TAHSEEN W. RABBANI
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STATEMENT

I am currently a student at the University of Virginia majoring in Mathematics and minoring in Biology. In mathematics, I have experience with error-correction theory, quadratic forms, and Hadamard difference sets. In biology, I am very familiar with techniques employed in genetic engineering.

EDUCATION

University of Virginia, Charlottesville, VA: Third Year Undergraduate
B.A. in Mathematics, Graduate Preparatory Concentration **Class of 2015**

AWARDS

Research Grant (University of Virginia Mathematics Dept., Provost's Office, $2500) **Summer 2014**
Grant purpose: To pursue research on quadratic forms, especially minimal unique forcing sets under the supervision of Dr. Andrew Obus and support on-grounds living expenses.

Distinguished Majors Program, Mathematics **Spring 2014-**
Thesis: p-adic numbers and the Hasse-Minkowski Theorem.

Small Research and Travel Grant (University of Virginia, $500) **Fall 2013**
Grant purpose: To pursue research on the existence criterion of (256, 120, 56) Hadamard difference sets and to present a poster at the 2014 Joint Mathematics Mathematics Meeting in Baltimore, MD.

Echols Scholar **2012**-

Dean's List **2011-Spring 2013**
Spring 2014

PAPERS

1. **"Unique Minimal Forcing Sets and Forced Representation of Integers by Quadratic Forms."**
Advisor: Dr. Andrew Obus. (submitted)

2. **"Improving the error-correcting code used in 3-G Communication."**
Advisor: Dr. James Davis. (submitted)

PRESENTATIONS

2015 Joint Mathematics Meeting, San Antonio, TX. Jan 10-Jan 13 20144
Poster presentation. Entitled "Improving the Error-Correcting Code Used in 3-G Communication." On the topic of a construction of a [30, 10, 10] error-correcting code and improved [30, 10, 11] code.

2014 Joint Mathematics Meeting, Baltimore, MD. Jan 16-Jan 18 2014
Poster presentation. Entitled "Bent Functions and Difference Sets." On the topic

of 6 variable bent functions and (256, 120, 56)-Hadamard difference sets.

WORK & RESEARCH EXPERIENCE

University of Virginia, Department of Mathematics, Kerchof Hall **Fall 2014**
Grader
I am the grader for MATH 3351: Elementary Linear Algebra.

University of Virginia, Department of Mathematics, Kerchof Hall **Fall 2014**
Independent Study, Supervisor: Dr. Peter Abramenko
Currently studying Coxeter groups and complexes under the supervision of Dr. Peter Abramenko. I intend to write a paper summarizing a recent result on Bruhat orders.

University of Virginia, Department of Mathematics, Kerchof Hall **Summer 2014**
Mathematics Research, Supervisor: Dr. Andrew Obus
Studied the theory of quadratic forms, especially minimal unique forcing sets under the supervision of Dr. Andrew Obus. Among the more important accomplishments was the design of an algorithm for determining whether a natural number has a unique minimal forcing set within a given superset. Also established a family of numbers without a minimal unique forcing set in T= {1, 2, 3, 5, 6, 7, 10, 14, 15}, which is Manjul Bhargava's minimal forcing set of the natural numbers. Paper in progress entitled "Unique Minimal Forcing Sets and Forced Representation of Integers by Quadratic Forms."

Specific topics studied included Bhargava's theory of escalators, Conway-Schneeberger's 15 Theorem, genus theory, invariant properties of equivalent forms, and the algebraic structure of p-adic fields. Research funded by the Mathematics department and the Provost's office.

University of Richmond, Department of Mathematics and Computer Science, Jepson Hall **Summer 2013-**
Mathematics Researcher, **Supervisor: Dr. James Davis**
Independently and collaboratively confirmed the (previously unknown) existence of (256, 120, 56)-Hadamard difference sets in 33 groups (out of 81 open cases) under the supervision and guidance of Dr. James Davis and using (unpublished) methods described by Taylor Applebaum. The project is of particular interest to the NSA, and as such, I have had correspondence with Dr. John Dillon, who spearheaded the project.

In addition to difference sets research, I independently studied the properties of a [30,10,10] error-correcting code under the guidance of Dr. James Davis. This particular code was the subject of a patent lawsuit between Samsung Group and Apple Inc. Developed a novel construction based on methods described in MacWilliams and Sloane's "Theory of Error Correcting Codes" to produce an improved [30,10,11] code. Paper is in progress entitled "Improving the 3G Code."

Gained experience in applications of error-correction theory, especially relating to Reed-Muller codes, and combinatorial group theory, particularly Hadamard difference sets.

Virginia Commonwealth University, Human and Molecular Genetics Department, Sanger Hall
Lab Assistant, Supervisor: Dr. James Lister **2009– 2010**
In the summer of 2009, I was trained in basic lab protocols, some specifically related to zebrafish research, including gel electrophoresis, PCR, restriction digests, in-situ hybridization, microinjections, dechorionation. In the summer of 2010, I undertook research on a project conceived by Dr. Lister and wrote an accompanying paper:
"The effect of morpholino knockdown of genes TFEB and PKD2 on gene CDH-17 and green fluroscent protein (GFP) expression in the developing kidneys of *Danio Rerio* (zebrafish)."

UPPER-LEVEL COURSEWORK

Lie Algebras (MATH 8710)

Algebra I (MATH 7751)

Advanced Linear Algebra (MATH 5651)

Introduction to Geometry (MATH 5700)

Introduction to Abstract Algebra (MATH 5652)

Number Theory (MATH 5653)

Introduction to Real Analysis (MATH 5310)

General Topology (MATH 5770)

COMPUTER SOFTWARE PROFICIENCIES

Mathematica
Magma
R
GAP

LANGUAGES

English – Native Language
Bengali – Fluent in speaking
French – Basic competency in reading, writing, and speaking.

MEMBERSHIPS & EXTRACURRICULARS

SOCA Men's Soccer League **2013-2014**
I play for an undergraduate team in the Charlottesville SOCA league.

English for Speakers of Other Languages (ESOL) Tutor **Fall 2012**
I tutored at the Adult Learning Center of Charlottesville under UVA's Madison House.
I worked with speakers at the "beginner" level.

Model United Nations **2011-2012**

I staffed for various Model UN conferences under the International Relations Organization (IRO). I create simulations of important historical events.