

Personal details

Personal details

First / given name Paweł
Second given name Marek
Third given name
Surname/family name Nosal
Date of birth 11 October 2001
Preferred first/given name Paweł
Previous surname
Country of birth
Legal nationality
Dual nationality
Country of residence United Kingdom
Have you previously studied with us at the University of Bristol? Yes

Contact details

Home address

Please provide your permanent residential address. If you have another address and would prefer for us to contact you at that address instead you have the opportunity to add a correspondence address in the next section.

Country Poland
Postcode 32-060
Address Line 1 Ściejowice 80
Address Line 2
City Liszki
County
Telephone

If you would like us to send any postal correspondence to an address which is not your home address please enter an alternative address here. If you want us to send correspondence to your home address then please select No.

Do you want to add a correspondence address? No
Country Poland
Postcode 32-060
Address Line 1 Ściejowice 80
Address Line 2
City Liszki
County
Telephone

Agent

Agent details

Agency Name
Email address

Other information

Additional Documents

Please upload required documents as outlined in your admissions statement

Mode of study

How would like to study this Full Time
programme?

Qualifications

Qualifications

Institution	Qualification	Type	Subject	Actual/predicted	Grade	Start date	End date
University of Bristol	Sixth Term Examination Paper	Academic Qualification	Maths 2 Step	Actual			
	Sixth Term Examination Paper	Academic Qualification	Maths Step 3	Actual			
	First degree BA/BSC etc	Academic Qualification		Predicted	1st Grade	28/Sep/2020	09/Jun/2023
	Master's Degree (PG)	Academic Qualification	Mathematics	Predicted	Distinction	01/Oct/2023	15/Jun/2024
University of Oxford	First degree BA/BSC etc	Academic Qualification	Mathematics	Actual	1st Mark	01/Oct/2020	06/Jul/2023

If these qualifications have altered since your last application please note the changes in the free text box here. I have graduated from the University of Bristol BSc Mathematics with Statistics degree with a first mark.

English Language

Is English your first language? No
What is your first language? Polish
Did you study at school/university where you were taught in English? Yes
For how many years? 4
Have you sat a relevant English language test? Yes

TOEFL (internet-based)

Registration number
Date of TOEFL test
TOEFL reading score
TOEFL listening score
TOEFL speaking score
TOEFL writing score
TOEFL total score

IELTS (International English Language Testing System)

Test report form (TRF) number
UKVI number (if applicable)
Date of IELTS test
IELTS listening score
IELTS reading score
IELTS writing score
IELTS speaking score
IELTS total score

Pearson Test of English

Score report code
Date of Pearson test
Pearson listening score

Pearson reading score

Pearson speaking score

Pearson writing score

Pearson overall score

Other English Language test

Name of course Certificate of Proficiency in English (CPE)

Registration number B2315501

Date of test 12 July 2020

Listening score 230/230 points

Writing score 209/230 points

Reading score 190/230 points

Total score 218

Experience

Current Employer

Employer name and address

Job title and main duties

Full time/Part time

Date of Appointment

End date (if applicable)

Previous employment 1

Employer name and address

Job title and main duties

Full time/Part time

Date of Appointment

End date (if applicable)

Previous employment 2

Employer name and address

Job title and main duties

Full time/Part time

Date of Appointment

End date (if applicable)

Previous employment 3

Employer name and address

Job title and main duties

Full time/Part time

Date of Appointment

End date (if applicable)

Other Experience

**Do you have any other relevant
work experience to support your
application?**

Please provide details

Personal statement

Personal details

Do you have a personal statement to upload?

Please type your personal statement in the box

Research proposal

Research proposal

Proposed supervisor 1

Proposed supervisor 1

Proposed project title
(max 150 chars)

Passport and visa

Visa required

Do you require a visa to study in the UK? No

Please fill out your passport details below. If you are unable to provide these at the current time you will have another opportunity to upload your passport after you submit the form. If you do not provide us with this information we will be unable to issue you with your confirmation of acceptance number and you will be unable to obtain a visa.

Passport details

Passport number

Further details

Have you previously studied in the UK?

What was the highest level of study in the UK?

Please confirm the total length of your UK study in years

Referees

Referee 1

Do you have a reference to upload? No

Type of reference Academic

Referee title Dr

Forename Oleksiy

Surname Klurman

Position Associate Professor

Institution/Company University of Bristol

Email address oleksiy.klurman@bristol.ac.uk

Country United Kingdom

Referee 2

Do you have a second reference to upload? No

Type of reference Academic

Referee title Dr

Forename Mike

Surname Blake

Position Associate Professor

Institution/Company University of Bristol

Email address mike.blake@bristol.ac.uk

Country United Kingdom

Funding

Funding 1

What is your likely source of funding? University of Bristol scholarship

Please give the name of your scholarship or Studentship
Please specify

Percentage from this source 100

Is this funding already secured? No

Funding 2

What is your likely source of funding?

