CSC476 Research Proposal  
Group 3

Project Domain: Automated Timetable Examination Scheduler

## By

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# Evaluating the effectiveness of automated timetable examination scheduling in real-world settings (The University of Ibadan Case sturdy)

# INTRODUCTION

The orchestration of academic activities is a vital feature in the dynamic landscape of higher education that directly affects the efficiency and contentment of learners as well as instructors. The examination timetable scheduling process, which plays a critical role in establishing a streamlined and effective academic calendar, is a critical component in this complicated orchestration. This study aims to dig into the field of automated timetable examination scheduling, specifically analyzing its efficiency in real-world settings using The University of Ibadan as a case study.

Automated timetable examination scheduling represents a revolutionary shift in academic assessment organization. The use of computer algorithms and optimization techniques tries to handle the complications associated with creating schedules that meet a variety of courses, faculty preferences, and resource constraints. This study strives to clarify the intricacies of automated scheduling by evaluating its impact on the accuracy, effectiveness, and adaptability of examination timetables in the setting of The University of Ibadan.

### Related Computer Field

This topic, which sits at the crossroads of computer science and educational administration, falls under the umbrella of artificial intelligence (AI), operations research, and optimization. The adoption of automated scheduling algorithms entails complex computational approaches that use AI to optimize and modify the process of creating examination timetables. This research contributes to the growing body of knowledge at the intersection of computer science and academic administration by investigating these technological breakthroughs.

### Context of Problem Domain

As a microcosm of the larger academic world, the University of Ibadan provides an ideal context for investigating the practical consequences and challenges of implementing automated examination scheduling. The complexities of the university's curriculum, faculty preferences, and infrastructural constraints provide an extensive variety of variables that define automated scheduling systems' real-world implementation. We hope to get insights that transcend theoretical frameworks and provide meaningful recommendations for institutions facing comparable issues by immersing ourselves in this specific setting.

### Beneficiaries of the Research, if Completed

The potential beneficiaries of this research go beyond academic institutions. Students will benefit from a more planned and predictable examination timetable, which will encourage a climate conducive to good preparation. Faculty members benefit from streamlined processes, which allow them to focus more on instructional activities. Furthermore, administrative staff and university administration may benefit from the resource optimization and time efficiency provided by computerized scheduling. Finally, the project's outcomes aim to improve all stakeholders' academic experience.

# BACKGROUND TO THE STUDY

*Why is this problem or question important?*

The importance of effective timetable examination scheduling in academic institutions cannot be overstated. As education systems evolve, the demand for optimized and efficient scheduling processes becomes increasingly critical. The seminal work by Carter and Laporte (1998) on the examination timetable problem underscores the complexity of this challenge and the potential impact on educational institutions. In their research, they highlighted the intricate nature of scheduling examinations, emphasizing the need for innovative approaches to address the computational complexities involved.

Building upon this foundation, the study by Burke, Cowling, and Keuthen (2002) delves into the realm of automated examination timetabling, examining the practical applications of metaheuristic algorithms. Their work not only acknowledges the computational challenges but also recognizes the potential for technological solutions to enhance the scheduling process. This underscores the relevance of exploring automated timetable examination scheduling, aligning with the evolving landscape of technological advancements in the broader field of operations research.

*Who else has worked on this or similar problems?*

The examination timetable problem has attracted the attention of researchers worldwide, reflecting its universal relevance. In the realm of automated scheduling, the work of Mohamed et al. (2017) provides a review of the development and application of genetic algorithms for solving timetable scheduling problems. Their research adds a genetic algorithm perspective to the existing body of knowledge, presenting a diverse set of methodologies for tackling the complexities inherent in crafting efficient timetables.

Furthermore, the study by Yaghini et al. (2015) explores the integration of ant colony optimization in examination timetabling, presenting an alternative approach to algorithmic solutions. This diversity in methodologies emphasizes the multidimensional nature of the problem, necessitating a comprehensive exploration of automated scheduling techniques.

*What methods were used?*

Previous research has employed a range of methodologies to address the examination timetable problem. Carter and Laporte (1998) utilized mathematical programming techniques to formulate the problem, emphasizing the need for exact solutions. In contrast, Burke et al. (2002) delved into metaheuristic algorithms, leveraging the power of simulated annealing and genetic algorithms to provide computationally efficient solutions. The diverse array of methods employed in prior research highlights the versatility required to tackle the multifaceted challenges posed by examination timetable scheduling.

*What were the results or conclusions of previous research?*

The outcomes of previous research underscore the progress made in understanding and addressing the examination timetable problem. Carter and Laporte (1998) provided a foundational understanding of the problem's complexity, emphasizing the intractability of certain instances. Burke et al. (2002), focusing on automated scheduling, demonstrated the practical applicability of metaheuristic algorithms, showcasing their effectiveness in generating near-optimal solutions.

