2013 Colloquia in Combinatorics
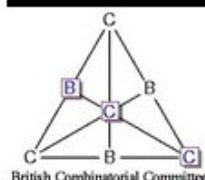
Two consecutive one-day events hosted by QMUL and LSE

A full report of the event can be read here

Queen Mary University of London

Julia Böttcher (LSE)

Ben Green (Cambridge)

Simon Griffiths (IMPA)

Dan Hefetz (Birmingham)

Wojciech Samotij (Tel Aviv)

Anusch Taraz (Munich)

Venue: Maths Lecture Theatre, Mathematical Sciences Building, QMUL

Contact: Prof Peter Keevash (p.keevash@qmul.ac.uk)

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE ■

Noga Alon (Tel Aviv)

Roman Glebov (Warwick)

Gábor Kun (Budapest)

Viresh Patel (Birmingham)

Endre Szemerédi (Budapest)

Julia Wolf (Paris)

Venue: New Theatre, East Building, LSE (room number: EAS.E171)

Contact: Dr Jozef Skokan (j.skokan@lse.ac.uk)

Those interested are welcome to attend for all or any part of the event. The two hosting institutions are less than half an hour apart by tube; it is hoped that many people will be able to attend for both days. There is no formal registration process and seats will be allocated each day on a first come, first served basis.

Queries should be sent to Rebecca Lumb.

Funding

Some funds are available to contribute to the **basic** travel expenses of research students who wish to attend the meetings. We would ask you to keep costs to a minimum, using public transport on **all** occasions and off-peak student travel tariffs wherever possible. Receipts for all journeys must be maintained as proof of travel. At this stage, we are unable to confirm the maximum amount available; please contact Rebecca Lumb for further information.

There are also some funds available from the London Mathematical Society for help with childcare costs. Further details can be found at http://www.lms.ac.uk/content/childcare-supplementary-grants.

Event Support

Support for this event by the London Mathematical Society and the British Combinatorial Committee is gratefully acknowledged by the organisers.

Supported by

British Combinatorial Committee

LONDON MATHEMATICAL SOCIETY

Full event programme

Report of the event

Wednesday 15 May 2013
Start time: 10:30 (coffee from 10:00)
Venue: Maths Lecture Theatre, Mathematical Sciences Building, QMUL *(campus map:* http://www.qmul.ac.uk/docs/about/26065.pdf. *Please note: this is not the same venue as last year)*

Time	Speaker (Institution)	Presentation title
10:00	Coffee	
10:30	Anusch Taraz (Munich)	*Density and Ramsey results concerning graphs with sublinear bandwidth*
11:20	Julia Böttcher (LSE)	*A Blow-up Lemma for sparse graphs*
12:10	Lunch *(own arrangements – options on campus and nearby)*	
13:30	Wojciech Samotij (Tel Aviv)	*Typical structure of graph homomorphisms*
14:20	Danny Hefetz (Birmingham)	*Winning strong games through fast strategies for weak games*
15:10	Afternoon tea break	
15:40	Simon Griffiths (IMPA)	*The triangle-free process and R(3,k)*
16:30	Ben Green (Cambridge)	*The sum-free set constant is 1/3*
17:20	End	

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE ■

Thursday 16 May 2013
Start time: 10:00
Venue: New Theatre, East Building, LSE (room number: EAS.E171)
(*map and directions:* http://www2.lse.ac.uk/mapsAndDirections/findingYourWayAroundLSE.aspx)

