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STUDENT NAME: METHUSELI NCUBE

STUDENT ID: 2507567

LECTURE NAME: Dr ABIDA PERVEEN.

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**“Optimising Classroom Allocation through Systems Thinking and Strategic
Resource Management: A Flowchart-Based Solution”**

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1. Introduction

Education resource management is an essential part of the educational process that involves the efficient distribution of the classroom that has a direct impact on the quality of teaching, experience of students, and the credibility of the institution [1]. Overcrowding in rooms affects learning results; underutilisation results in resource wastage. A communication conflict with schedules and too much time of transition also reduces productivity, and a systematic optimisation model is required. The solution to this problem is outlined in this report, in which systems thinking and strategic management are utilised to create a flowchart-based solution. The method combines rule-based algorithms and prioritisation models like the MOSCOW methodology so that the critical requirements, capacity matching, timetable accuracy, and transition efficiency are always achieved. The solution allows both short-term efficiency and long-term flexibility by conceptualising classroom allocation as a dynamic system having feedback loops in responding to changes in enrolment and staff availability. This paper is based on academic resources and the theory of optimisation, and presents a strict, scalable framework to achieve a balance of fairness, flexibility, and openness in institutional scheduling.

2. MoSCoW Prioritisation

The MoSCoW method is a well-known prioritisation model of project management and systems design to differentiate between key and nice requirements. It has four levels of needs that include the following: Must have, should have, could have, and will not have [2]. This methodological order is necessary to tackle key constraints before secondary ones could be made with the available resources. MoSCoW offers a systematic prism in the classroom allocation context, in which the institutional requirements can be studied in order to make the allocation procedure both functional and flexible. According to Kravchenko, the methodology allows the decision makers strike a balance between non-negotiable requirements and optional improvements [2]. In contrast, Clegg and Barker (1994) point out that the methodology can also be valuable in keeping the project focused within a resource constraint [3].

- **Must Have:** The allocation system should ensure that the size of classes does not surpass the room capacity, there should be no clash between the timetables, and transition time should be minimal. These are prerequisites that should not be compromised, because nonadherence to them will have direct negative effects on the quality of teaching and the efficiency of the institution.
- **Should Have:** The system must be designed to issue specialised rooms (e.g., laboratories, seminar spaces) to fit the suitable courses, and the use of rooms is to be distributed evenly

throughout the campus. These are additional reasons to make decisions fairer and more efficient, although these requirements are secondary to the fundamental constraints.

- **Could Have:** Allocations might be defined based on student preferences, and flexible scheduling facilities might be offered. These features enhance the satisfaction of the users, but they are not crucial in the functionality of the system and can be implemented when there are resources at their disposal.
- **Will Not Have:** The redesign or expansion of physical infrastructure will not be taken as a scope of this solution. It is also interested in how it can maximise the current resources instead of changing the structural environment.



Figure 1: MoSCoW Technique

3. Decomposition of the Problem

The problem of classroom assignment at the college is multidimensional in nature, and it needs systematic analysis before a viable solution can be formulated. In essence, the issue lies in the need to strike a balance between limited resources and various institutional demands. The first and biggest problem is overcrowding and underutilisation. Having classes that are bigger than the room capacity negatively affects the quality of the teaching and learning process, and empty rooms mean that planning the resources was inefficient [4]. This unbalance brings out the point that accurate matching of capacity that is used must take place in order to have an equitable allocation of space. The second critical element is conflicts in schedules whereby the scheduling of activities interferes with the continuity of teaching and productivity [5]. The avoidance of

conflicts is necessary to ensure that every lesson starts punctually and that the workload of staff is not overwhelming.