Please give the name of your scholarship or Studentship
Please specify

Percentage from this source

Is this funding already secured?

Funding 3

What is your likely source of funding?

Please give the name of your scholarship or Studentship
Please specify

Percentage from this source

Is this funding already secured?

Other funding

I would like to be considered for other funding opportunities Yes

Documents

Document type	File name
Transcript	2015923 - NOSAL - Transcript v3.pdf
Curriculum vitae	CV.pdf
Transcript	Oxford courses taken.pdf
Personal statement	Bristol PhD PS.pdf
Research proposal	Research_Statement_Bristol.pdf

By ticking the checkbox below and submitting your completed online application form, you acknowledge the University of Bristol will use the information provided from time to time, along with any further information about you the University may hold, for the purposes set out in the [University's full Data Protection Statement](#). Applicants applying to the collaborative programmes of doctoral training should also read the [Data Protection Statement](#) for collaborative programmes of doctoral training.

The information that you provided on your application form will be used for the following purposes:

- To enable your application for entry to be considered and allow our Admissions Advisors, where applicable, to assist you through the application process;
- To enable the University to compile statistics, or to assist other organisations to do so. No statistical information will be published that would identify you personally;
- To enable the University to initiate your student record should you be offered a place at the University.

All applicants should note that the University reserves the right to make without notice changes in regulations, courses, fees etc at any time before or after a candidate's admission. Admission to the University is subject to the requirement that the candidate will comply with the University's registration procedure and will duly observe the Charter, Statutes, Ordinances and Regulations from time to time in force.

By ticking the checkbox below and submitting your completed online application form, you are confirming that the information given in this form is true, complete and accurate and that no information requested or other material information has been omitted. You are also confirming that you have read the Data Protection Statement and you confirm the statement below.

I can confirm that the information I have provided is true, complete and accurate. I accept that the information given in my application will be stored and processed by the University of Bristol, in accordance with the *UK General Data Protection Regulation and Data Protection Act 2018*, in order to:

- Consider my application and operate an effective and impartial admissions process;
- Monitor the University's applicant and student profile;
- Comply with all laws and regulations;
- Ensure the wellbeing and security of all students and staff;
- If my application is successful to form the basis of the statement made within my application.

If the University of Bristol discovers that I have made a false statement or omitted significant information from my application, for example examination results, I understand that it may have to withdraw or amend its offer or terminate my registration, according to circumstances.

CV

MSC · MATHEMATICAL SCIENCES

University of Oxford, St Anne's College, 56 Woodstock Rd, Oxford OX2 6HS

✉ pawel.nosal@st-annes.ox.ac.uk, pawel.nosal12@gmail.com

Profile

MSc Mathematical Sciences student at the University of Oxford, whose greatest motivation is the desire to learn, planning to become a researcher. Previously BSc Mathematics with Statistics student at University of Bristol. Solid communication, team working, and problem solving skills, developed through work on my degree, helping out as a teacher assistant in the School of Mathematics at University of Bristol, paid and unpaid research and independent extracurricular study in my free time. Outside of that, brazilian jiu-jitsu practitioner, gym enthusiast and chess fan. Main areas of interest in mathematics are Number Theory and Probability Theory.

Education

University of Oxford

MSC MATHEMATICAL SCIENCES

Oxford

09.2023 - Present

University of Bristol

BSc MATHEMATICS WITH STATISTICS

Bristol

09.2020 - 06.2023

Year 3

- Complex Functions Theory (88, 1st Mark)
- Martingale Theory with Applications 3 (86, 1st Mark)
- Measure Theory and Integration (90, 1st Mark)
- Number Theory (96, 1st Mark)
- Theory of Inference (82, 1st Mark)
- Year 3 Project - Concentration Inequalities [Supervisor: Professor Bálint Tóth] (77, 1st Mark)

Year 2

- Algebra 2 (92, 1st Mark)
- Mathematical Programming (88, 1st Mark)
- Metric Spaces (89, 1st Mark)
- Multivariable Calculus and Complex Functions (78, 1st Mark)
- Probability 2 (76, 1st Mark)
- Statistics 2 (88, 1st Mark)