However, these studies also acknowledge the limitations and computational challenges associated with examination timetabling. The need for continuous refinement and adaptation of methodologies to real-world scenarios is a common theme, setting the stage for our research to explore the application of automated scheduling in the specific context of the University of Ibadan.

# PROBLEM STATEMENT

The heart of this research lies in addressing the complexities of examination timetable scheduling, particularly in the context of the University of Ibadan. The problem at hand involves the intricate orchestration of various variables to create an optimal schedule that satisfies the diverse needs and constraints imposed by the academic environment. This examination timetable problem, as articulated by Burke et al. (1997), encapsulates both hard and soft constraints, forming the crux of our investigation.

*Variables and Their Relationships*

#### Hard Constraints:

Hard constraints, as defined by Burke et al. (1997), represent the non-negotiable requirements that must be fulfilled for a timetable to be considered viable. These constraints typically involve factors such as room capacities, faculty availability, and the avoidance of conflicting exam schedules. For instance, each examination must be assigned to a suitable venue with sufficient seating capacity, and no two exams should occur simultaneously for students enrolled in multiple courses. Adhering to these hard constraints is imperative to ensure the integrity and feasibility of the examination timetable.

#### Soft Constraints:

In contrast, soft constraints introduce a layer of flexibility, allowing for optimization based on preferences and desirability. Burke et al. (1997) highlight soft constraints as considerations that, while not mandatory, contribute to the overall quality and user satisfaction of the timetable. Examples of soft constraints include minimizing gaps between exams for students, balancing the distribution of exams across days, and accommodating faculty preferences regarding the timing of their assessments. These constraints, while not as rigid as their hard counterparts, play a pivotal role in enhancing the overall user experience and efficiency of the examination scheduling process.

The relationships between these variables are intricate and dynamic. The challenge lies in finding a delicate balance between adhering to the rigid requirements of hard constraints and optimizing the schedule based on the preferences and desirability factors represented by soft constraints. This delicate equilibrium forms the core of our exploration as we seek to develop and evaluate the effectiveness of automated timetable examination scheduling in the real-world setting of The University of Ibadan.

# AIM AND OBJECTIVES

### General Goal:

The overarching goal of this research project is to enhance the efficiency and effectiveness of the examination timetable scheduling process at The University of Ibadan through the implementation and evaluation of automated scheduling solutions. By leveraging advancements in computer science and operations research, the aim is to contribute to the optimization of academic resource utilization, reduce scheduling errors, and create a more streamlined and adaptable timetable.

### Specific Objectives:

* **Evaluate Existing Automated Scheduling Methods:**

Conduct an in-depth review of existing automated scheduling methods and algorithms under them, including but not limited to Sequential methods, Meta-heuristic methods, and Constraint-based approaches.

Assess the strengths, weaknesses, and applicability of each algorithm in the context of examination timetable scheduling.

* **Adapt Algorithms to University-Specific Constraints**:

Identify and characterize the unique constraints and requirements of the University of Ibadan, encompassing course structures, faculty preferences, room availability, and other institutional considerations.

Modify and adapt selected automated scheduling algorithms to address the specific variables and constraints present at the university.

* **Implement Automated Scheduling System:**

Develop a prototype of the automated timetable examination scheduling system tailored to the specific needs of The University of Ibadan.

Integrate the adapted algorithms into the system, ensuring functionality and efficiency in generating examination timetables.

* **Assess System Performance and Accuracy:**

Implement the automated scheduling system using historical data and hypothetical scenarios to generate examination timetables.

Evaluate the system's performance in terms of speed, accuracy, and adaptability, comparing results with manually created timetables.

* **Collect Stakeholder Feedback:**

Engage with key stakeholders, including students, faculty, and administrative staff, to gather feedback on the usability and practicality of the automated scheduling system.

Incorporate stakeholder input to refine the system and ensure alignment with the diverse needs of the university community.

* **Provide Recommendations for Implementation:**

Based on the findings from the evaluation and stakeholder feedback, formulate practical recommendations for the implementation of automated timetable examination scheduling at The University of Ibadan.

Outline guidelines for the integration of automated scheduling solutions into the university's administrative processes.

These specific objectives are designed to provide a systematic and comprehensive approach to addressing the research problem, allowing for the development, implementation, and evaluation of an automated timetable examination scheduling system tailored to the unique context of The University of Ibadan.

# PROJECT METHODOLOGY

This research project adopts a mixed-methods approach, combining elements of both qualitative and quantitative research methodologies. The integration of these methods is deemed essential for a comprehensive understanding of the intricacies surrounding the evaluation of automated timetable examination scheduling at The University of Ibadan.

Sources

The primary sources of data for this study will include:

* **Historical Data**: Examination timetables from previous academic sessions to understand patterns, constraints, and challenges.
* **Stakeholder Interviews**: Engaging with students, faculty members, and administrative staff to capture qualitative insights into the nuances of the examination scheduling process.

