Omar M. Elshenawy

Cairo, 24^{th} of February, 2004
Mathematics BSc, Constructor University, Bremen, Germany
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STATEMENT

with aspirations to foster a culture of awareness, understanding & appreciation of mathematics, Omar is not afraid to experiment, to make mistakes and profit from them, to accept frustration and yet persevere to an ultimate triumph.

EDUCATION

Constructor University, Bremen, Germany — September 2022 — Current
Bachelor of Science in Mathematics, Minor in Data Science —*Relevant Courses* — Current Grade: B+

Cairo University, Giza, Egypt — July 2024 — August 2024
Summer School in Mathematical Physics

RESEARCH

Dessins D'enfants & Complete Regular Maps — American Mathematical Society — Stony Brook, New York, US
Research Group led by Professor Lisa Berger — June 2024 — Current

✧ a complete regular map is an embedding of a complete graph K_n into a $g-$holed surface that exhibits maximal symmetry. Norman Biggs [1972] constructed such maps as Cayley maps associated to finite fields. James and Jones [1985] proved Biggs' construction gives all complete regular maps. We propose an alternative construction that emphasizes an interesting interplay between elements of Algebraic Number Theory and Topological Graph Theory.

Interaction Energy of Quasi-particles in a Bose gas — Bremen, Germany
Student Research Group led by Professor Sören Petrat — November 2022 — February 2023

✧ the Bose-Einstein condensate is a state of matter formed when bosons occupy the same quantum state at ultracold temperatures, leading to macroscopic quantum phenomena. We aim to compute the interaction energy between two quasi-particles in a homogeneous Bose gas beyond Bogoliubov theory, identifying regimes of attractive and repulsive interactions based on their momenta. The study of mathematical physics demands great rigor, and an early pursuit of this goal implied a remarkable step towards mathematical maturity.

SEMINARS & TALKS

An Algebraic Construction of Complete Regular Maps via Prime Ideals — January 2025
AMS Special Session, Joint Mathematics Meetings, Seattle, US. Funded Talk. — Abstract, Slides

Gedankenexperimente!– *Thought Experiments!* — Fall 2024
General Audience Workshop, Five Thought Experiments in German. — Workshop

Fibrations & Applications to Computations of Higher Homotopy Groups — Spring 2024
Seminar in Algebraic Topology — Talk, Paper, Slides

Zermelo's Theorem in Game Theory — Spring 2024
The Mathematics Undergraduate Seminar @ Constructor University — Paper

The Banach-Tarski Paradox — Fall 2023
The Mathematics Undergraduate Seminar @ Constructor University — Paper, Slides

PROFESSIONAL EXPERIENCE

Scholastic Aptitude Test (SAT) — Bremen, Germany
Mathematics Instructor @ Constructor University — October 2024 — December 2024 | Course Page

- with a one-week notice to assume full responsibility for the class, a two-month plan utilising the Collegeboard Educator QuestionBank was successfully set out and executed.
- adopted a topic-based treatment to 19 skills that encompass the mathematics test, and instilled a developmentally appropriate learning framework with difficulty based exercises.
- implemented a technical project to digitally transform 3 × 19 quizzes to `moodle`, encompassing a total of 850+ questions.
- ensured a proper recording and documentation of class materials, including lectures, exercises & handouts.

Calculus & Elements of Linear Algebra I — Bremen, Germany
Teaching Assistant @ Constructor University — September 2024 — December 2024 | Course Page

- held lectures on behalf of the course instructor, and conducted engaging mathematical discourse in tutorials.
- created 120+ short video tutorials to overview problem set solutions, amassing 36 hours of video content.
- oversaw the Learning Management System, performing a full digital transformation of question sets.

Mathnasium of the Courtyard — Giza, Egypt
Assistant Director — April 2022 — August 2022

- analyzed student attendance trends, maintained a target 3:1 student-to-instructor ratio with a 90% success rate.
- implemented an individual, developmentally appropriate learning experience for 35+ students.
- built family relationships; solicited parent feedback; generated leads.

Lead Mathematics Instructor — November 2021 — April 2022

- orchestrated the instructor team (floor) to provide excellent instruction.
- mentored and oriented newly-hired instructors to facilitate an easy transition into their roles.
- provided individual instruction to high volumes of students (3 - 4 students) concurrently.

SCHOLARSHIPS & AWARDS

Participation, International Mathematics Competition Blagoevgrad, Bulgaria
final placing: 387^{th} out of a total 401 participants. August 2024

Die Sparkasse Mathematik, €10.800 Bremen, Germany
recognition of students with outstanding aptitude and enthusiasm for mathematics. 2022 — 2025

Jacobs University Grant, €18.000 Bremen, Germany
awarded on a performance potential basis to talented students from around the world. 2022 — 2025

PROJECTS

.txt to moodle.sty Notebook
RegEx Project — Implemented in Python November 2024

- the project resolves an obstacle with the digital transformation of Collegeboard Educator QuestionBank questions.
- built on top of mathPix's LaTeX OCR engine, the rendered LaTeXtext is returned in a moodle.sty compatible format.
- processing is done by fetching `id,ans,body,choices,type` for each question by means of simple logic.
- the culmination of many simple steps gives rise to an object that is complicated and functional.

Numerical Schemes in the Context of Differential Equations Notebook
Joint with Mohammad Bennani — Implemented in Python June 2024

- introduces standard approximation schemes in the realm of numerical solutions and intermediate, boundary value problems.
- comprehensively treats the implicit and explicit Euler schemes, as well as the finite differencing and shooting methods.
- numerically solves the heat equation (PDE) in two dimensions for given initial conditions.

sustainApple Application
Joint with Fabian Vogel — jacobsHack! 22 Hackathon November 2023

- aims to reduce carbon footprint by comparing its users' sustainability scores (in apples) to create self-awareness.
- uses geo-locational input to provide insightful inferences on CO2 emissions of a user's vehicle, inspired by the EEA database.

ENTREPRENEURSHIP

ξ — **Xi!** Teaching Statement
Mathematics Initiative - Founder & Director March 2024 — Current

- transforming the academic journey of 10+ students, with 4+ courses featuring +120 hours of content.
- implementing a learning methodology that captures the uniqueness of each student's learning journey.
- illustrating the study of Mathematics as a construct of intellectual empowerment, a poetry of eloquence & precision.
- fostering questioning minds that are unafraid of frustration, eager to make mistakes and persevere to the ultimate triumph.

LEADERSHIP

The Mathematics Society @ Constructor University Bremen, Germany
Co-lead September 2023 — Current

- initiated a Mathematics Support Center for 30+ registrants, operating single-handedly for four hours a week in Fall 2024.
- introduced Open Discourse in Fall 2024, a dynamic initiative dedicated to immersive mathematical talks in the community.
- orchestrated a renaissance of the mathematics community, with a record 22+ members in Fall 2023.
- mentoring younger students; and motivating dialogue that dismantles math stereotypes.

Google Developer Student Club @ Constructor University Bremen, Germany
Project Management Core October 2022 — Current

- mentored ResQme 2x, ExoHeal, Grub On, Navimate to a top-100 worldwide spot in the Google Solution Challenge.
- conducted 10+ workshops for Google and the Hult Prize Foundation on the human element of design thinking.
- directed 400+ design thinkers to design creative solutions for the 17 UN Sustainable Development Goals.

SOFTWARE LaTeX— Moodle — Java — SQL — HTML — JavaScript — NumPy — SciPy — Pandas — Scikit.learn

LANGUAGES German *(B1-B2)* — English *(Fluent)* — Arabic *(Native)*