



THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■



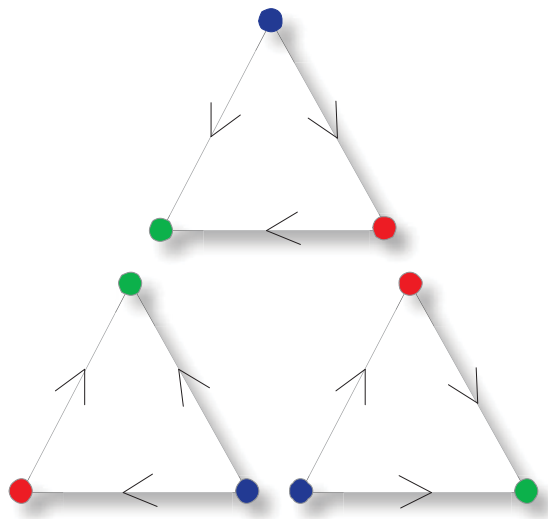
Queen Mary
University of London

Queen Mary, University of London

**The London School of Economics
and Political Science**

Two One-Day Colloquia in Combinatorics

13th and 14th May 2015



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



When tweeting about the Colloquia, please use the hashtag **#CC2015**

Follow us at:
@LSEMaths
@QMULMaths

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INFORMATION

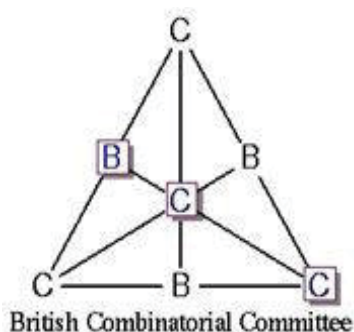
Those interested are welcome to attend for all or any part of the event; it is hoped that many people will be able to attend for both days.

Some funds are available to contribute to the **basic** travel expenses of **research students** who attend the meetings. We 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. Expense claim forms are available at the event from the event organisers. Please contact Rebecca Lumb (r.c.lumb@lse.ac.uk) for further information.

Event organisers: Dr Robert Johnson (QMUL), Dr David Ellis (QMUL) and Dr Jozef Skokan (LSE).

SUPPORT

Support for this event from the London Mathematical Society (www.lms.ac.uk) and the British Combinatorial Committee (<https://britishcombinatorial.wordpress.com/>) is gratefully acknowledged.



LONDON
MATHEMATICAL
SOCIETY

WEDNESDAY 13th MAY 2015

Schedule

The first day of the Colloquia in Combinatorics will be held at Queen Mary, University of London on Wednesday 13th 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	Presentation title
10:00	Coffee (<i>Maths Building Foyer</i>)	
10:30	Stéphan Thomassé (Lyon)	Decomposing 24-edge-connected graphs with high minimum degree into paths of fixed length
11:20	Alex Scott (Oxford)	Colouring graphs without odd holes
12:10	Lunch (<i>own arrangements – options on campus and nearby</i>)	
13:30	Olof Sisask (Stockholm)	Quantitative continuity of convolutions in additive combinatorics
14:20	Anita Liebenau (Warwick)	On the minimum degree of minimal Ramsey graphs
15:10	Afternoon tea break (<i>Maths Building Foyer</i>)	
15:40	Ron Peled (Tel Aviv)	Probabilistic existence of regular combinatorial structures
16:30	Gregory Sorkin (London)	VCG auction mechanism cost expectations and variances
17:20	End	

Decomposing 24-edge-connected graphs with high minimum degree into paths of fixed length

Stéphan Thomassé

The Barát-Thomassen conjecture asserts that there is a function f such that for every fixed tree T with t edges, every graph which is $f(t)$ -edge-connected with its number of edges divisible by t has a partition of its edges into copies of T . This has been proved in the case of paths of length 2^k by Thomassen, and recently shown to be true for all paths by Botler, Mota, Oshiro and Wakabayashi.