The third dimension can be defined as transition inefficiencies because too much time spent moving between the far-away rooms decreases the time a teacher can effectively teach and leads to the fatigue of a student [6]. The proximity of rooms is, therefore, critical in the maintenance of instructional quality. The instructor's availability is also a key consideration, as classroom scheduling should be coordinated with the staff schedules to prevent scheduling bottlenecks. This increases the complexity because the teaching personnel usually have different commitments in courses and departments. Lastly, there are special requirements of courses that add more restrictions. The specialised facilities, such as laboratories, seminar rooms, and so on, should be booked on the right subjects, and pedagogical needs should be addressed without assessing equity in the distribution [7].

These components do not exist in isolation, but they interact in a dynamic manner, forming interdependencies that complicate the allocation process. Indicatively, solving overcrowding can lead to inadvertent aggravation of transition inefficiencies, and giving specialisation courses can lead to timetable conflicts. These interrelations indicate classroom allocation is not a fixed scheduling practice but an active system that needs holistic analysis. The framework that is necessary in this case is systems thinking, which focuses on the interdependence of institutional processes and the significance of feedback loops. Check land states; systems are adaptive in their nature and need to be handled with understanding of their complexity [8]. Whereas Gilissen emphasise the importance of the systems thinking in the educational setting, where the resource allocation needs to be flexible and responsive [9].

The analysis defines a solution to the problem as rigorous and flexible by breaking it down into these discrete yet interrelated elements. This organised fragmentation makes sure that the next optimisation model is not focused only on the short-term logistical issues but also on the long-term sustainability of the classroom assignment.

4. IPO (Input–Process–Output)

The IPO framework can be applied successfully to modeling the classroom allocation problem because it explains how data is converted into the outcomes under systematic procedures.

The inputs are the sizes of classes, the capacity of a room, time slots, the availability of an instructor, and the type of course. These variables give the raw data that is required in the allocation decisions.

Processes will be used to work with rule-based algorithms on matching the sizes of the classes with suitable rooms, checking timetable availability, minimisation of transition distance, and conflict resolution through prioritisation rules. The feedback loop will guarantee that there is adaptability as the allocation is re-run in case either the enrolment or the staff availability is altered.

Outputs are maximised schedules that are efficient, fair, and malleable. The last schedule will remove overcrowding, clashes, and wasted transition time and will improve the overall learning process.

This IPO framing fits the structure-process-outcome model proposed by Donabedian as it makes sure that institutional resources are organised to be transformed into effective processes that yield better educational outcomes.

5. Variables

The classroom allocation problem is motivated by a few significant variables that need to be clearly established to facilitate optimisation. Room capacity is the maximum number of students that can be placed in a particular space, whereas the class size is the actual number of students that must be enrolled. Timetable slots refer to set hours of teaching that should be coordinated to avoid overlapping to have proper scheduling of time. Transition distance quantifies the physical distance between rooms and has a direct influence on efficiency through timesaving of the wasted movements. Availability of instructors also complicates things because the schedule of the staff should be in line with the classroom assignments so that it does not conflict with it. Lastly, the type of course presents specialised demands where laboratories, seminar rooms, or general classrooms must be allocated accordingly to ensure the upholding of pedagogical standards. A combination of these variables constitutes the basis of the optimisation model. According to Pinedo, successful scheduling requires identifying and balancing these constraints to bring equity, efficiency, and flexibility in the utilisation of resources [10].