Year 1

- Analysis (89, 1st Mark)
- Introduction to Proofs and Group Theory (88, 1st Mark)
- Linear Algebra (81, 1st Mark)
- Mathematical Investigations (73, 1st Mark)
- ODEs, Curves and Dynamics (89, 1st Mark)
- Probability and Statistics (83, 1st Mark)

Experience

- 2023-2023 **Summer Research Associate (under Summer Studentship Scheme)**, School of Mathematics, Faculty of Science, University of Bristol
- 2022-2023 **Undergraduate Teacher Assistant, Algebra 2**, School of Mathematics, Faculty of Science, University of Bristol
- 2022-2023 **Undergraduate Teacher Assistant, Metric Spaces**, School of Mathematics, Faculty of Science, University of Bristol
- 2022-2023 **Student Ambassador**, School of Mathematics, Faculty of Science, University of Bristol

Awards

- 2023 **Henry Ronald Hasse Finalist Prize for the best final year single honours maths student(s)**, University of Bristol, School of Mathematics
- 2021 **Honorary Mention**, International Mathematical Competition
- 2020 **The Regional Scholarship Programme co-financed with the EU 2019/2020**, Voivodeship Board of Małopolska
- 2019 **Silver Rose Award**, Society of the Creative Schools of Poland
The Regional Scholarship Programme co-financed with the EU, 2018/2019, Voivodeship Board of Małopolska
- 2018 **Prime Minister Scholarship**, Mateusz Morawiecki, Prime Minister of Poland

Development

In preparation to future work I conducted the following projects:

Summer Internship 2023 - Consequences of Riemann Hypothesis, Supervisor: Doctor Ethan S Lee. In summer 2023 I was one of the students granted the possibility to conduct a summer research project of my choice, where I was funded by the School of Mathematics, University of Bristol. The project involved careful study of problems in Analytic Number Theory, with focus on ones directly connected to distribution of non-trivial zeros of the Riemann zeta function. The project culminated in a paper titled "Sharper bounds for the error in the prime number theorem assuming the Riemann Hypothesis", where Dr. Lee and I improve the best current bounds for error in the Prime Number Theorem assuming Riemann Hypothesis. Paper should be available on arXiv.

Year 3 project: "Concentration Inequalities and Cramér's Large Deviations Theorem", Supervisor: Professor Bálint Tóth. Project under the supervision of Professor Tóth, goal of which was to get familiar with the theory of probability concepts outside the scope of previously taken units. Topics included Hoeffding's Inequality, Bernstein's Inequality and Cramér's Large Deviations Theorem.

Summer research project in Analytic Number Theory Problems, Supervisor: Doctor Oleksiy Klurman. Spent the summer 2022 working with Dr. Klurman on problems in analytic number theory, with aim of getting familiar with non-elementary Number Theory results. Problems covered involve Dirichlet's Theorem on Primes in Arithmetic Progressions and Prime Number Theorem, as well as various questions connected to Dirichlet characters and multiplicative functions.

Papers

PREPRINTS

Nosal P, Lee E. 2023. Sharper bounds for the error in the prime number theorem assuming the Riemann Hypothesis, arXiv:2312.05628

Paweł Nosal — Personal Statement for Phd in Mathematics, University of Bristol

I have always believed that human beings live in pursuit of laws governing the universe. Since I can remember, I have considered maths to be one of the fundamental truths, with number theory holding a particularly special place in my heart.

My fascination with the theory of numbers started similarly to most enthusiasts of the subject. I was a young child, fascinated by the puzzles I saw in Polish mathematical competitions, with many of them relating to and using properties of those weird-looking numbers called primes. It was only in high school, that I discovered number theory as a field of mathematics. It instantly sparked my interest and made me consider pursuing this area seriously. It all culminated in me leaving my home country to arrive at the University of Bristol, where I had the chance to undertake the undergraduate degree in Mathematics and ultimately find myself at Oxford, where I am currently studying to complete a graduate MSc degree in Mathematical Sciences.

Throughout the last 4 years of my university journey, I have been exploring my interests by taking relevant courses in my respective degrees, for example, the Complex Analysis and Number Theory courses at the University of Bristol and the courses that I am currently attending, or planning to attend at the University of Oxford such as Modular Forms, Additive Combinatorics and Analytic Number Theory.