In this talk, we propose an alternative proof of the path case with a weaker hypothesis: Namely, we prove that there is a function f such that every 24-edge-connected graph with minimum degree $f(t)$ has an edge-partition into paths of length t whenever t divides the number of edges. The 24 bound cannot be replaced by 2, and we suspect that 3-edge connected and large minimum degree suffice. We will also present work in progress to reach the bound 8, and an approach which will (hopefully) attain the bound 3.

This is joint work with Julien Bensmail and Ararat Harutyunyan.

Colouring graphs without odd holes

Alex Scott

Gyarfás conjectured in 1985 that if G is a graph with no induced cycle of odd length at least 5, then the chromatic number of G is bounded by a function of its clique number. We prove this conjecture (joint work with Paul Seymour) and discuss some further results on induced cycles in graphs of large chromatic number (joint with Maria Chudnovsky and Paul Seymour).

Quantitative continuity of convolutions in additive combinatorics

Olof Sisask

Suppose A is a set of integers. If A is contained in $\{1, 2, \dots, N\}$, how long an arithmetic progression must the sumset $A + A = \{a + b, a, b \in A\}$ contain, in terms of the size of A ? What about $A + A + A$? How large can A be if it itself does not contain any arithmetic progressions – solutions to $x + y = 2z$? What about other linear equations? Or suppose we know something about the sumset, say that $|A + A| < K|A|$, where K is a fixed constant and $|A|$ is large. What can we say about A ?

These are some central questions in additive combinatorics, and there has been substantial progress in the quantitative answers to each of them over the past few years. The aim of this talk is to describe some of this progress, which is due to many people, and to give an idea of one of the key results underlying it all, which we shall phrase as a continuity result for three-fold convolutions.

On the minimum degree of minimal Ramsey graphs

Anita Liebenau

We study graphs G that are r -Ramsey minimal for a graph H , that is, any r -colouring of the edges of G contains a monochromatic copy of H , but no proper subgraph of G has this property. Let $s_r(K_k)$ denote the smallest possible degree of a graph G that is r -Ramsey minimal for the clique on k vertices. Burr, Erdős and Lovász showed in 1976 that $s_2(K_k) = (k-1)^2$. This is in striking contrast to the fact that the known bounds for the Ramsey numbers are far apart.

We study the dependency of $s_r(K_k)$ on r and show that, under the condition that k is constant, $s_r(K_k)$ is roughly quadratic in r . It turns out that $s_r(K_k)$ is tightly connected to another extremal parameter: the Erdős-Rogers function $f_{k,k+1}(n)$, introduced by Erdős, Hajnal and Rogers, is the largest integer t such that any K_{k+1} -free graph on n vertices contains a subset of size t that is K_k -free.

This is joint work with Jacob Fox, Andrey Grinshpun, Tibor Szabó and Yury Person.

Probabilistic existence of regular combinatorial structures

Ron Peled

We show the existence of regular combinatorial objects which previously were not known to exist. Specifically, for a wide range of the underlying parameters, we show the existence of non-trivial orthogonal arrays, t -designs, and t -wise permutations. In all cases, the sizes of the objects are optimal up to polynomial overhead. The proof of existence is probabilistic. We show that a randomly chosen structure has the required properties with positive yet tiny probability. Our method allows also to give rather precise estimates on the number of objects of a given size and this is applied to count the number of orthogonal arrays, t -designs and regular hypergraphs. The main technical ingredient is a special local central limit theorem for suitable lattice random walks with finitely many steps.

This is joint work with Greg Kuperberg and Shachar Lovett.

