

Methodology and System Design of Seat Distribution Matrix for Admission to Professional Courses

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Abstract:- Deliberation over the concept of improvisation in the system of higher education garners rigorous and meticulous views from an extensive spread of people. Contemplating the usual and traditional way of seat distribution comprises of using a static graphical user interface that distributes seats according to CET or JEE marks only for the Maharashtra state province. Expanding the scope of seat distribution all over the country and extending it to amass of branches by making use of a dynamic graphical user interface is our perception of a transitional system for seat distribution. The errors that were otherwise fixed manually can now be actively adjusted using the software. A systematic and well-organized balance is also maintained between different categories of Open and Reserved, Home University and Outside Home University, Ladies and General. An algorithm has been developed that enhances, elaborates and amplifies seat distribution for all branches and does not limit itself only to Maharashtra state province and can be used to distribute seats countrywide.

Keywords:- *Seat Matrix; Status code; Sanction Intake.*

I. INTRODUCTION

With the growing number of students keen to take admission, there is no particular software that encompasses all branches and courses of all institutions nationwide. The rules and regulations involved in the admission process are issued by government and seat matrix is to be developed abiding those rules. These rules and regulations differ according to policies adopted by states. A software that uses algorithms to dissipate and distribute seats according to specific rules can be used as an improvisation of the earlier static method. An effective implementation requires a complete understanding of constituting elements and at the same time considerations for a holistic view to stay focused on its overall objectives. The dynamic nature of the now under development web based framework gives the user an opportunity to input the rules and regulations specific to the branch and course for which all the categories such as Home University-Outside Home University, Open-Reserved, Ladies-General and Minority-Non Minority, etc. The errors that were otherwise highlighted using a red color in the report generated are now minimized to a level below 1. Historic data of the past 3 years are also kept in consideration while generating the current seat matrix as a

comparison is initiated with the past seat distribution so as to induce an accurate result.

The static nature of the now in use model gives the user scope to view and produce seat matrix for Maharashtra state province that needs manual error correction along with no balance maintained among categories. No changes during runtime could be established and hence the need for a new software was felt that could dynamically adapt to runtime changes. The algorithm established makes use of a tree data structure that distributes seats into a top down manner as we go on traversing.

II. PRELIMINARIES

Significant online research and minute interventions with DTE SRS have concluded that a change needs be adapted in the way people have been perceiving the system of seat distribution. Seat Distribution refers to the art of distributing college seats in such a way that all the available seats are apportioned. The existing system exploits patterns mentioned as constraints in reservation rules and regulations to extract relevant information and distribute seats automatically in a fair manner but the quality of service produced degrades. The motive of proposed system is to stimulate the development of existing system with an equitable distribution and to furnish insight into their performance.

A greater focus is maintained on extensibility, scalability, security, availability, accuracy, performance and by the application software model. It also concentrates on aligning the information strategy with the business strategy of the organization to the desired extent that ultimately derives the maximum benefits out of computerization.

III. OBJECTIVE

Accumulation of data required for effective seat distribution and extraction of similar patterns requires a flexible system model that could conform to rapid changes. Remodelling and altering the prevailing system to emphasize and prioritize precision and accuracy is the main intention of the new application software. Manual rectification and adjustment of errors is highly time-consuming, making it difficult to keep pace with the objective of upright seat distribution. Therefore, a high demand to decelerate these errors using algorithmic computerization comes into picture.

This research aims to facilitate the clients involved in seat distribution with an error free web based application software. There is a requisite of balancing vacant seats for different categories. This can be done by considering historical data so as to perform a fair and just seat distribution.

IV. METHODOLOGIES

A. System description

The dynamic web based framework extends a graphical user interface that takes input in the form of a Comma Separated File (CSV) which includes specifications such as branch, institute name, institute code, seat intake, status codes. Status code 1 states the Government and All India, status code 2 states the Autonomous and Non-Autonomous and status code 3 pertains to Minority and Non-Minority which forms the basis of the input file description. To avoid data conflicts, separate tables are produced in the database that stores the CSV file input of branch.

Different constituents are included that bestows the user to view and add institutes and courses, view seat matrix, generate seat matrix for a choice code that is like the already stored code and download reports in PDF formats corresponding to error minimization and comparison. Keeping in mind the security of software, 2 factor authentications has been utilized that in-turn increases the user-friendly nature and makes it more manageable.