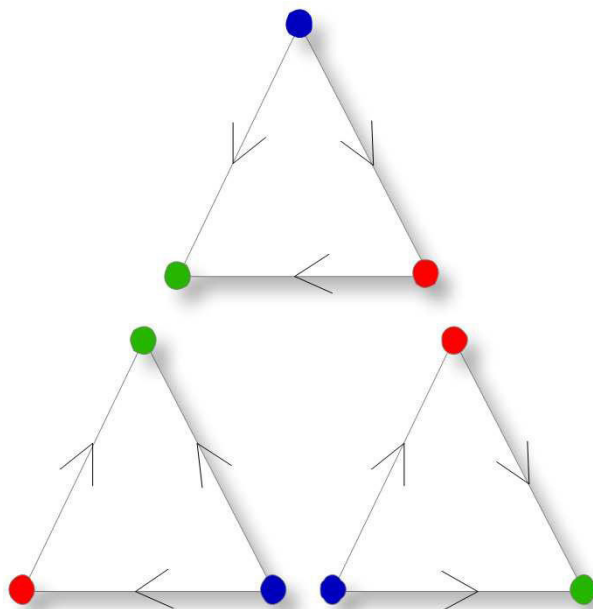| Time	Speaker (Institution)	Presentation title
10:00	Roman Glebov (Warwick)	*On bounded degree spanning trees in the random graph*
10:50	Coffee break	
11:20	Endre Szemerédi (Budapest)	*A new proof of the Pósa-Seymour Conjecture*
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13:00	Lunch *(own arrangements – options on campus and nearby)*	
14:10	Viresh Patel (Birmingham)	*A conjecture of Thomassen on Hamilton cycles in highly connected tournaments*
15:00	Afternoon tea break	
15:30	Julia Wolf (Paris)	*Sumsets, sampling and almost periodicity*
16:20	Noga Alon (Tel Aviv)	**THE NORMAN BIGGS LECTURE:** *Random Cayley graphs*
17:20	End	

Queen Mary, University of London

The London School of Economics and Political Science

Two One-Day Colloquia in Combinatorics
2013

15th & 16th May 2013

If attending both days, please keep this programme for day two

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INFORMATION

Those interested are welcome to attend for all or any part of the event; it is hoped that many people will be able to attend for both days.

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Event organisers: Prof Peter Keevash (QMUL) and Dr Jozef Skokan (LSE).

SUPPORT

Support for this event by the London Mathematical Society (www.lms.ac.uk) and the British Combinatorial Committee (www.maths.qmul.ac.uk/~pjc/bcc) is gratefully acknowledged.

British Combinatorial Committee

LONDON MATHEMATICAL SOCIETY

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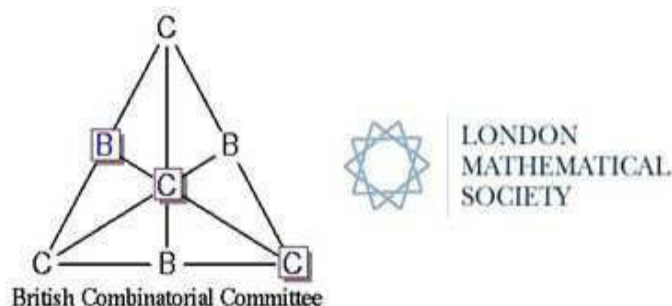
WEDNESDAY 15th MAY 2013:
Schedule

The first day of the Colloquia in Combinatorics will be held at Queen Mary, University of London on Wednesday 15th May, starting at 10.30am. Everyone interested is welcome to attend any part of the event. All the talks will be held in the Maths Lecture Theatre, Mathematical Sciences Building, Mile End Campus, QMUL.

Time	Speaker (Institution)	Presentation title
10:00	Coffee	
10:30	Anusch Taraz (Munich)	Density and Ramsey results concerning graphs with sublinear bandwidth
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16:30	Ben Green (Cambridge)	The sum-free set constant is 1/3
17:20	End	

Density and Ramsey results concerning graphs with sublinear bandwidth

Anusch Taraz

The existence of Hamilton paths and cycles in host graphs satisfying certain conditions is one of the central questions in extremal graph theory. We survey recent results that generalize these questions from paths to spanning graphs with sublinear bandwidth and discuss bounds on the 2- and 3-colour Ramsey numbers of planar graphs and grids in particular.

A Blow-up Lemma for sparse graphs

Julia Böttcher

The Blow-Up Lemma of Komlós, Sárközy and Szemerédi is an important tool for embedding large graphs H into dense graphs G. We recently obtained versions of this lemma for subgraphs G of sparse random and pseudo-random graphs.

In the talk I will explain our results, outline the methods we use in the proofs and describe some applications.