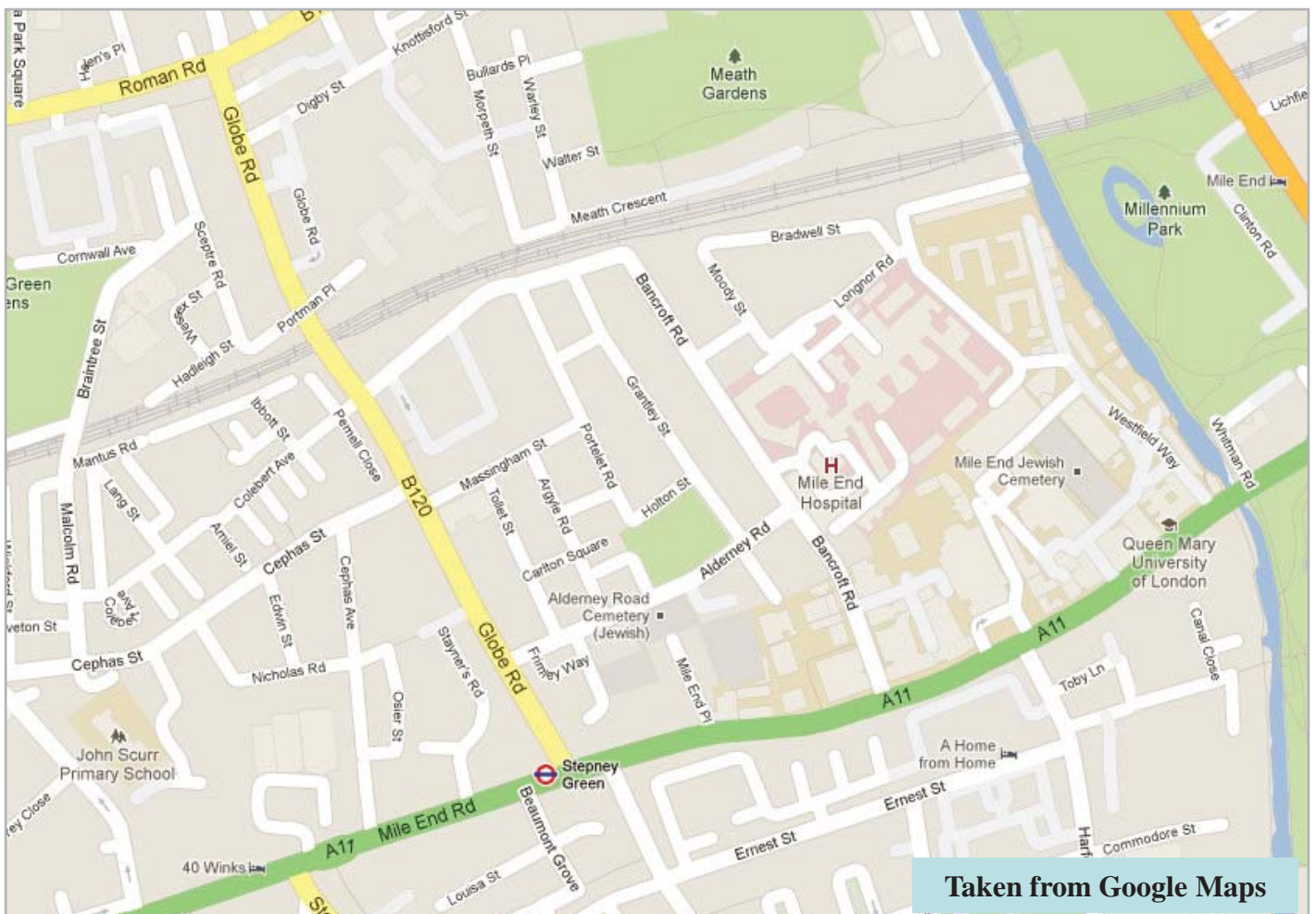
VCG auction mechanism cost expectations and variances

Gregory Sorkin

We consider Vickrey-Clarke-Groves (VCG) auctions for a very general combinatorial structure, in an average-case setting where item costs are independent random variables. When the costs have uniform $(0, 1)$ distribution, we prove that the expected VCG cost is at least double the expected nominal cost, and exactly double when the desired structure is a basis of a bridgeless matroid. In the matroid case we further show that, conditioned upon the VCG cost, the expectation of the nominal cost is exactly half the VCG cost, and we show several results on variances and covariances among the nominal cost, the VCG cost, and related quantities, as well as considering other distributions. As an application, we find the asymptotic variance of the VCG cost of the minimum spanning tree in a complete graph with random edge costs.