B. Detailed Description of Architectural Design

The entire solution is based on a central work flow engine that allows recommendation, review request, authorization and approvals. The client server architecture as shown in Fig.1 is implemented along with different modules which forms the foundation of the software. It is broken down into different modules using the divide and conquer strategy and the result of each module is then combined to get the solution of the initial problem at hand. The modules used are described in detail in the below segment.

- Pre-processing module: Analysis of current data that contains choice code, course code, institution code, status code- 1, status code-2, status code-3.
- Seat distribution module: This includes the provision of viewing seat matrix according to given institute and course entered. The institute that has an error above 1 in distributing seats are highlighted through a red color in the PDF generated of the same.

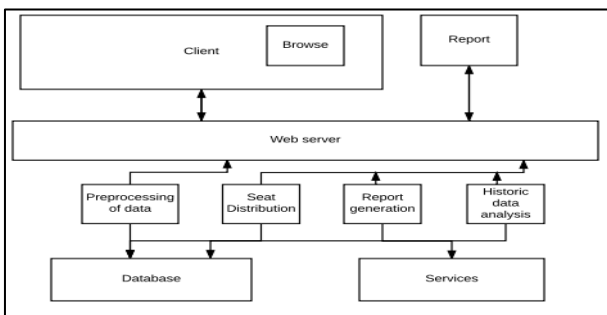


Fig 1:- Architecture

- User interface module: The web-based framework will provide segments to view and add Courses, institutes and view seat matrix for entered course and institute for given constraints like status code 1,2,3.
- Historical Data analysis module: Within the user interface module, there exists provision to view historical seat distribution for past 3 years. This gives us an idea about past seat distributions and what all constraints should we keep in mind for current seat distribution.
- Report module: The deliverables in the form of various PDF reports and MS Access and Excel data format for further processing are generated.

C. Data Specifications and Development

The data flow diagram or a DFD represents the flow of data in a software in terms of the input and output sequence. [8] As the name suggests, it gives an idea about the flow of information, how the data is stored and where it goes. A detailed design of level 0 and level 1 diagram depicts the initial flow of data and focuses on the main functions carried out by the system as they are separated into sub processes. [8]

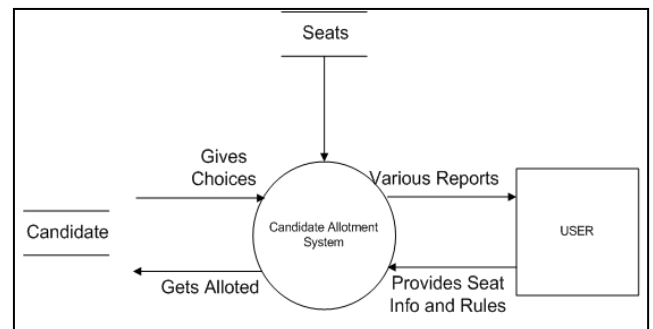


Fig 2:- Level 0 data flow diagram

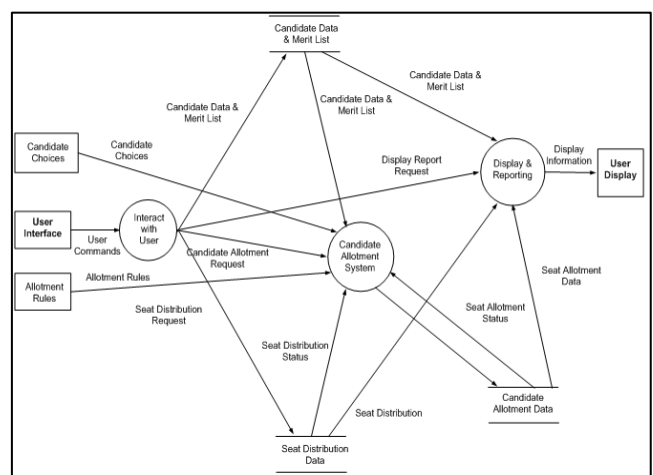


Fig 3:- Level 1 data flow diagram

Fig. 2. shows the initial proceedings where after taking input such as seat intakes, rules and regulations from client, the software then generates various reports keeping in consideration the reservation criteria. [1]

Fig. 3. depicts a detailed strategic model along with the various modules involved in the development. [1]

V. MAJOR CONSTRAINTS

The reservation criteria followed is described in a tabular format which highlights the percentage of reservation and the categories that fall under it. There are namely 8 categories that includes Open and 7 Reserved categories. When contemplating seat distribution algorithm, these categories are further divided into ladies and general that also have their respective percentage of dispersion.