Joint work with Peter Allen, Hiep Hán, Yoshi Kohayakawa and Yury Person

Typical structure of graph homomorphisms

Wojciech Samotij

Given two graphs G and H, a graph homomorphism from G to H is a mapping of $V(G)$ to $V(H)$ that maps edges of G to edges of H. Counting and describing the typical structure of homomorphisms between graphs have many interesting aspects and a surprising number of applications. Numerous models in statistical mechanics and questions in extremal graph theory can be phrased in these terms.

In this talk, we will focus our attention on the case when H is some small fixed graph, which can be thought of as a generalization of graph coloring. For many natural classes C of graphs, one observes the following phenomenon: A typical homomorphism from every G in C to H is very rigid, exhibiting strong spatial correlations. We will discuss several examples of this phenomenon, focusing on two particular settings:

(i) G is (a large subbox of) the d-dimensional integer grid;
(ii) G is a regular bipartite graph with strong expansion properties.

We will also state several open questions. No prior knowledge of graph homomorphism or expander graphs will be assumed.

Joint work with Ron Peled (Tel Aviv University) and Amir Yehudayoff (Technion).

Winning strong games through fast strategies for weak games

Danny Hefetz

Given a strong game which is known to be a first player's win, one would like to know how to win the game, that is, to have an explicit winning strategy for the first player. Unfortunately, this is a very hard problem in general and very few such strategies are known. In this talk we will see how such strategies can be found by using explicit fast winning strategies for the corresponding weak games.

The triangle-free process and $R(3, k)$

Simon Griffiths

The *triangle-free process* (introduced by Bollobás and Erdős) starts with the empty graph on n vertices, and at each step thereafter a uniformly random edge is added subject to the condition that no triangle is created in the graph. The process ends when we reach a maximal triangle-free graph; which we denote $G_{n,\triangle}$. Bohman, using the differential equations method of Wormald, proved that

$$e(G_{n,\triangle}) = \Theta(n^{3/2}\sqrt{\log n}),$$

with high probability.

In this talk we discuss recent progress in understanding this process. Using the self-correcting nature of families of random variables associated with the evolution of the process we prove that

$$e(G_{n,\triangle}) = \left(\frac{1}{2\sqrt{2}} + o(1)\right)n^{3/2}\sqrt{\log n},$$

with high probability.

In addition, this improved understanding allows us to bound the independence number of $G_{n,\triangle}$ by $(\sqrt{2}+o(1))\sqrt{n\log n}$, which implies the following lower bound on off-diagonal Ramsey numbers:

$$\left(\frac{1}{4} - o(1)\right)\frac{k^2}{\log k} \leq R(3,k) \leq (1 + o(1))\frac{k^2}{\log k},$$

the upper bound here is due to Shearer.

Based on joint work with Gonzalo Fiz Pontiveros and Robert Morris. Similar results have been obtained independently by Thomas Bohman and Peter Keevash.

The sum-free set constant is $1/3$

Ben Green

A well-known argument of Erdős, often used as a simple example to illustrate the probabilistic method, proves that any set of n integers contains a sum-free subset of size at least $n/3$. (Sum-free means it has no solutions to $x + y = z$.) Recently, jointly with Sean Eberhard and Freddie Manners, we have shown that the constant $1/3$ is best possible. The proof uses an "arithmetic" version of the regularity lemma, some sumset estimates and the Brunn-Minkowski theorem about convex bodies. I will try and give an overview of it.

PLACES TO EAT: in and around QMUL

Drapers Bar and Kitchen – wide range to suit all dietary requirements, Bancroft Road
Drunken Monkey – Asian fusion, Westfield Way
Greedy Cow – gastropub food, Grove Road
Half Moon Pub – Wetherspoons serving standard pub food, Mile End Road
Matsu – Japanese food, Mile End Road
Morgan Arms – Up-market pub food, Morgan Street
Mucci's – Italian trattoria, Library Square
Nandos – Portuguese Chicken, Mile End Road
Pride of Asia – Bangladeshi restaurant with all-you-can-eat buffet, Mile End Road
The Curve – international food to eat-in or take away, Westfield Way
The Jasmine Kitchen – railway arch café serving Thai food, White Church Lane