PLACES TO EAT: in and around QMUL

Baghdad Café – Authentic Iraqi and Arabic food, Burdett Road
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
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



Mile End Campus

Educational/Research		Residential		Facilities	
ArtsOne	37	Albert Stern Cottages	3	Advice and Counselling Service	27
ArtsTwo	35	Albert Stern House	1	Housing Hub	48
Arts Research Centre	39	Beaumont Court	53	Bookshop	22
The Bancroft Building	31	Chapman House	43	Careers Centre	19
Bancroft Road Teaching Rooms	10	Chesney House	45	Clock Tower	20
Computer Science Building	6	Creed Court	57	CopyShop	56
Engineering Building	15	France House	55	The Curve	47
Fogg Building	13	Feilden House	46	Drapers Bar and Kitchen	8
G.O. Jones Building	25	Hatton House	40	Canalside	63
Geography	26	Ifor Evans Place	2	Ground Café	33
Informatics Teaching Laboratories	5	Lindop House	21	The Hive	24
Joseph Priestley Building	41	Lodge House	50	Infusion	9
Library	32	Lynden House	59	IT Services	19
Law	36	Maurice Court	58	Mucci's	29
Lock-keeper's Graduate Centre	42	Maynard House	44	Occupational Health Service/ Student Health Service	28
Mathematical Sciences	4	Pooley House	60	Octagon	19a
Occupational Health and Safety Directorate	12	Selincourt House	51	Police Box	38
The People's Palace/Great Hall	16	Varey House	49	Portering and Postal Services	17
Queens' Building	19			Qmotion Health and Fitness Centre	
Temporary Building	61			Sports Hall	7
				Santander Bank	62
				Security/France House Reception	54
				St Benet's Chaplaincy	23
				Students' Union Hub	34
				Student Enquiry Centre	19
				Village Shop	52
				Westfield Nursery	11

New Graduate Centre construction site18

Currently no through route between Geography Square and Bancroft Road.

Information

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

Smoking is prohibited on 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

Bicycle lockers

Cash machine





THURSDAY 14th MAY 2015

Schedule

The second day of the Colloquia in Combinatorics will be held at The London School of Economics and Political Science on Thursday 14th May, starting at 10.30am. 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.E304, East Building, LSE; reception will be held in the Shaw Library, Sixth Floor Old Building, LSE.

Time	Speaker	Presentation title
10:00	Coffee (<i>room EAS.E304</i>)	
10:30	Will Perkins (Birmingham)	Birthday inequalities, hard spheres, and independent sets
11:20	Alexander Schrijver (Amsterdam)	Edge-colouring models
12:10	Lunch (<i>own arrangements – options on campus and nearby</i>)	
13:30	Frank Vallentin (Köln)	New upper bounds for the density of translative packings of superspheres
14:20	Christina Goldschmidt (Oxford)	Scaling limits of Galton-Watson trees, and line-breaking constructions
15:10	Afternoon tea break (<i>room EAS.E304</i>)	
15:40	Alexey Pokrovskiy (Berlin)	Connectedness in tournaments
16:30	Tim Gowers (Cambridge)	Biggs Lecture: Communication complexity and interleaved products
17:30	Reception (<i>Shaw Library, Sixth Floor Old Building</i>)	

Birthday inequalities, hard spheres, and independent sets

Will Perkins

I will discuss two related models from statistical physics and combinatorics: the hard sphere model of random non-overlapping spheres in Euclidean space and the hardcore model of a random independent set in the d -dimensional integer lattice. I will present a new method for bounding the partition function in both models, and show applications including a surprising fact about spheres in 24 dimensions.

Edge-colouring models

Alexander Schrijver

Several graph invariants can be described as ‘partition functions’ (in the sense of de la Harpe and Jones), and their duals based on edge-colouring models. We give characterizations of such invariants, and of related invariants for knots and chord diagrams, where Lie algebras come in.

The talk will be introductory and does not assume any specific knowledge in this area.