Beyond these courses, my passion led me to spend the past two summers working on analytic number theory. During the summer of 2022, I worked with Dr Oleksiy Klurman on some problems concerning completely multiplicative functions, connected to Dirichlet characters. I covered the fundamentals of analytic number theory, going over Apostol's "Introduction to Analytic Number Theory" as well as sections of "Multiplicative Number Theory" of Davenport. The preceding summer, I received an offer to work as a summer student researcher at the University of Bristol, where under the guidance of Dr Ethan Lee, I researched the consequences of the Riemann Hypothesis. Throughout the course of the internship, I familiarised myself with results from Murty's "Problems in Analytic Number Theory" as well as Titchmarsh's classic work on the Riemann zeta function. The result of this project is a paper that Dr Lee and I have currently put on arXiv, titled "Sharper bounds for the error in the prime number theorem assuming the Riemann Hypothesis". In this paper, we provide an improvement to the current well-known conditional bounds for the error in the prime number theorem.

Another project I am particularly proud of completing, is a Third Year project I have wrote under the supervision of Professor Bálint Tóth in my final year at the University of Bristol on the topic of Concentration Inequalities. This project introduced me to the concept of using probabilistic methods to prove non-probabilistic results. Two seemingly different fields of mathematics coming together opened my eyes to different possibilities of studying number theory.

I was recently accepted to write my master's dissertation on the Hardy—Littlewood Method with Professor Ben Green as my supervisor. I believe that the experience I get out of this project will help me become a better mathematician and give me a glimpse of what a PhD in a related field would look like.

My passion for learning also prompted me to solidify the fundamentals of the courses I have already undertaken, which resulted in me getting a job as a Teacher Assistant in the 2022/2023 academic year at the School of Mathematics of the University of Bristol. I was leading two problem classes for my younger colleagues, one in Metric Spaces and one in Algebra 2. I imagine the above experience would translate well to conducting classes for undergraduates as a PhD student.

Judging by the above, my application to pursue further post-graduate study at Bristol is not

very surprising. Considering my ongoing passion for number theory, the prospect of working with the brightest minds in the field is incredibly exciting. I would consider my interests to be reasonably well-matched with Dr Oleksiy Klurman, whom I would like to propose as a potential PhD supervisor. My interest in studying sums of multiplicative characters seem to align particularly well with Dr Klurman's research. I would also like to express my interest in working under a joint supervision of Dr Klurman and Dr Joseph Najnudel, whose research project advertised on the university website seems very interesting, as it would allow me to joint my interest in sums of multiplicative functions and probability.

I know that the PhD in Mathematics at Bristol is a programme that offers the perfect environment for mathematicians to grow and learn. Nonetheless the most important thing for me, is that it would give me a chance to keep doing what I love at the highest level.

Last but not least, I wish to let you know that I would like to be considered for the Heilbronn Doctoral Partnership, apart from other funding opportunities. I would be grateful for your consideration.

About Me

I am an MSc Mathematical Sciences student at the University of Oxford, previously BSc Mathematics with Statistics student at the University of Bristol. My greatest motivation is the constant desire to learn, with the hopes of working in research. My main area of interest is Number Theory. I became infatuated with this subject in my teens, which resulted in pursuing my degree in the UK, where I engaged in many research related activities, as well as explored Number Theory to the best of my ability. I enjoy problems with an analytic flavour, which coupled with my love for Number Theory, evolved into my current major interest in the analytic branch of the theory of numbers. My secondary interests lie in Probability Theory.

Previous Research Experience

As an applicant to PhD in Mathematics I have undertaken three significant projects with the aim of preparing for a research role.

The first one was a summer research project in analytic number theory under the supervision of Dr Oleksiy Klurman. The goal of the project was getting familiar with non-elementary results of Number Theory, such as Dirichlet's Theorem on Primes in Arithmetic Progressions and Prime Number Theorem. Moreover, the summer research also brought rise to many interesting questions connected to Dirichlet characters. Most notably, I was working with partial sums of multiplicative arithmetic functions defined as a slight modification of typical Dirichlet characters, exploring order of partial sums, their maxima and general behaviour.

The second of them was a Third Year thesis in my final year at the University of Bristol, in the field of Probability Theory, which I wrote under the supervision of Professor Bálint Tóth. The aim was to familiarize myself with measure concentration inequalities, explore their properties and applications. The final part of the task aimed to prove and understand Cramer's Large Deviations Theorem, a celebrated asymptotic result in probability theory. In the project I presented one application of probabilistic method to high-dimensional geometry, which opened my eyes to possibilities of exploring number theory using stochastic tools.