Taken from Google Maps
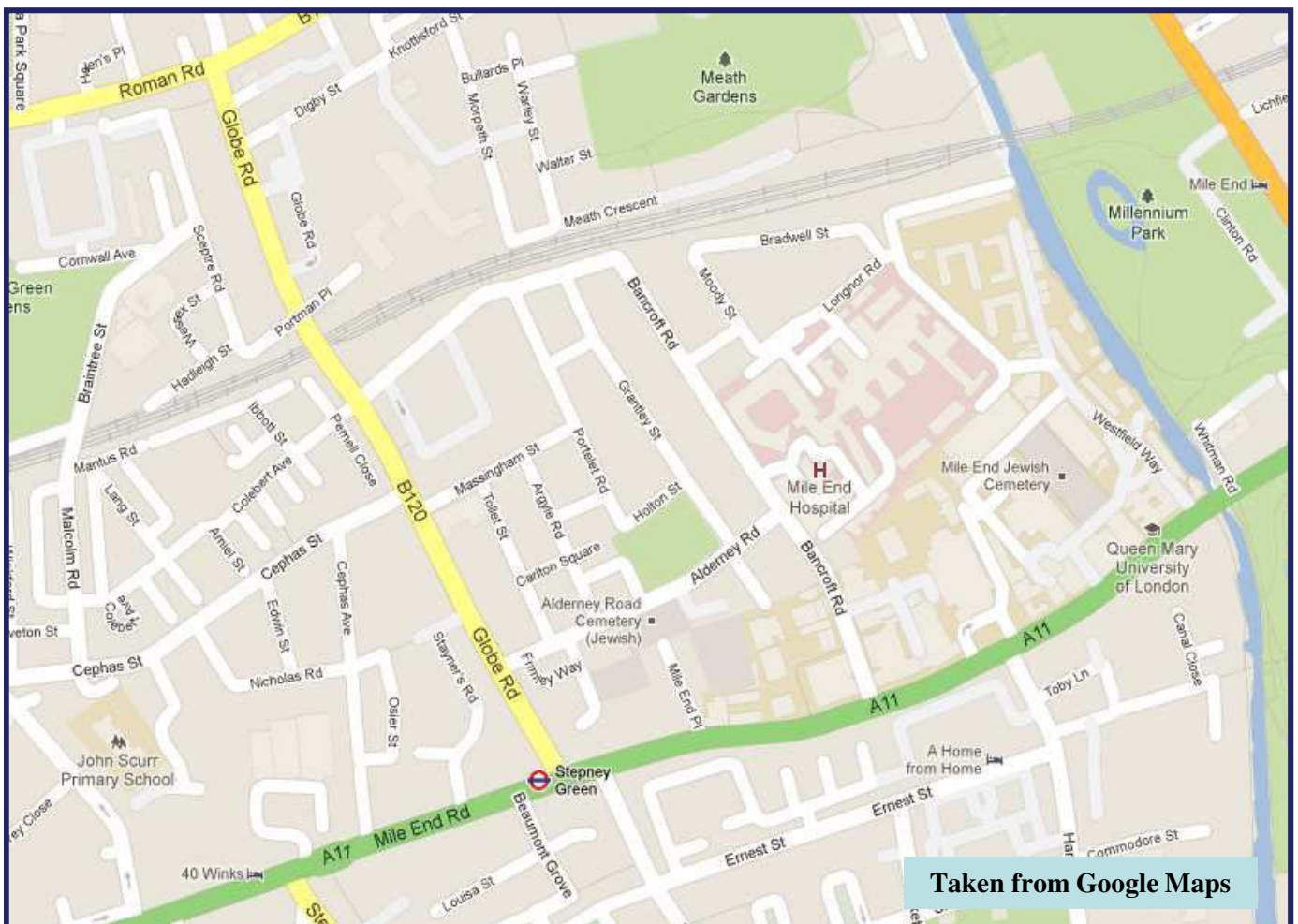
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ⓘ Information

Visitors who require further information or assistance please go to the Main Reception in the Queens' Building.