Sr. No.	Category of Reservation	Percentage of Reservation
1.	Scheduled Castes and Schedule caste converts to Buddhism (SC)	13.0
2.	Schedule Tribes (S.T.)	7.0
3.	Vimukta Jatis (V.J.)/De notified Tribes(D.T.)	3.0
4.	Nomadic Tribes (NT-1) (NT-B)	2.5
5.	Nomadic Tribes (NT-2) (NT-C)	3.5
6.	Nomadic Tribes (NT-3) (NT-D)	2.0
7.	Other Backward classes (O.B.C.)	19.0
Total		50.0

Fig 4:- Constraints [2]

VI. ALGORITHM AND FLOWCHART

Tree data structure is used in most parts of software to develop the algorithm since information needs to be stored that naturally forms a hierarchy.

The sanction intake is partitioned into Home University and Outside Home-University which further branches itself into Open and Reserved categories. The Reserved category constitutes of 7 categories within itself which are then dissipated into Ladies and General.

A. Algorithm I Pseudo Code

Physically Handicapped and Defense are some of the special categories which are given seats from the Open category.

There are specific rules and regulations that are adhered to when distributing seats. Fig. 4. [2] describes the percentages of reservation categories. Apart from these percentages, there are some more constraints that need to be conformed to. The Home-University takes 70 % of the total sanction intake whereas Outside Home university gets 30% of the intake. These are further segregated into Open and Reserved categories that acquire 50 % respectively.

Input:

Sanction intake

Rules and regulations that need to be followed

Output: Seat matrix

Description:

1. Find category of institute i.e. Home University(HU)/ Outside Home University(OHU) and find status of institute using status codes 1,2,3.
2. Based on status, divide the seats into autonomous and non- autonomous, Minority seats and Institute level seats, reservation category (OPEN, SC, ST, NT, VJDT, etc).
3. Define percentages of HU and OHU. If the institute has state level seats instead of HU-OH, their values are stored in OHU values.

4. Divide seats into HU and OHU
5. Divide HU and OHU into open and reserved
6. For categories:
 - 6.1 Open divided into L(ladies) and G(general)
 - 6.2 For 7 reserve categories divided into groups
 - 6.2.1 create G1= SC, ST, VJNT, NT1
 - 6.2.2 create G2= NT2, NT3, OBC
 - 6.3 Subdivide G1 and G2 until each group has 1 Category
7. For Physically Handicapped Seats:
 - 7.1 if category== PH:
 - 7.1.1 Seats= 3 % of Sanction Intake.
 - 7.2 The number obtained is distributed as PH1, PH2, PH3 seats.
 - 7.3 if institute intake <3 % of seats:
 - 7.3.1 Assign seats to OHU/HU Open category seats.
8. For Defence Seats:
 - 8.1 if category== Defence:
 - 8.1.1 Seats=5 percent seats of sanction intake.
 - 8.2 if institute intake <5%:
 - 8.2.1 Distribute seat as a defence seat
 - 8.3 else:
 - 8.3.1 Assign seat to OHU/HU Open category seats.

Fig. 5. pictorially depicts the seat distribution in a tree data structure format.

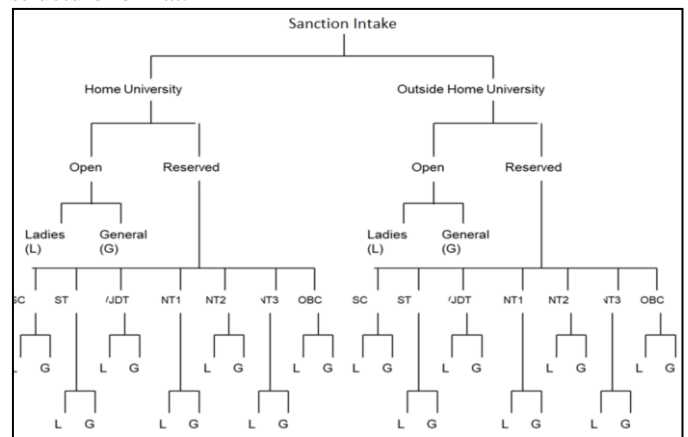


Fig 5:- Seat distribution in Tree Data Structure format [1]

B. Flowchart of described system

Flowchart visually presents a series of actions or flow of control in a system and can also describe the steps in development of software.