My third and biggest ongoing project is a result of the Summer Research Studentship I was admitted to at the University of Bristol last summer. Under the supervision of Dr Ethan Lee I explored a variety of topics in analytic number theory. Those included problems related to the distribution of zeros of the zeta function, like understanding the classical zero-free region due to De la Vallée Poussin, the asymptotically superior variant due to Koborov and Vinogradov and Stetchkin's improvement to the classical zero-free region. I also spent a significant amount of time studying the error term in the prime number theorem, as well as problems related to primes in short and long intervals.

The project continued further after the summer and resulted in a paper Dr Lee co-authored with me, titled "Sharper bounds for the error in the prime number theorem assuming the Riemann Hypothesis". In this paper, we improve the current well-known bounds of the error in the prime number theorem due to Rosser and Schoenfeld. The preprint is available on arXiv and in the upcoming future will be submitted to a journal. Feel free to take a look and send me any comments that you might have!

Currently I got accepted to write my Master's dissertation under the supervision of Professor Ben Green on the topic of the Hardy—Littlewood Method. I believe that the experience I get out of this project will help me become a better mathematician and give me another glimpse of what a PhD in a related field

would look like.

Research Goals

In my research as a PhD in Mathematics student I would like to recommence my work with Dr Oleksiy Klurman, continuing my work on multiplicative functions and their properties, although I will gladly explore any other analytic number theory related topic. I am also happy to work on any problems concerning distribution of primes, properties of different kind of the zeta function and study their connections to other areas. Given the opportunity, I would love to connect my passion for number theory with my interests in probability, through undertaking a project under joint supervision of Dr Oleksiy Klurman and Dr Joseph Najnudel, studying random multiplicative functions on integers and randomized modifications of the zeta function. The use of probabilistic methods has been an avenue of interest for me for quite some time.

The goal of my research in the first year would be to build off my experience in the field so far, and conduct a more thorough exploration of related problems, in preparation for doctoral work, with hopes of original findings. In particular, I am planning to focus on problems related to ± 1 valued multiplicative functions with small partial sums, which are related to Erdős discrepancy problem. I plan to quickly organize an efficient work schedule and aim to develop a skillset and a wide range of mathematical tools, that would provide me with good base for working in research long-term. I believe I could acquire it working under the guidance of Dr Klurman, whose research interests are closely related to mine, and with whom I already had a pleasure of working with. Given the opportunity, I would be open to possibilities of exploring collaborative research with others, outside of my current comfort zone, however I would still prefer the ultimate goal of my project to be exploration of the aforementioned topics in analytic and probabilistic number theory.

UNIVERSITY OF BRISTOL TRANSCRIPT/DIPLOMA SUPPLEMENT

This transcript incorporates the model developed by the European Commission, Council of Europe and UNESCO/CEPES for the Diploma Supplement (DS) and aspects of the Higher Education Achievement Report. The purpose of the transcript/DS is to provide sufficient recognition of qualifications and it is designed to provide a description of the nature, level, context and status of the studies that were pursued and successfully completed by the named individual. Further information about the Diploma Supplement is available at <https://europa.eu/europass/en/diploma-supplement> and the Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies at <https://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf>.

Name of Student	Pawel Marek Nosal
Date of Birth	11 October 2001
University Reference	2015923/1
HESA Reference	2011120159233
Qualification	Bachelor of Science
FHEQ Level	Bachelor's Degree (Honours and Ordinary)
Programme of Study	Mathematics with Statistics (BSc)
Length of Programme (on a full time basis)	3 Year(s)
Faculty	Faculty of Science
Mode of Study	Full Time
Awarding/Teaching Institution	University of Bristol
Language(s) of Instruction/Assessment	English

2020/21 Mathematics with Statistics (BSc)	Unit Level	Unit Status	1st Mark	1st Outcome	Additional Attempt	Additional Mark	Additional Outcome	Credit
MATH10009 Mathematical Investigations	4	C	73	P				20
MATH10010 Introduction to Proofs and Group Theory	4	C	88	P				20
MATH10011 Analysis	4	C	89	P				20
MATH10012 ODEs, Curves and Dynamics	4	C	89	P				20
MATH10013 Probability and Statistics	4	C	83	P				20
MATH10015 Linear Algebra	4	C	81	P				20
Credit points awarded in this academic year								120
Cumulative credits								120
2021/22 Mathematics with Statistics (BSc)	Unit Level	Unit Status	1st Mark	1st Outcome	Additional Attempt	Additional Mark	Additional Outcome	Credit
MATH20006 Metric Spaces	5	O	89	P				20
MATH20008 Probability 2	5	O	76	P				20
MATH20014 Mathematical Programming	5	O	88	P				20
MATH20015 Multivariable Calculus and Complex Functions	5	O	78	P				20
MATH20800 Statistics 2	5	O	88	P				20
MATH21800 Algebra 2	5	O	92	P				20
Credit points awarded in this academic year								120
Cumulative credits								240



