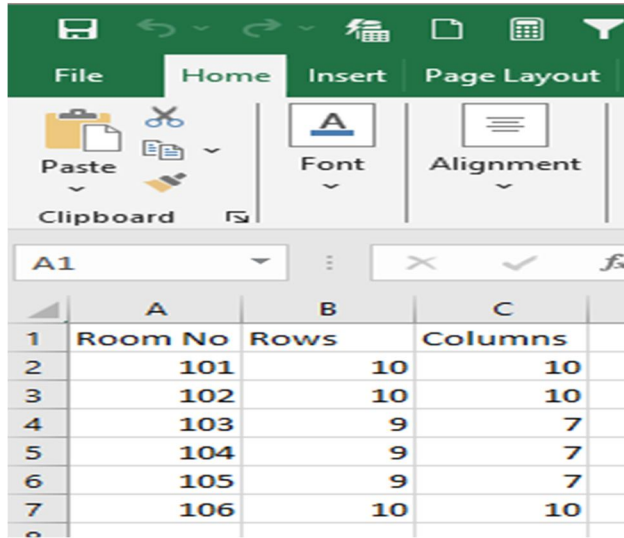
- 1) *Pandas*: Pandas is a versatile Python library commonly used for data manipulation and analysis. It offers data structures and functions to efficiently work with structured data, making it an essential tool for tasks like data cleaning, transformation, and analysis.
- 2) *Openpyxl*: Openpyxl is a Python library that specializes in reading and writing Excel files. It provides the capability to handle Excel workbooks, worksheets, and cell data, making it valuable for tasks involving data import and export from and to Excel spreadsheets.
- 3) *Tkinter*: Tkinter is the standard GUI (Graphical User Interface) library for Python. It enables developers to create interactive desktop applications with user-friendly interfaces. With Tkinter, you can design and build windows, buttons, menus, and other graphical elements to create visually appealing and functional applications.

VII. RESULTS



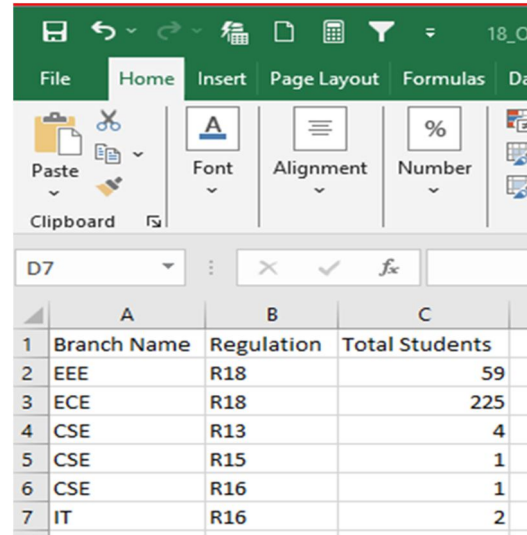
AAR Mahaveer Engineering College										
Seating Arrangement 2-1 External Examination Oct 23										
ROOM NO:101				DT:18-Oct-23						
Strength:ECE 50EEE 50										
	ROW 1		ROW 2		ROW 3		ROW 4		ROW 5	
ENTRANCE	ECE	EEE	ECE	EEE	ECE	EEE	ECE	EEE	ECE	EEE
	21321A0401	21321A0201	21321A0411	21321A0212	21321A0421	21321A0222	21321A0431	21321A0232	21321A0441	22325A0204
	21321A0402	21321A0202	21321A0412	21321A0213	21321A0422	21321A0223	21321A0432	21321A0233	21321A0442	22325A0205
	21321A0403	21321A0203	21321A0413	21321A0214	21321A0423	21321A0224	21321A0433	21321A0234	21321A0444	22325A0206
	21321A0404	21321A0204	21321A0414	21321A0215	21321A0424	21321A0225	21321A0434	21321A0235	21321A0445	22325A0207
	21321A0405	21321A0205	21321A0415	21321A0216	21321A0425	21321A0226	21321A0435	21321A0236	21321A0446	22325A0208
	21321A0406	21321A0207	21321A0416	21321A0217	21321A0426	21321A0227	21321A0436	21321A0237	21321A0447	22325A0209
	21321A0407	21321A0208	21321A0417	21321A0218	21321A0427	21321A0228	21321A0437	21321A0238	21321A0448	22325A0210
	21321A0408	21321A0209	21321A0418	21321A0219	21321A0428	21321A0229	21321A0438	22325A0201	21321A0449	22325A0211
	21321A0409	21321A0210	21321A0419	21321A0220	21321A0429	21321A0230	21321A0439	22325A0202	21321A0450	22325A0212
	21321A0410	21321A0211	21321A0420	21321A0221	21321A0430	21321A0231	21321A0440	22325A0203	21321A0451	19321A0209