New upper bounds for the density of translative packings of superspheres

Frank Vallentin

In this talk I will present new upper bounds for the maximum density of translative packings of superspheres in three dimensions (unit balls for the l^p -norm). This will give some strong indications that the lattice packings experimentally found in 2009 by Jiao, Stillinger, and Torquato are indeed optimal among all translative packings. For this we apply the linear programming bound of Cohn and Elkies which originally was designed for the classical problem of packings of round spheres. The proof of our new upper bounds is computational and rigorous. Our main technical contribution is the use of invariant theory of pseudo-reflection groups in polynomial optimization.

This is joint work with Maria Dostert, Cristobál Guzmán, and Fernando Mário de Oliveira Filho.

Scaling limits of Galton-Watson trees, and line-breaking constructions

Christina Goldschmidt

Consider a Galton-Watson branching process with a critical offspring distribution, conditioned to have total progeny n . The family trees of such processes constitute a natural collection of models for random trees, which includes various standard combinatorial trees such as uniform random labelled trees and uniform binary planar trees. Since 1990, a beautiful theory of scaling limits for these objects has been developed. It turns out that there is a good way to rescale distances in the tree so that, in the limit as n tends to infinity, one obtains a compact limit object. The family of possible limiting objects, which are essentially "tree-like" path metric spaces, is now known as the stable trees.

I will give a survey of some of this theory, and then talk about joint work with Bénédicte Haas (Paris-Dauphine), in which we give a new almost sure construction of the stable trees, via a surprisingly elementary line-breaking procedure.

Connectedness in tournaments

Alexey Pokrovskiy

Thomassen conjectured that there is a function $f(k)$ such that every strongly $f(k)$ -connected tournament contains k edge-disjoint Hamiltonian cycles. This conjecture was recently proved by Kühn, Lapinskas, Osthus, and Patel who showed that $f(k) < O(k^2 \log^2 k)$ and conjectured that there is a constant C such that $f(k) < Ck^2$. A proof of this conjecture will be presented. The proof uses the method of "linkage structures" introduced by Kühn, Lapinskas, Osthus, and Patel, which is a fairly general method for studying highly connected tournaments.

As a second application of this method we'll show that every $452k$ -connected tournament is k -linked, solving another conjecture of Kühn, Lapinskas, Osthus, and Patel.

“The Norman Biggs Lecture”

Communication complexity and interleaved products

Tim Gowers

Communication complexity is a concept of great importance in theoretical computer science. It concerns situations where a number of people have partial information about a function and they want to evaluate it while exchanging as few bits as possible.

I shall discuss recent joint work with Emanuele Viola. Motivated by an application in communication complexity, we proved a theorem that says that if G is the group $SL_2(q)$ for large q , A and B are arbitrary dense subsets of G^2 , and (a_1, a_2) and (b_1, b_2) are chosen randomly from A and B , respectively, then the product $a_1 b_1 a_2 b_2$ is very close to being uniformly distributed. I shall also talk about a multiparty generalization of this result, which has further applications to communication complexity and required us to prove a group-theoretic result of independent interest.