UNIVERSITY OF BRISTOL TRANSCRIPT / DIPLOMA SUPPLEMENT

Academic Information

1. The University's qualifications and the number and level of credit points required for each qualification, as set out in the University's credit framework, are provided at: www.bristol.ac.uk/academic-quality/assessment/regulations-and-code-of-practice-for-taught-programmes/programme-design/.
2. Students with prior learning may be admitted directly into a programme of study, see: www.bristol.ac.uk/academic-quality/assessment/regulations-and-code-of-practice-for-taught-programmes/rpl/.
3. The pass mark is 40 for units at levels 4-6 and 50 for level 7 and units on the Veterinary Science, Medicine and Dentistry programmes. A unit may be marked on a pass/fail basis where no numerical mark is given. For the purposes of determining progression and degree classification, the unit mark may be capped at the pass mark where it is achieved at the second attempt.
4. The University's regulations for awarding qualifications and degree classification, including the classification bands, are available, by academic year at: www.bristol.ac.uk/academic-quality/assessment/.
5. Explanation of Unit Status Symbols:

C	Compulsory	O	Optional	V	Voluntary
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Explanation of Outcome Symbols:

P	Pass
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6. Further details relating to programme outcomes, structure, methods of assessment, access requirements and any professional skills/status obtained are outlined in the University's Programme Specifications at: www.bristol.ac.uk/prog-catalogue/.
7. If there are queries regarding the content of this Transcript, or if it is required in an alternative format, please contact the relevant Faculty Office (www.bristol.ac.uk/faculties/).

Name of Student Pawel Marek Nosal
 Date of Birth 11 October 2001
 University Reference 2015923/1
 HESA Reference 2011120159233

2022/23 Mathematics with Statistics (BSc)	Unit Level	Unit Status	1st Mark	1st Outcome	Additional Attempt	Additional Mark	Additional Outcome	Credit
MATH30007 Measure Theory and Integration	6	O	90	P				20
MATH30027 Martingale Theory with Applications 3	6	O	86	P				20
MATH30200 Number Theory	6	O	96	P				20
MATH32200 Project 1	6	O	77	P				20
MATH33000 Complex Function Theory	6	O	88	P				20
MATH35600 Theory of Inference	6	C	82	P				20
Credit points awarded in this academic year								120
Cumulative credits								360

Award Bachelor of Science in Mathematics with Statistics
 Classification (If any) With First Class Honours
 Commendation (If any)
 Date of Award 6 July 2023
 Date Transcript Issued 24 July 2023

Issued by: Paula Coonerty, Academic Registrar Signature:




UNIVERSITY OF BRISTOL TRANSCRIPT / DIPLOMA SUPPLEMENT

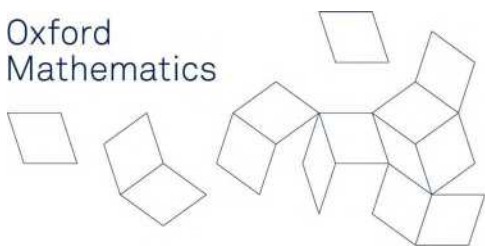
Academic Information

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5. Explanation of Unit Status Symbols:

C	Compulsory	O	Optional	V	Voluntary
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Explanation of Outcome Symbols:

P	Pass
---	------
6. Further details relating to programme outcomes, structure, methods of assessment, access requirements and any professional skills/status obtained are outlined in the University's Programme Specifications at: www.bristol.ac.uk/prog-catalogue/.
7. If there are queries regarding the content of this Transcript, or if it is required in an alternative format, please contact the relevant Faculty Office (www.bristol.ac.uk/faculties/).



11th December 2023

To Whom It May Concern

Re: Paweł Nosal – MSc in Mathematical Sciences

I am writing to confirm that Paweł Nosal is enrolled in the full time MSc in Mathematical Sciences running from 1st October 2023 to 30th June 2024 at the Mathematical Institute, University of Oxford. All assessment takes place at the end of the course and so no marks, and hence no official transcript, are available yet. Students are required to complete six lecture courses and a double unit dissertation in order to complete the MSc. There is also the possibility of taking one or two extra lecture courses. Students will make the final decision on which courses to be assessed on part way through the second term.