🚭 Please do not smoke on the campus.

📹 These premises are alarmed and monitored by CCTV, please call security on 020 7882 5000 for more information.

📖 Library/bookshop

🏋 Fitness centre

🍺 Bar

☕ Coffee place

🍴 Eatery

Ⓟ Staff Car Park

🚲 Bicycle Parking

💷 Cash Machine

THURSDAY 16th MAY 2013:
Schedule

The second day of the Colloquia in Combinatorics will be held at the London School of Economics and Political Science on Thursday 16th May, starting at 10.00am. Everyone interested is welcome to attend any part of the event. The talks will be held in the New Theatre (room number: EAS.E171), East Building, LSE; refreshments breaks will be taken in EAS.E168, East Building, LSE.

Time	Speaker (Institution)	Presentation title
10:00	Roman Glebov (Warwick)	On bounded degree spanning trees in the random graph
10:50	Coffee break *(room EAS.E168)*	
11:20	Endre Szemerédi (Budapest)	A new proof of the Pósa-Seymour Conjecture
12:10	Gábor Kun (Budapest)	A measurable version of the Lovász Local Lemma
13:00	Lunch *(own arrangements – options on campus and nearby)*	
14:10	Viresh Patel (Birmingham)	A conjecture of Thomassen on Hamilton cycles in highly connected tournaments
15:00	Afternoon tea break *(room EAS.E168)*	
15:30	Julia Wolf (Paris)	Sumsets, sampling and almost periodicity
16:20	Noga Alon (Tel Aviv)	**THE NORMAN BIGGS LECTURE:** Random Cayley graphs
17:20	End	

On bounded degree spanning trees in the random graph

Roman Glebov

The appearence of certain spanning subraphs in the random graph is a well-studied phenomenon in probabilistic graph theory. In this talk, we present results on the threshold for the appearence of bounded-degree spanning trees in $G(n, p)$ as well as for the corresponding universality statements. In particular, we show hitting time thresholds for some classes of bounded degree spanning trees.

Joint work with Daniel Johannsen and Michael Krivelevich.

A new proof of the Pósa-Seymour Conjecture

Endre Szemerédi

In 1974 Paul Seymour conjectured that any graph G of order n and minimum degree at least $(\frac{k-1}{k})n$ contains the $(k-1)^{th}$ power of a Hamiltonian cycle. This conjecture was proved by Komlós, Sárközy and Szemerédi earlier with the help of the Regularity Lemma – Blow-up Lemma method for $n \geq n_0$ where n_0 is very large. Here we present another proof that avoids the use of the Regularity Lemma and thus the resulting n_0 is much smaller. The main ingredient is a new kind of connecting lemma.

This work is joint with Asif Jamshed.

A measurable version of the Lovász Local Lemma

Gábor Kun

The Lovász Local Lemma was first applied to hypergraph colouring problems. Lovász and Erdős proved that for every subset S of the real numbers if $k \gg 1 + |S|\log(|S|)$ then the real line can be coloured by k colours so that every translate $S + x$ will contain all k colours. But can we get measurable colour classes in similar theorems?

We give a measurable version of the Lovász Local Lemma. We apply this to the dynamical version of the von Neumann problem.

A conjecture of Thomassen on Hamilton cycles
in highly connected tournaments

Viresh Patel

A conjecture of Thomassen from 1982 states that for every k there is an $f(k)$ such that every strongly $f(k)$-connected tournament contains k edge-disjoint Hamilton cycles. A classical theorem of Camion, that every strongly connected tournament contains a Hamilton cycle, implies that $f(1) = 1$. Until now, even the existence of $f(2)$ was open. In this talk, I will discuss a proof of Thomassen's conjecture. Our methods in fact allow us to show that $f(k) = O(k^2 \log^2 k)$, which is best possible up to the logarithmic factor.

This is joint work with Daniela Kühn, John Lapinskas, and Deryk Osthus.