Fig. 6. represents the progression in every stage of the software that showcases Login along with secure 2 Factor Authentication which leads to uploading input file specifications in the form of CSV and searching institutes and courses with respect to choose codes. Applying distribution process according to the rules and regulations gives us seat matrix that describes the category wise seat distribution.

The software then checks for any vacant seats that need to be balanced and then displays the balanced seat matrix

along with minimized error in the form of report generated in PDF format.

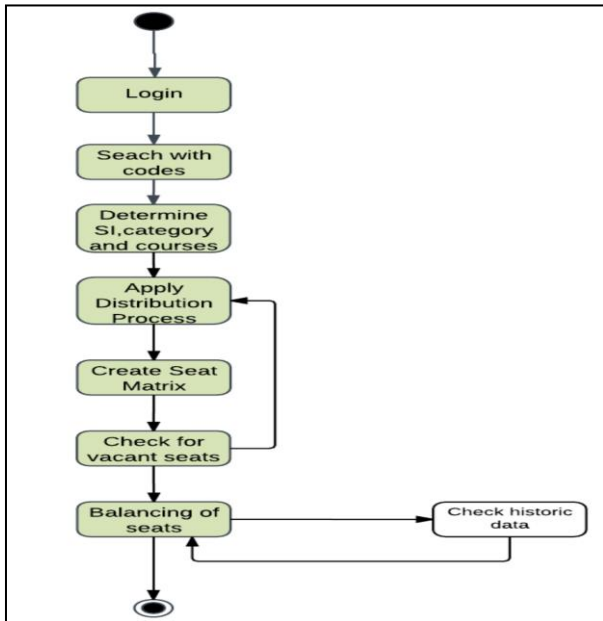


Fig 6:- Activity Diagram

VII. SYSTEM COMPARISON

The software that is now in use and the one that is currently under development vary from each other in a number of ways. Listed in TABLE 1 are the disadvantages due to which the need for new software model was felt.

The new software under development uses an Iterative model that initially focuses on simplified implementation but progressively gains more complexity and a broader feature set. The divide and conquer strategy that makes use of breaking down the software into independent modules increases its readability and extensibility. The reports depicting the seat matrix in tabular format improves the visual output and helps the user gains a detailed insight.

Existing system	Proposed system
The User Interface is static in nature.	The User Interface .is dynamic in nature
No changes can be initiated at runtime.	No changes can be initiated at runtime
No balance is maintained between vacant seats.	Balance is maintained between vacant seats.
No error minimization is introduced. Errors are depicted using red color highlight	Error minimization is done and then reports are generated
No security is maintained	Security is maintained using 2 factor authentications.
Existing system is a legacy system.	The system under development is dynamic in nature.

Table 1. Comparison table Between Existing System and Proposed System

VIII. DISCUSSION

The software like candidate seat distribution of any institute is an evolutionary path. Many spontaneous changes can be done in the modelling of software so as to simulate a perfect version without any disadvantages. The distribution of seats in the proposed system maintains a balance between Home university and Outside home university, Open and Reserved categories, Ladies and General, Defense and Physically handicap categories which provides an equitable distribution of all the available seats. This software can not only be used in higher education but also finds itself a place in placement distribution in case of offices, banks, etc.

The contrast in computation of actual, desired and calculated seats gives rise to the term 'error' in the software model of seat distribution. The error generated due to the mere difference between the rounded off figure of the calculations is can be fixed to a value below 1 by adding the 'carry forward error' to the next iteration of determining the value of seat distribution for that category.

IX. CASE STUDIES

An analysis of different seat distribution rules and regulations that identifies with the current situation and recommends solutions for creating seat matrix is carried out. Distribution rules of various universities belonging to distinct states are carefully examined and a summary of the same are stated below.