Further information about the student:

Teaching institution:	University of Oxford, Mathematical Institute
College:	St Anne's College
Mode of attendance:	Full-time
Lecture courses (term 1):	Additive Combinatorics Combinatorics Modular Forms Analytic Topology
Provisional lecture courses (term 2):	Analytic Number Theory Elliptic Curves Limits Theorems in Probability Random Matrix Theory
Dissertation topic:	The Hardy-Littlewood Method
Dissertation supervisor:	Ben Green

Please do not hesitate to get in touch by emailing kathryn.gillow@maths.ox.ac.uk if there is any further information I can provide.

Yours faithfully,



Dr Kathryn Gillow
Course Director for the MSc in Mathematical Sciences



UNIVERSITY OF BRISTOL

We hereby certify that

Paweł Marek Nosal

*having duly satisfied the Examiners appointed by Senate
and having fulfilled all the conditions prescribed
by ordinance and regulations
by resolution of the Board of Trustees
was awarded the Degree of*

**BACHELOR OF SCIENCE
in Mathematics with Statistics
with First Class Honours**

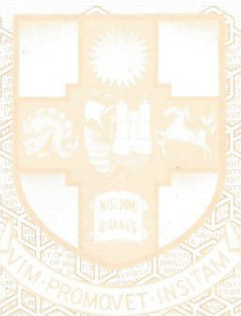
on the

6 July 2023

VICE - CHANCELLOR
AND PRESIDENT

2015923

REGISTRAR AND
UNIVERSITY SECRETARY



UNIVERSITY
OF BRISTOL



Dr. Oleksiy Klurman

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School of Mathematics,
University of Bristol,
Fry Building, Bristol, BS8 1 UG, UK
T +44 (0)117 924 9317
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In Fall of 2020, I lectured first part of the Real Analysis course and Mr. Pawel Nosal (Pawel) was a student of mine. He established a reputation of being one the top out of 340 students who were taking the course scoring 92%. Pawel was always extremely well prepared for both live-streamed problem sessions and the tutorials, and very actively involved in the class discussion. He has an excellent way of presenting his ideas and solutions - the explanations were always very natural and clear. Not only was he solving all assigned homework problems, but he also worked through all the exercises in our booklet! Some of them were quite challenging and his ability to come up with clever solutions indicates high level of creativity. Pawel attended practically all the online office hours and so I know him well. In contrast to most of other students, who usually come to ask some exercises he was always interested in "the ideas behind the concepts." We have been discussing the most challenging problems from the course and I was often developing them into more advanced topics that connect Analysis to Number Theory and Probability.

In Spring of 2021, I started offering extracurricular problem classes focusing on topics in competitive mathematics (those of Putnam style). The topics of our meetings cover multiple subjects including Algebra, Analysis, Combinatorics, Probability and several others. Pawel is a driving force for such meetings and certainly one of the very best students there. He has particularly strong intuition when it comes to questions of analytic and probabilistic flavour. While still a second year student, Pawel voluntarily attended all my lectures in the third year Number Theory course, actively engaging in the class discussions and getting top scores for all assessed homework as well as solving all bonus questions.

In the summer of 2022, Pawel asked if we could work on some number theoretic topics as an extracurricular activity and I gladly agreed. To get started on the subject of multiplicative number theory, I asked Pawel to work through chapters of Apostol's "Introduction to Number Theory" book which he has successfully finished in a remarkably short period of time.

The aim of our research project is to better understand "extremal" examples in the famous Erdős discrepancy problem (EDP). Tao in his solution to the EDP, reduced the problem to showing that $\sup_x |\sum_{n \leq x} f(n)| = \infty$ for any completely multiplicative function $f : N \rightarrow \{\pm 1\}$. It is a deep conjecture in the field that for such objects to have uniformly small partial sums (to be precise, $\ll \log x$) it is necessary for f to be of a special form (what is now called "modified characters" of the prime power conductor). During this time, Pawel proved that in the class of "modified characters" a sharp upper bound for such partial sums is $c_p \log x$, where miraculously c_p is the constant related the distribution of the *largest positive* character sums $\sum_{n \leq x} \chi_p(n)$ where χ_p is a quadratic character of prime modulus p . This naturally connects that problem with flourishing area of analytic number theory, which studies the distribution of the character sums. Pawel discovered (and already partially proved) interesting features related to the distribution of

the sing changes of partial sums of modified characters.