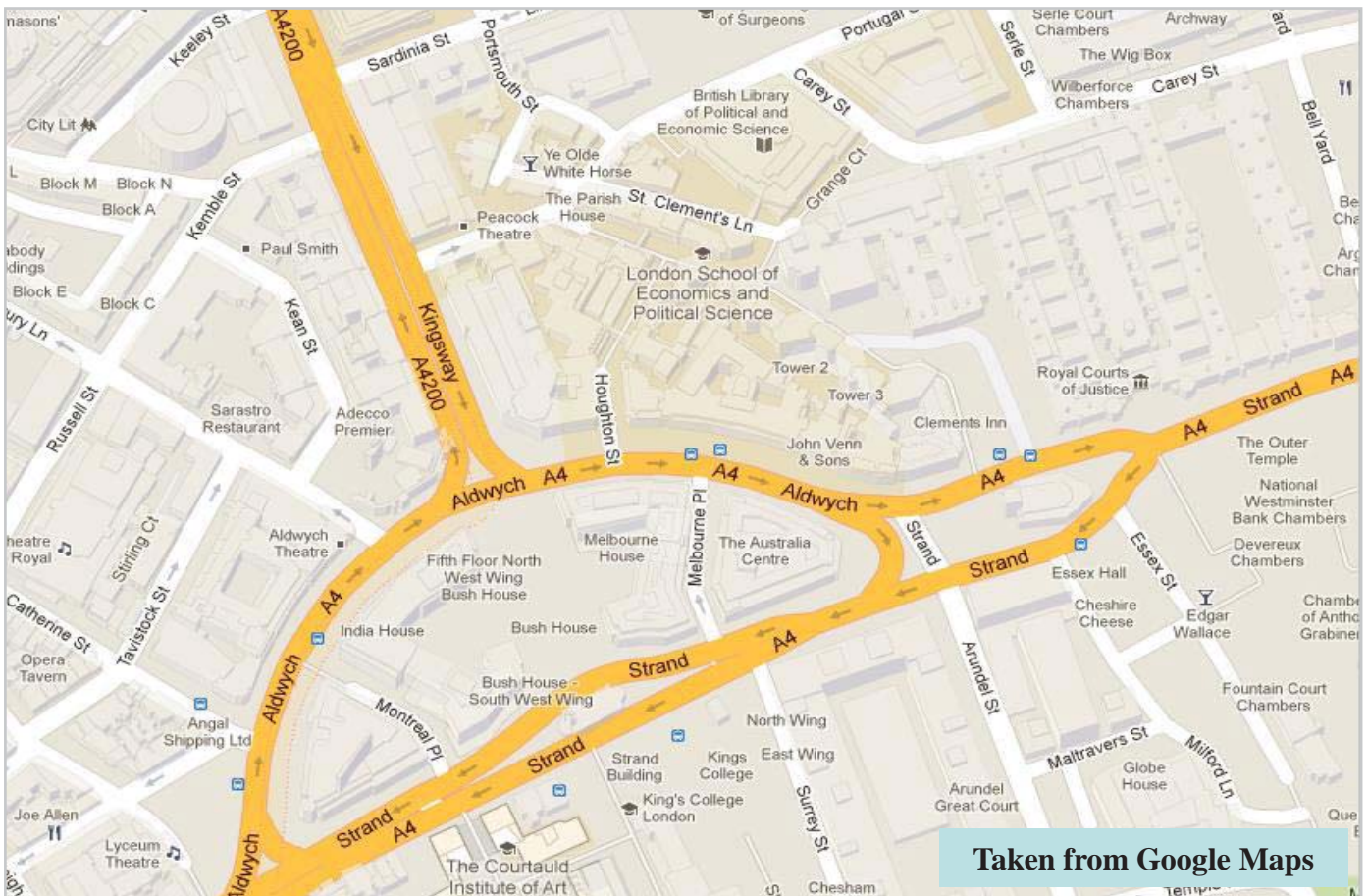
PLACES TO EAT: in and around LSE

Close by:

All Bar One – Kingsway
Belgo – Kingsway
Bill's – Kingsway
Café Amici – Kingsway
Café Nero – Kingsway
Costa – Kingsway
EAT – Kingsway
Paul – Kingsway
Pret a Manger – Kingsway
Sainsburys – Kingsway
Starbucks – Kingsway
Subway – Kingsway
The Delaunay – Aldwych
Viet Eat – Kingsway
Wasabi – Kingsway


On campus:

The Bean Counter – 32 Lincoln's Inn Fields
Café 54 – Mezzanine floor, New Academic Building
Daily Grind Coffee Shop – Tower One reception
Fields Bar and Kitchen – Lincoln's Inn Fields
Fourth Floor Café Bar – Old Building
Fourth Floor Restaurant – Old Building
George IV Pub – Portugal Street
LSE Garrick – Columbia House
Plaza Café – John Watkins Plaza
Three Tuns Bar – Saw Swee Hock Student Centre




Accessibility Map

 Disabled lift  Lift

 Disabled parking (blue badge)