It is basically an empirical inquiry that investigates a phenomenon within its real-life context.[9]

A. Gujarat Reservation Rules and Regulations

A certain number of seats in the participating institutes under GUJCET are reserved as per the policies of the state of Gujarat. These seats are reserved for the different categories that are considered as minority by the Government. The applicants who belong to these categories can apply for admission if they meet the reservation criteria. The categories which are allotted reservation are Scheduled Caste, Scheduled Tribe, OBC, PWD and more. [4]

S.No.	Categories	Percentage of seats reserved
1.	Scheduled Caste	7% of total seats
2.	Scheduled Tribe	15% of total seats
3.	OBC (Socially and Educationally Backward classes.	27% of total seats
4.	Unreserved Economically weaker sections	10% of total seats
5.	Physically Disabled	3% of total seats
6.	Children of Defense Personnel and Ex-servicemen.	1% of total seats

Table 2. Gujcet Reservation Criteria [4]

B. Karnataka Reservation rules and Regulations

The examination authority of Karnataka CET, KEA reserves certain seats for the candidates falling in the various categories as per the KCET reservation criteria. The seats are reserved for special categories candidates including Scheduled Caste (SC), Scheduled Tribes (ST), Other Backward Classes (OBC), physically disabled, defense categories to name few. It releases seat matrix for KCET examination under each category. [5]

S.No.	Categories	Percentage of seats reserved
1	Rural candidates	15% of Government seats
2	Kannada Medium	5% of Government seats
3	Jammu and Kashmir migrants	1 seat in every Engineering college
4	OBC/SC/ST under category-1,2A,2B,3A,3B	Not Available
5	Defense Personnel of Karnataka origin	10% seats in all Engineering college
6	Sports Special Category.	Not Available
7	Scouts and Guides	Not Available
8	Physically Disabled	Not Available
9	NCC Category	Not Available
10	Supernumerary Category	5% seats all Engineering college

Table 3. Kcet Reservation Criteria [5]

C. Hyderabad Karnataka

Candidates who are local persons of areas/districts including Bidar, Gulbarga, Yadgir, Raichur, Koppal and Bellary are can claim seat under this category. The government releases seat matrix under each category.

Rules of reservations are indicated in the below table that depict the regulations need to be followed for constructing accurate seat matrix. [5]

University/Institution	Percentage of seats reserved
Any regional University or educational institution in Hyderabad-Karnataka Districts	70% of seats in every program
State University/Engineering College/Institution	8% of seats in every program

Table 4. Seats Reserved Under Hyderabad-Karnataka Category [5]

D. Madhya Pradesh Reservation Rules and Regulations

MP PET Reservation Criteria explains the percentage of seats reserved as per the guideline of the Government of Madhya Pradesh for the various given categories. MP PET has now been replaced by JEE Main. The guidelines are the same

but the admissions will be on the basis of the JEE Main Ranks.[6]

Categories	Percentage of seats reserved
Scheduled Castes	16%
Scheduled Tribes	20%
Other Backward Classes	14% (Non - Creamy Layer)
Female Candidates	30% under Horizontal Reservation
PWD Candidates	3% Horizontal Reservation
(Sainik), FF (Freedom Fighter)	5 %
TS (Technical Stream)	1%
J & K Migrants	One seat in each educational Institute.

Table 5. Mp Pet Reservation Criteria [6]

Categories	Percentage of seats reserved
Students of MP	90%
NRI students	5%
Students from the rest of the country	5%

Table 6. Mp Pet Reservation Criteria For Students From Mp And Outside Mp [6]

E. Seat Reservation Rules in Anna University

Reservation has been a way for the government to uplift the lower segment of our community. The pie chart below shows the details of reservation of engineering seats to different segments of our society. Tamil Nadu native candidates alone will be considered for communal reservations. [7]