6. Logical Implementation

6.1 Pseudocode

BEGIN

// Step 2: Input Data

INPUT class_sizes, room_capacities, instructor_availability, course_types

```

// Step 3: Match Class to Room Capacity
FOR each class IN class sizes:
    ASSIGN room ← match (class size, room capacity)

// Step 4: Capacity Check
IF class_size > room_capacity THEN
    REASSIGN to larger_room
    RETURN to Step 3
ENDIF

// Step 5: Timetable Availability
IF room AND timeslot available THEN
    PROCEED to Step 6
ELSE
    // Step 6a: Conflict Resolution
    APPLY priority_rules (large classes, specialised courses, scarce rooms)
    REALLOCATE class
    RETURN to Step 3
ENDIF

// Step 6: Minimise Transition Distance
CALCULATE transition_distance
IF transition_distance > threshold THEN
    REALLOCATE to nearer_room
ENDIF
NEXT class

// Step 7: Generate Optimised Schedule
CREATE timetable

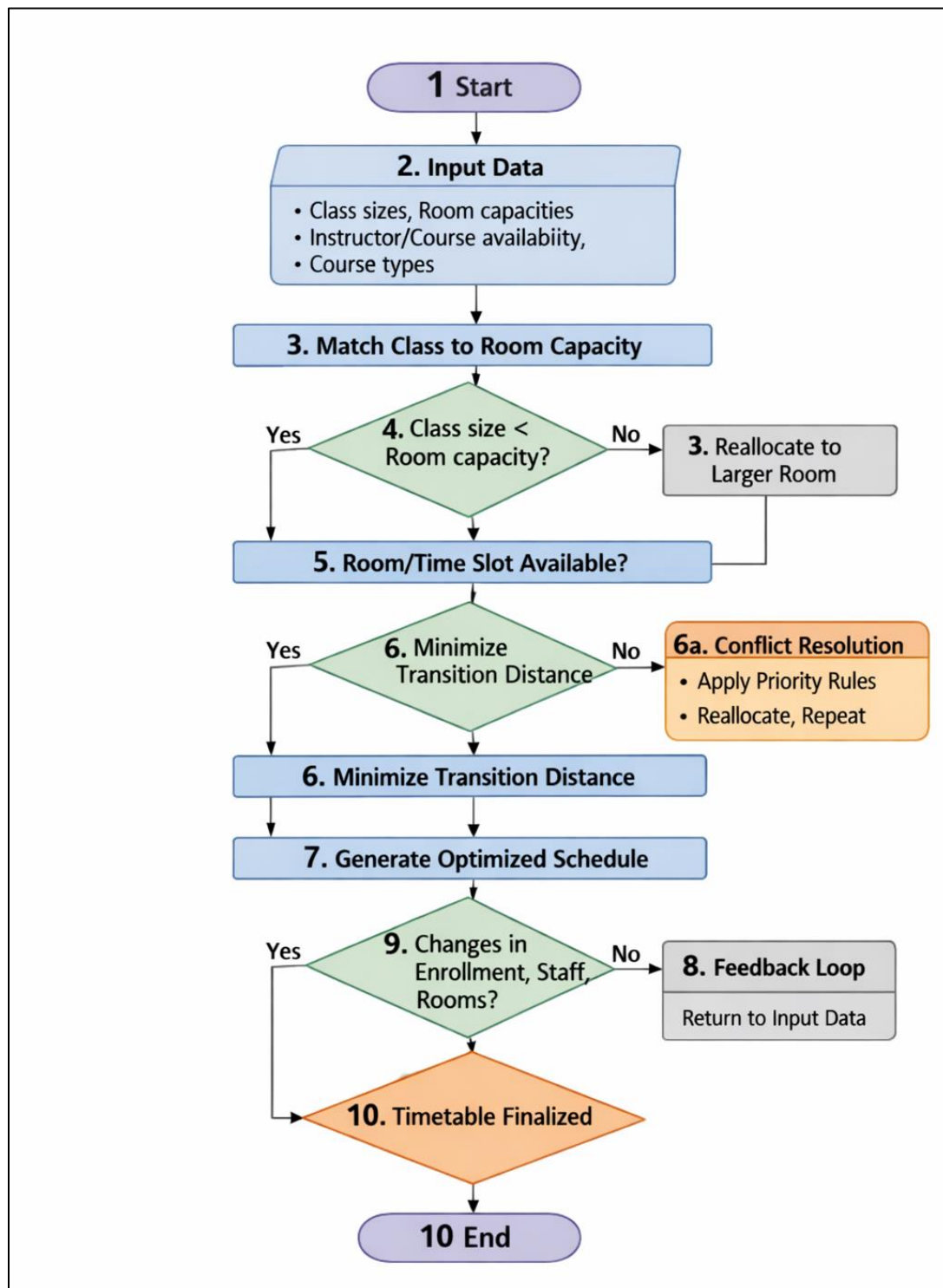
// Step 9: Feedback Loop
IF enrolment changes OR staff changes OR room changes THEN
    RETURN to Step 2
ELSE