Sumsets, sampling and almost periodicity

Julia Wolf

So-called "almost-periodicity" results for sumsets, first introduced by Croot and Sisask in 2009, have led to important quantitative advances in additive combinatorics in recent years. We explain the general philosophy and give a new statement and proof that avoids L^p norms and relies exclusively on Chernoff-type tail estimates. If time permits, we will sketch an application to the decoding of Reed-Muller codes of order 2.

This is joint work with Eli Ben-Sasson, Noga Ron-Zewi and Madhur Tulsiani.

"The Norman Biggs Lecture"

Random Cayley Graphs

Noga Alon

The study of random Cayley graphs of finite groups is related to the investigation of Expanders and to problems in Combinatorial Number Theory and in Information Theory. I will discuss this topic, describing the motivation and focusing on the question of estimating the chromatic number of a random Cayley graph of a given group with a prescribed number of generators.

PLACES TO EAT: in and around LSE

Close by:

All Bar One - Kingsway
Belgo - Kingsway
Café Amici - Kingsway
Café Nero - Kingsway
Costa - Kingsway
EAT - Kingsway
Hot - Kingsway
Paul - Kingsway
Pret a Manger - Kingsway
Sainsburys - Kingsway
Starbucks - Kingsway
Subway - Kingsway
The Delaunay - Aldwych
Wasabi - Kingsway

On campus:

3 Tuns - Ground floor, Clare Market St
Café 54 - Ground floor, New Academic Building
Fourth Floor Café Bar - Old Building
Fourth Floor Restaurant - Old Building
George IV Pub - Portugal Street
LSE Garrick - Ground floor, Columbia House
Mezzanine Café - New Academic Building
Plaza Café - John Watkins Plaza

Taken from Google Maps
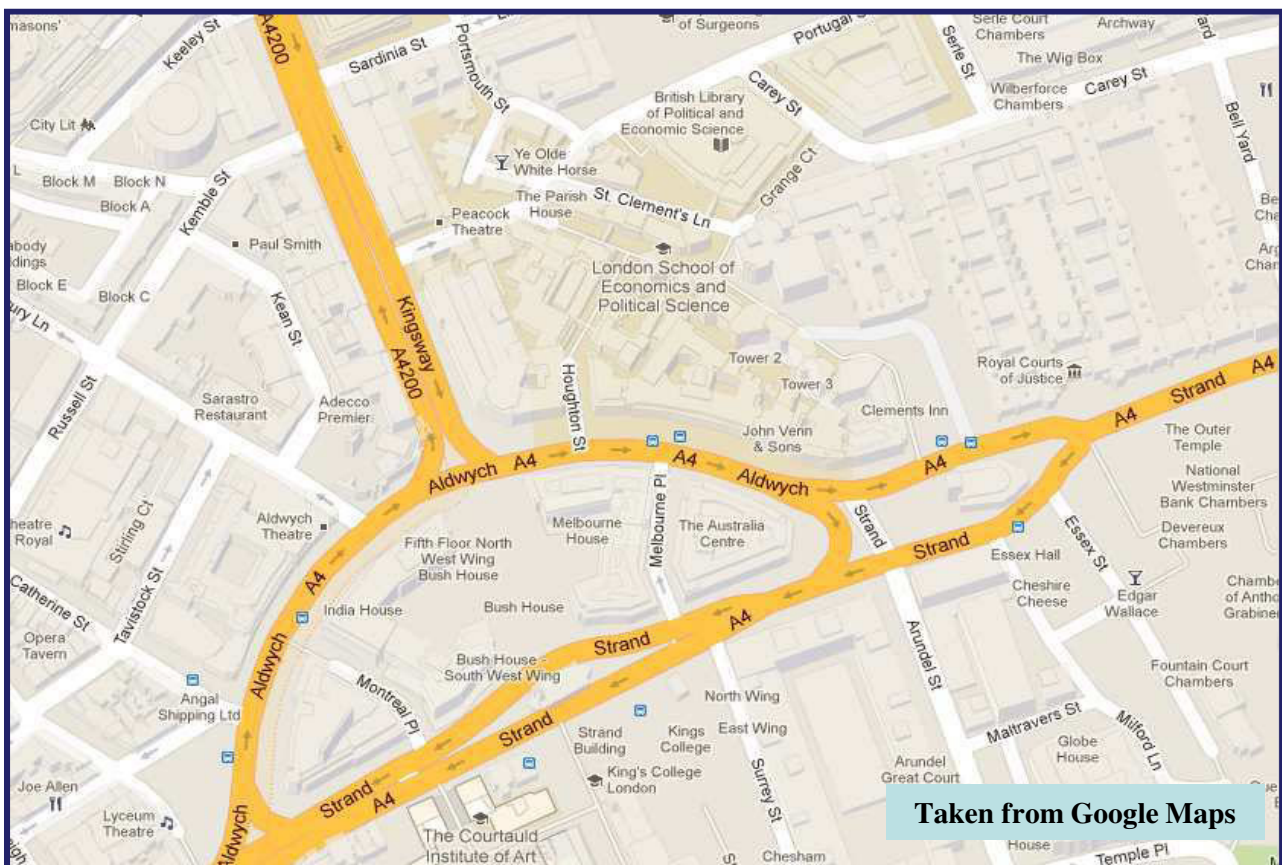
Disabled access information

THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

Legend

- Disabled lift
- Disabled parking
- Toilets for wheelchair user
- Lift
- Unisex toilets
- disabled access

Disabled access

Portable ramp for 20 Kingsway (**KSW** only) is located in entrance foyer. Please call 020 7955 6200 for Security staff to set up the ramp on request.

After 6.30pm, please call Security Control on 020 7955 6200 to ensure that any disabled access doors are open.

Map labels

32 Lincoln's Inn Fields
Basement & Lower Ground Floor
Basement, LG,G,1,2,4

32L
32 Lincoln's Inn Fields

New Academic Building **NAB**

1st floor

Library
Floors: Lower Ground,5
All Floors

Entrance to LSE Research Lab (floors 4 and 5)

Ground floor

50L

SARDINIA STREET

PORTSMOUTH STREET

PORTUGAL STREET

CAREY STREET

Sardinia House **SAR**
Ground floor
All floors

2nd floor

POR **LCH**

LAK

MAIN LIBRARY
LRB Lionel Robbins Building

NSC

SHF

KGS

COW

2nd Floor

Floors: G-4

PAR

STC St Clement's

JOHN WATKINS PLAZA

Ramp

GRANGE COURT

St Clement's Building
Floors: 1,2,4

Peacock Theatre **PEA**

All floors

Parish Hall
Floors: 1,2

CLARE MARKET

CMK Clare **ANC** Market

Lift and Steps

CLEMENT'S INN

Tower Two
Floors: 6,10

KSW

Old Building
1st floor
Floors: G,1,2

KINGSWAY

OLD
Old Building

EAS East Building

Tower One **TW1**

Tower Two **TW2**

Tower Three **TW3**

Tower Three
Floors: 4,6,7

PORTUGAL STREET

Clare Market
1st floor

Tower One
Floors: 1-11

Connaught House
Floors: 3,5,7

CON Connaught House

HOUGHTON STREET

COL Columbia House

ALD

Clement House **CLM**
Clement House
5th Floor
Basement, Floors: 3, 4 & 6

Columbia House
Ground Floor
1st Floor

ALDWYCH

entrance hidden from view

entrance

bridge

Right-hand list

Student Services Centre
Ground floor, Old Building

Graham Wallas Room
OLD 5.25, Old Building

Hong Kong Theatre
Ground floor, Clement House

New Theatre EAS E171, East Building

Old Theatre
Ground floor, Old Building

Shaw Library Sixth floor, Old Building

Sheikh Zayed Theatre
New Academic Building

Thai Theatre New Academic Building

The Wolfson Theatre
New Academic Building

Vera Anstey Room
Between ground and first floor, Old Building

3 Tuns
Ground floor, Clare Market St

Café 54
Ground floor, New Academic Building

Daily Grind Tower 1/2 Reception

Fourth Floor Café Bar Old Building

Fourth Floor Restaurant
Old Building

George IV pub Between LCH and KGS,
Portugal Street

LSE Garrick Ground floor, Columbia House

Mezzanine Café New Academic Building

Plaza Café John Watkins Plaza

**Senior Common Room
and Dining Room** Fifth floor, Old Building

Student Common Room
Ground floor, King's Chambers

Building index

ALD	Aldwych House *Aldwych*
ANC	The Anchorage
CMK	Clare Market *Houghton Street*
CKM	Clement House *Aldwych*
COL	Columbia House *Aldwych*
CON	Connaught House *Aldwych*
COW	Cowdray House *Portugal Street*
EAS	East Building *Houghton Street*
KGS	King's Chambers *Portugal Street*
KSW	20 Kingsway
50L	50 Lincoln's Inn Fields *Portsmouth Street*
32L	32 Lincoln's Inn Fields
LCH	Lincoln Chambers *Portsmouth Street*
LAK	Lakatos Building *Portugal Street*
LRB	Lionel Robbins Building, Library and LSE Research Lab
NAB	New Academic Building *Lincoln's Inn Fields*
NSC	New Students' Centre Development *Sheffield Street*