Figure 4 Hall Plan



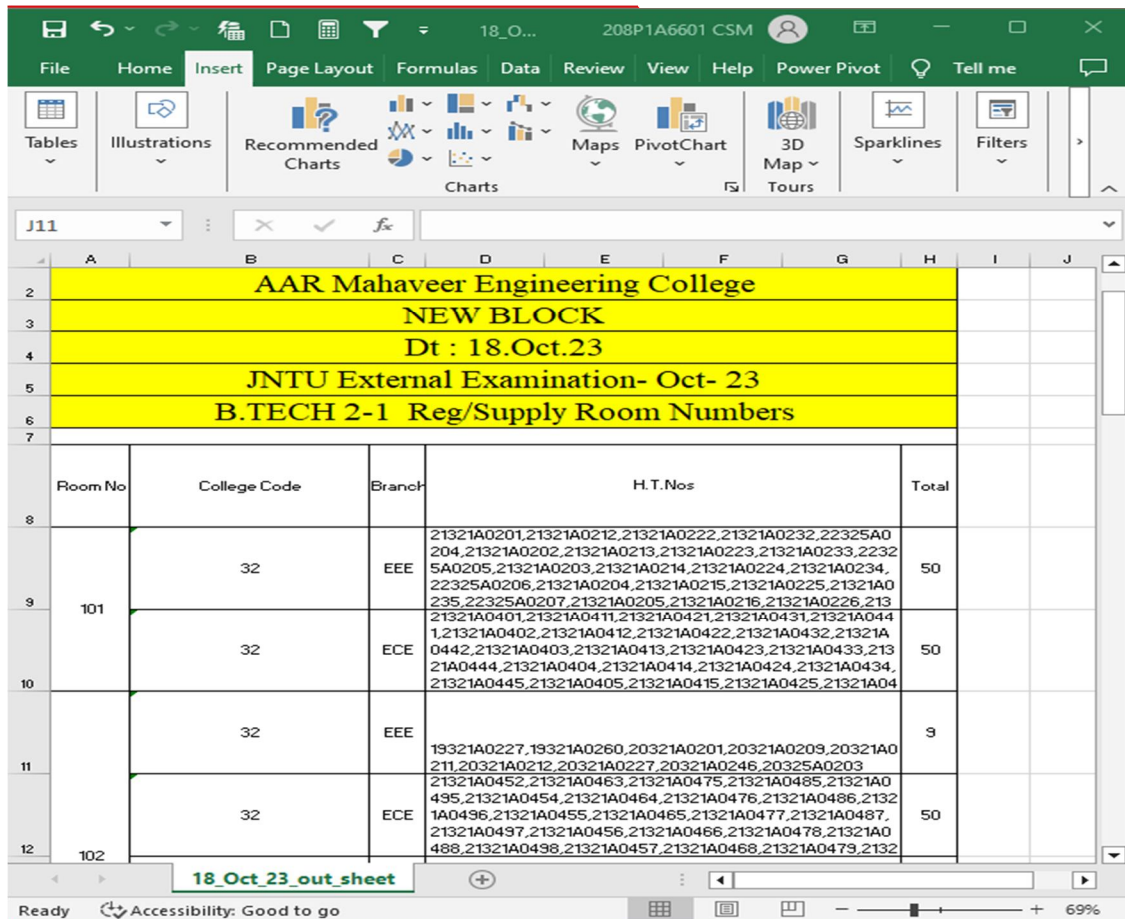
	A	B	C
1	Room No	Rows	Columns
2	101	10	10
3	102	10	10
4	103	9	7
5	104	9	7
6	105	9	7
7	106	10	10

Figure 5 Hall Capacity



	A	B	C
1	Branch Name	Regulation	Total Students
2	EEE	R18	59
3	ECE	R18	225
4	CSE	R13	4
5	CSE	R15	1
6	CSE	R16	1
7	IT	R16	2

Figure 6 Candidate Strength



Room No	College Code	Branch	H.T.Nos	Total
AAR Mahaveer Engineering College				
NEW BLOCK				
Dt : 18.Oct.23				
JNTU External Examination- Oct- 23				
B.TECH 2-1 Reg/Supply Room Numbers				
8	101	EEE	21321A0201,21321A0212,21321A0222,21321A0232,22325A0204,21321A0202,21321A0213,21321A0223,21321A0233,22325A0205,21321A0203,21321A0214,21321A0224,21321A0234,22325A0206,21321A0204,21321A0215,21321A0225,21321A0235,22325A0207,21321A0205,21321A0216,21321A0226,21321A0401,21321A0411,21321A0421,21321A0431,21321A0441,21321A0402,21321A0412,21321A0422,21321A0432,21321A0442,21321A0403,21321A0413,21321A0423,21321A0433,21321A0444,21321A0404,21321A0414,21321A0424,21321A0434,21321A0445,21321A0405,21321A0415,21321A0425,21321A0435,21321A0445	50
9	101	ECE	19321A0227,19321A0260,20321A0201,20321A0209,20321A0211,20321A0212,20321A0227,20321A0246,20325A0203,21321A0452,21321A0463,21321A0475,21321A0485,21321A0495,21321A0454,21321A0464,21321A0476,21321A0486,21321A0496,21321A0455,21321A0465,21321A0477,21321A0487,21321A0497,21321A0456,21321A0466,21321A0478,21321A0488,21321A0498,21321A0457,21321A0468,21321A0479,21321A0489,21321A0499	50
10	101	EEE		9
11	101	ECE		50
12	102			

Figure 7 Hall-wise Summary report of Candidates

VIII. FUTURE ENHANCEMENTS

This work can be further enhanced in such a way that the system should prepare hall plan in accordance with schedule given by institution so that the work will be fully automated. Further it should make sure that the different branch students writing same exam should not sit beside each other.



IX. CONCLUSION

This work is currently being used by our institution to generate the seating arrangement in our college during the external examinations. The output files are generated and saved in such a way that they are not even required to do the formatting. The complete process of using excel formulas in manual way is converted to automated process. It helps in saving time, conduct exams in fair manner and without any malpractices.

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