In the meantime, Pawel informed me that he would like to pursue Ph.D. in number theory and so I suggested that he applies to Oxford for MSc. first to get experience with advanced courses in Analytic Number Theory and Additive Combinatorics. At the same time, he won a bursary and started working with our Heilbronn postdoc Ethan Lee. In their preprint, they combined various methods from explicit number theory and the state-of-art information on the zeros of Riemann zeta function, to give an explicit improvement to the classical bound of Schoenfeld on the prime counting function. The paper contains some nice technical innovation and certainly shows that Pawel already has strong grasp of many analytic techniques required for successful Ph.D. study.

From my experience, I strongly believe that Pawel Nosal, as a Ph.D. student, would be an excellent addition to any top Mathematics Department.

I would thus like to end this letter by providing Pawel Nosal with the strongest possible recommendation.

Please do not hesitate if any further information is required.

A handwritten signature in black ink, appearing to be 'K3' or similar, with a stylized, cursive-like form.



Dr. Mike Blake
Associate Professor in
Theoretical Physics
School of Mathematics,
University of Bristol,
13th December 2023.

To whom it may concern,

It is a pleasure to write this letter to offer my strongest support to Pawel Nosal's application to study for the Mathematics (PhD) at the University of Bristol. I have known Pawel since October 2020, and was his academic personal tutor during his time studying for a BSc in Mathematics with Statistics at the University of Bristol from which he graduated in June 2023 with an outstanding first-class honours degree. Beyond his raw academic achievements, which I highlight below, Pawel has already obtained significant research experience and is now studying for an MSc in Mathematical Sciences at the University of Oxford. In my view he would make an exceptional member of any PhD programme.

Pawel is an exceptionally talented student, one of the very strongest I have encountered at Bristol. His marks in our undergraduate examinations were consistently outstanding as you can see from his transcript, with many unit marks above 85 and 90. To highlight a few final year units, his marks in Number Theory (96), Measure Theory and Integration (90) and Complex Function Theory (88) were outstanding. To place his achievements in the proper context, let me note that Pawel obtained an overall programme mark of 87, which ranked as the joint second highest mark amongst single-honours mathematics students. As a result he was awarded the **Henry Ronald Hasse Prize**, given to the final year honours student who has, 'in the opinion of the examiners in the School of Mathematics, obtained the highest proficiency in Mathematics courses' [I note the award was shared with two other students].

I myself have taught Pawel on two units - a first-year unit 'Mathematical Investigations' in which students worked on group projects, and a second-year unit 'Multivariable Calculus and Complex Functions'. Although these units were some time ago now, he impressed me enormously in both. In particular, he took a leading role in all of the group projects he worked on, often exploring topics in far more detail than necessary, including performing his own numerical simulations in a project studying probabilistic descriptions of poker. His mark of 78 in the Multivariable Calculus and Complex Functions unit was also exceptional, given that the marks across the whole student year group were exceptionally low for this exam.

However, what has impressed me most about Pawel is not his raw academic marks, but a genuine passion for learning mathematics and in particular an ability to learn independently. From his very first term at Bristol, Pawel was already reading advanced textbooks and material way beyond what I would expect of a first-year student. On multiple occasions he has asked for access to the resources for units he is not taking for examination. He has been especially keen to study topics in analysis, probability and number theory, which are particular passions of his.

As well as being able to learn material independently, Pawel has also undertaken several research projects during his time at Bristol. In the summer of 2022, he worked with Dr. Oleksiy Klurman gaining experience in research in analytic number theory, and during the academic year 2022/2023 undertook a project unit working with Prof. Bálint Tóth on an advanced problem in probability theory. My understanding is that this was a rather intensive collaboration. Of his experience working with Pawel, Prof. Tóth informed me that that 'Pawel made a very good impression on me. He has a very strong mathematical background, in particular, in analysis... He is also ambitious, motivated and diligent I have no doubt about his ability and determination to pursue a successful academic career.'

Prof Tóth's highly positive view of Pawel and his ability to pursue research are consistent with my own impressions. Furthermore, in addition to his research potential, Pawel is a positive, engaging presence, who I believe any supervisor would enjoy working with. He is responsible and diligent, and has been trusted by the School of Mathematics to deliver Maths Cafe sessions tutoring other students on the second year units Algebra 2 and Metric Spaces.

In summary, Pawel is an exceptional student. He has consistently obtained excellent marks in examinations, performed extensive additional reading on his own, and undertaken multiple research projects. I believe his research potential is extremely high, and his current MSc programme at Oxford will provide ideal preparation for a PhD degree. As such he has my strongest possible recommendation to study for the Mathematics (PhD) at the University of Bristol.

Yours sincerely,

Dr. Mike Blake

A handwritten signature in black ink, appearing to read 'mblake'.