OLD	Old Building *Houghton Street*
PAR	Parish Hall *Sheffield Street*
PEA	Peacock Theatre *Portugal Street*
POR	1 Portsmouth Street
SAR	Sardinia House *Sardinia Street*
SHF	Sheffield Street
STC	St Clement's *Clare Market*
TW1	Tower One *Clement's Inn*
TW2	Tower Two *Clement's Inn*
TW3	Tower Three *Clement's Inn*

January 2013

Queen Mary, University of London & The London School of Economics and Political Science

Two One-Day Colloquia in Combinatorics, 2013
15ᵗʰ & 16ᵗʰ May 2013

Event organisers: Prof Peter Keevash (QMUL) and Dr Jozef Skokan (LSE)

The website associated with the conference is:
http://www2.lse.ac.uk/maths/Seminars/Colloquia_2013.aspx

The conference followed the successful format established over the past seven years: six invited talks were delivered on each of the two days. The meeting went according to plan, and our expectations were met in full. Most participants attended both days. The conference attracts both excellent speakers and a steadily growing audience, with participants coming not only from the UK but also from continental Europe.

The Queen Mary day started with two talks on topics from extremal graph theory: first, Anusch Taraz surveyed recent results and methods for finding spanning subgraphs in a given host graph, and he also discussed how to adopt these methods for the use in Ramsey theory. Then, Julia Böttcher gave a great talk about the new extension of the Blow-up Lemma to sparse graphs and its applications. Afterwards, Wojciech Samotij talked about counting and describing the typical structure of homomorphisms between graphs and Danny Hefetz spoke about finding winning strategies in two-player games on graphs. In the next talk, Simon Griffiths gave an excellent exposition of some of the recent intriguing work on the triangle-free processes that yielded the best known lower bounds on the Ramsey number $R(3,k)$. The programme culminated in an excellent talk by Ben Green who outlined the proof of a conjecture of Paul Erdős from 1965: For every $c>0$ there exists a set A of n integers with the following property: every subset B of A with at least $(1/3 + c)n$ elements contains three distinct elements x, y, z with $x + y = z$.

At the LSE day, the first talk was by Roman Glebov who discussed thresholds for the appearance of bounded-degree spanning trees in the random graph $G(n, p)$. In the next talk, Endre Szemerédi (2012 Abel Prize Laureate) revisited some classical results proved 20 years ago using his famous Regularity Method and showed how to obtain quantitative improvements of the same results by avoiding the very same Regularity Method. The morning session was concluded by Gábor Kun who talked on the measurable version of the Lovász Local Lemma. In the afternoon, Viresh Patel gave a beautiful talk about his recent proof of a conjecture of Thomassen on Hamilton cycles in highly connected tournaments. Afterwards, Julia Wolf spoke about the role of almost periodicity results for sumsets in additive combinatorics. The final talk, the traditional Norman Biggs lecture, was delivered by Noga Alon. In his captivating talk, Professor Alon talked about random Cayley graphs of finite groups and discussed their connection and relations to problems in combinatorial number theory and information theory.