PRIORITY-BASED EXAMINATION TIMETABLE SCHEDULING USING ANSWER SET PROGRAMMING APPROACH: A CASE STUDY OF COVENANT UNIVERSITY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE (M.Sc) DEGREE IN COMPUTER SCIENCE IN THE DEPARTMENT OF COMPUTER AND INFORMATION SCIENCES, COLLEGE OF SCIENCE AND TECHNOLOGY, COVENANT UNIVERSITY.

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ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the degree of Master of Science in Computer Science in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria.

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DECLARATION

I, **OTUNUYA HENRY CHUKS (19PCG02025)** declares that this research was carried out by me under the supervision of Prof. Ambrose A. Azeta of the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

OTUNUYA HENRY CHUKS

Signature and Date

CERTIFICATION

We certify that this dissertation titled **"PRIORITY-BASED EXAMINATION TIMETABLE SCHEDULING USING ANSWER SET PROGRAMMING APPROACH: A CASE STUDY OF COVENANT UNIVERSITY"** is an original research work carried out by **OTUNUYA HENRY CHUKS (19PCG02025)** in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Prof. Ambrose A. Azeta. We have examined and found this work acceptable as part of the requirements for the award of Master of Science in Computer Science.

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(Dean, School of Postgraduate Studies) **Signature and Date**

DEDICATION

This research is dedicated to the Almighty God and Jesus Christ my Lord, through and for whom all things were made.

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LIST OF ABBREVIATIONS

Abbreviation	Full meaning
ACO	Ant Colony Optimization
ASP	Answer Set Programming
CTD	Course to Day
CTT	Course to Time
CSS	Cascading Stylesheet
CU	Covenant University
CIS	Computer and Information Sciences
CST	College of Science and Technology
CSV	Comma-separated Values
DBMS	Database Management System
ETSP	Examination Timetable Scheduling Problem
EttS	Examination Timetabling System
SAT	Satisfiability solving
GC	Graph Colouring
GA	Genetic Algorithm
HBMO	Honey Bee Mating Optimization
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
ILP	Integer Linear Programming
NP	Non-deterministic Polynomial time
PSO	Particle Swarm Optimization
SUS	System Usability Scale
UML	Unified Modeling Language
UI	User Interface
UG	Undergraduate

ABSTRACT

Timetabling is the process of assigning an event subject to one or more constraints. It is a complex problem by nature. Majority of the scheduling problems known today fall under the NP-hard (NP for non-deterministic polynomial time) class of computational problems. This complexity is as a result of the many events which needs to be efficiently scheduled using limited resources. The examination timetable scheduling problem is one whose main events are examination courses with resources including examination venues, days and time slots. The primary purpose of examination timetable scheduling is to arrange exams in such a way as to avoid clashes bringing about a seamless examination process for students. The complexity of the examination timetable scheduling problem has been addressed using several heuristic approaches like Genetic Algorithm (GA) and Ant Colony Optimization (ACO) algorithm. The objective of this study was to provide a priority-based examination timetable scheduling model using the Answer Set Programming (ASP) approach. ASP unlike conventional techniques which have being employed in solving the timetable scheduling problem, offers a purely declarative approach to problem solving and is designed chiefly for NP-hard computational problems. An ASP examination timetable model was proposed in this research using the departments of Computer and Information Sciences, and Architecture in Covenant University Nigeria used as case study. The model was implemented using the web technologies of clingo-wasm (a clingo WebAssembly), HTML (Hypertext Markup Language), CSS (Cascading Stylesheet), JS (JavaScript) and Node.js. clingo-wasm which is a core component of the system was used for the grounding and solving of the developed ASP encodings. Five (5) instances of the model were analyzed in results session. The results show the execution times taken by each instance with the total time ranging from 1.47 to 7.763 CPU seconds for all the examination timetable solutions (stable models) executed. The proposed model can be adapted for other variants of the examination timetable scheduling problem (ETSP) as its elaboration tolerant feature would make such adaptions easy to do.

Keywords: Priority-based scheduling, Answer Set Programming, Examination timetabling, Scheduling, Combinatorial problem