### Research Methods

* **Literature Review**: A thorough examination of existing literature, including academic articles, conference papers, and relevant publications, to establish a theoretical foundation and identify gaps in current knowledge.

* **Algorithmic Analysis**: Evaluating the performance of existing automated scheduling algorithms through simulations and benchmarking against manual scheduling processes. This involves implementing and testing algorithms in controlled scenarios to assess their efficacy.

* **Prototype Development**: Designing and developing a prototype of the automated scheduling system using a combination of programming languages and tools, with a focus on adaptability to the specific constraints of The University of Ibadan.

* **User Feedback Surveys**: Administering surveys to stakeholders, capturing quantitative feedback on the user experience, perceived efficiency, and overall satisfaction with the automated scheduling system.

### Practicalities

Foreseeable obstacles in terms of timescale and resources include:

* Data Availability: Ensuring access to comprehensive historical data for accurate algorithmic analysis.
* **Stakeholder Participation**: Securing active engagement from students, faculty, and administrative staff for meaningful feedback may pose challenges.
* **Complexity of Algorithm Implementation**: Developing and implementing sophisticated algorithms may be challenging, requiring careful consideration of the specific requirements of The University of Ibadan.

### Tools

The research will employ a variety of tools and technologies, including:

Programming Languages: Python and Java for algorithm implementation and system development.

* **Simulation Software**: Utilizing simulation tools to model and evaluate the performance of automated scheduling algorithms.
* **Survey Platforms**: Online survey platforms to facilitate the collection of stakeholder feedback.

The mixed-methods approach is chosen to triangulate findings, enhancing the validity and reliability of the study. Quantitative analysis of algorithmic performance provides objective insights, while qualitative data from stakeholder interviews offers a deeper understanding of user perspectives, preferences, and challenges. The use of historical data, algorithmic analysis, and stakeholder feedback will collectively contribute to a robust evaluation of the automated timetable examination scheduling system at The University of Ibadan.

# EXPECTED RESULTS

### Data Analysis

The analysis of data in this research will follow a specific approach to glean comprehensive insights from various sources. Quantitative data, such as algorithmic performance metrics and survey responses, will be subjected to statistical analysis.

Qualitative data from stakeholder interviews will undergo thematic analysis to identify recurring themes, perspectives, and challenges. This analysis method aims to provide an understanding of both the quantitative efficiency metrics and the qualitative user experiences associated with the automated timetable examination scheduling system.

### Expected Results

* Algorithmic Efficiency Metrics

- Anticipate enhanced efficiency and optimization in automated scheduling compared to manual processes, as reflected in reduced scheduling errors, improved resource utilization, and minimized conflicts.

- Identify the algorithm that demonstrates superior performance in the context of The University of Ibadan, providing insights into the most effective computational approach.

* Stakeholder Feedback

- Expect positive feedback from stakeholders regarding the usability and practicality of the automated scheduling system.

- Identify specific pain points or areas for improvement based on qualitative feedback, contributing to the iterative refinement of the scheduling system.

* Generalizations and Contributions

- Generalize findings to similar academic institutions, offering insights into the adaptability and transferability of automated scheduling solutions.

- Contribute to existing knowledge by providing a nuanced understanding of the complexities and considerations involved in the real-world application of automated timetable examination scheduling.

# RESEARCH PLAN: TIMELINE

The research plan is structured to provide a clear and systematic roadmap for the different phases of the research project. The timeline is outlined below:

#### Introduction and Literature Review (18th October 2023 to 25th October 2023)

* Conduct a comprehensive literature review to establish a theoretical foundation.
* Refine and finalize the introduction section, setting the stage for the research questions and objectives.

#### Research Methodology (25th October 2023 to 8th November 2023)

* Clearly define and justify the mixed-methods research approach.
* Develop a detailed plan for data collection, specifying sources, methods, and tools.
* Outline procedures for data analysis, encompassing both qualitative and quantitative methods.
* Address practicalities by foreseeing and planning for potential obstacles.

#### Implementation and Testing (8th November 2023 to 15th November 2023)

* Begin the development of the automated timetable examination scheduling system.
* Implement selected algorithms and integrate them into the system.
* Conduct initial testing and debugging to ensure functionality and identify any potential issues.
* Refine the prototype based on initial testing outcomes.

#### Summary, Conclusion, and Recommendations (15th November 2023 to 22nd November 2023)

* Summarize the key findings from algorithmic analysis, stakeholder feedback, and overall system performance.
* Formulate conclusions based on the synthesized results and align them with the research objectives.
* Develop practical recommendations for the implementation of automated timetable examination scheduling at the University of Ibadan.
* Finalize the research document, ensuring clarity, coherence, and completeness.

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