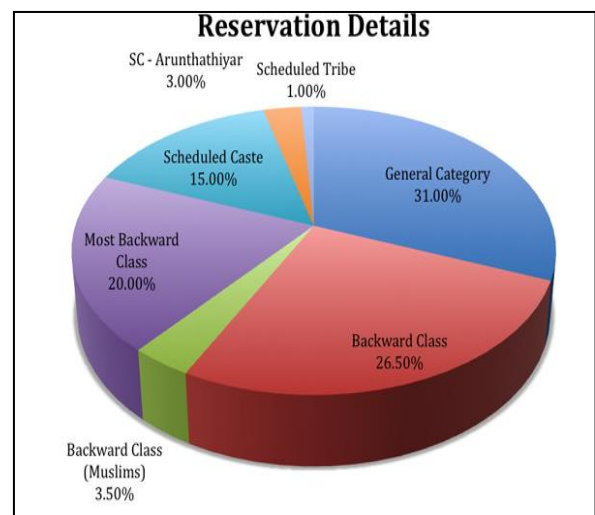


Fig 7:- Tamil Nadu reservation details [7]

Apart from the general reservation of seats Anna University also provides reservation for the following special categories:[7]

Categories	Number of Seats reserved
Children of ex-service	150
Children of freedom	10
Physically Handicapped	3 % (Orthopedic- 1% / Hearing impaired 1% / Visual impaired 1%)
Sports Quota	100

Table 7. Reservation Criteria of Special Categories for Anna University [7]

Universities	Total Seats	Govt. Reservation seats	Private Seats
Anna-University	5920	5920	0
Govt-Colleges	2825	2825	0
Govt-Aided-Colleges	1930	1544	386
Minority Institutions	44255	22128	22127
Private Colleges (Not Minority)	111320	75608	35712

Table 8. Seat Allocation In Engineering Colleges [7]

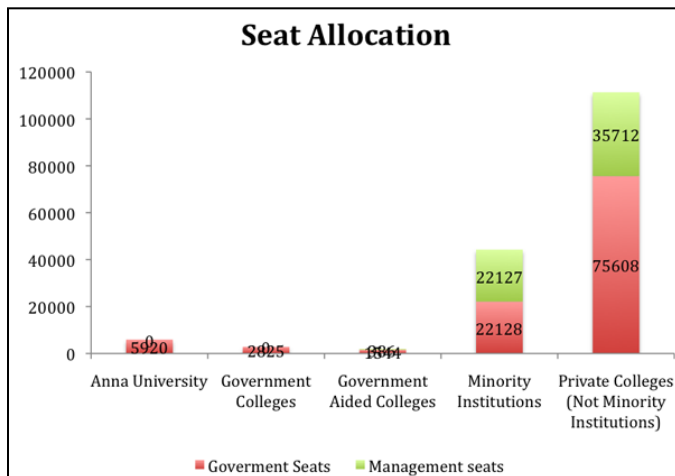


Fig 8:- Seat allocation in Engineering Colleges [7]

XI. FUTURE SCOPE

Artificial Intelligence module is planned to be used for selection of better candidature from the list of candidates on the basis of their merit status.

Example: In 2017-18 admission process, Engineering course sanctioned a seat to a ladies candidate scoring 87 percentage instead of sanctioning the seat to the general candidate scoring 92 percentage. This case was the result of 'manual error' that was used for balancing the seats so as to maintain the percentage sanctioned by the educational institute.

Module for seat allocation along with artificial intelligence can be designed that takes into consideration the merit stature of the candidate rather than the reservation categories. This will not only help in improved fair distribution of seats but also increase the precision, accuracy and quality of service of the software model.

XII. CONCLUSIONS

This paper discusses about the framework necessary for the preparation of seat matrix for admission in higher education institutes. The seat matrix obtained features the actual, desired and calculated distribution of seats along with error calculation. These errors can fall in a range from -0.5 to 0.5 which are highlighted using yellow color and the one falling between a range from -1 to 1 are depicted using dark pink color. The variations in the color schemes help to locate the errors easily and one can easily make out the type of errors that exist within given seat matrix. These errors can be reduced to a value below 1 using the advanced and remodelled algorithm. A balance is maintained among vacant seats by considering the historical seat distribution of the past 3 years. The reports depicting the seat matrix in tabular format improves the visual output and helps the user gain a detailed insight.

XIII. ACKNOWLEDGMENT

This work was supported by Four Pillars InfoTech India, a company that has been working in data engineering and mining domain for the past 6 years. They have been trying to expand and extend their legacy system into a dynamic web based framework.

We owe deep gratitude to our project guide Prof. Shilpa Pant, who took keen interest in our project work and guided us all along, till the completion of our project work by providing all the necessary information for developing a good system.

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