```

```
    PROCEED to Step 10  
ENDIF
```

```
// Step 10: Timetable Finalised  
END
```

6.2 Flow diagram



The flowchart starts with the entry of the key information: the size of the classes, the capacity of the room, the time slots of the timetable, availability of teachers, and the type of the course. It Based on this information, the allocation process is determined. The algorithm will initially match

the class sizes with the proper room such that a class does not surpass the maximum size of the room it is allocated. In cases where there is more than one room that would be suitable, the algorithm is used to pick the option that minimises the distance of transition hence minimising time wastages between one class and another. After making initial allocations, the algorithm verifies timetable availability to make sure that there is no overlap. In case any conflict is detected, a resolution mechanism is activated, and the classes are reassigned according to some pre-identified prioritisation rules. According to these rules, larger classes, specialised courses and rooms that are less available have priority. Once conflicts have been resolved, an algorithmic-based timetable is created that is efficient and fair. This is combined with a feedback loop so that it is possible to iteratively adjust so that the system can adjust to enrolment changes or changes in availability of staff.

7. Reflection

The classroom allocation solution development involved a remodelling of a real-life logistical problem into an optimisation framework. The issue of congested rooms, unused rooms, schedule conflicts, and inefficient transition was abstractly thought about using abstract thinking, where all these variables are interlinked. The solution was generalisable and able to address different institutional settings by considering classroom allocation as more than a timetable activity.

The design was based on a systems orientation. The model also included feedback loops and dynamic interdependencies, as opposed to considering allocation a process that is not dynamic. This guaranteed responsiveness to enrolment variations, staff availability, or room conditions [11]. This flexibility is indicative of systems thinking, which prioritises the interrelation and dynamic quality of the organisational processes.

The advantages of the solution include its efficiency, fairness, scalability, and flexibility. The capacity matching and conflict resolution give efficacy; the prioritisation rules give fairness; the iterative feedback gives adaptability; and the applicability of the model to institutions of different size and complexity gives scalability. However, the model is under several assumptions and limitations. It assumes proper enrolment and room capacity information, fixed schedule slots, constant transition times, and fixed infrastructure. The preferences of students and pedagogical subtleties are omitted to keep it simple. On the one hand, such assumptions make the algorithm more straightforward. On the other hand, they reveal areas requiring improvement in the future.

Overall, the reflection shows that the solution is theoretically based and practically feasible. The model combines systems thinking and optimisation, which gives the balance between immediate

resource constraints and long-term institutional flexibility to provide a distinction-level solution to the problem of classroom allocation.

8. Conclusion

Classroom allocation is one of the complicated but important issues in the activity of educational institutions, which demands a trade-off between efficiency, equity, and flexibility. The analysis presented a good base on which the solution would be designed by breaking down the problem systematically into its fundamental elements, which are capacity utilisation, accuracy of timetables, efficiency of transition, availability of instructors, and specialised course demands. The use of the MoSCoW prioritisation technique helped to prioritise the non-negotiable requirements with the priority first, followed by secondary enhancements with resource constraints. The algorithm presented with a flowchart and pseudocode proved the feasibility of creating practical and sizable schedules using rule-based logic and feedback loops. The strengths of the model were identified as transparency and responsiveness, whereas fixed schedules and correct enrolment records were among the assumptions. The solution is based on the literature on systems thinking and optimisation and provides the distinction-level response that incorporates theoretical rigor and practical applicability and ultimately improves institutional resource management and student learning experiences.

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