 Accessible toilets

 Gender Neutral accessible toilets

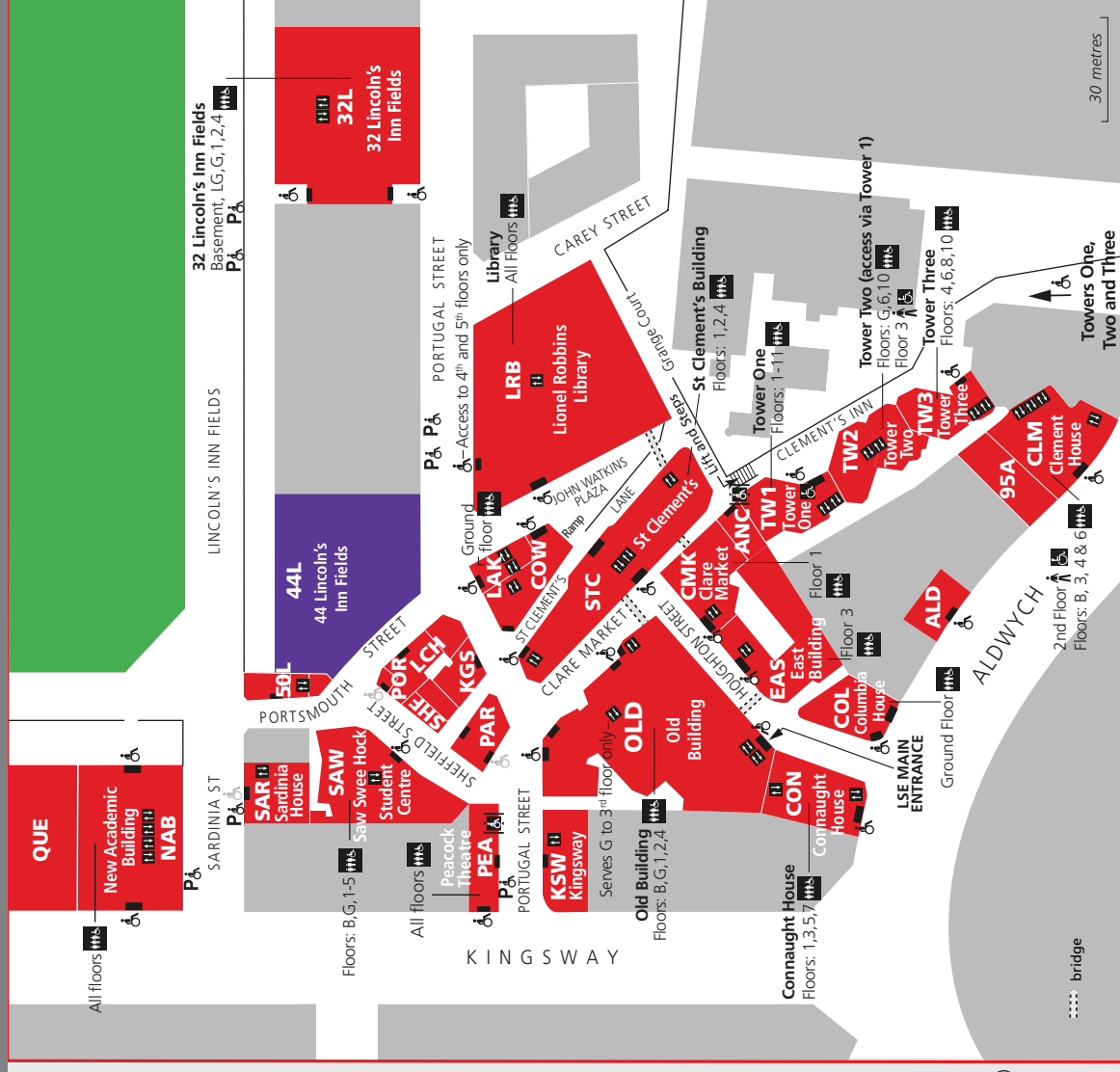
 Disabled access  Disabled access available from Summer 2015

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.

95A	95 Aldwych Aldwych
ALD	Aldwych House Aldwych
ANC	The Anchorage
CMK	Clare Market Houghton Street
CLM	Clement House Aldwych Research Lab, Lower Ground Floor
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
32L	32 Lincoln's Inn Fields
44L	44 Lincoln's Inn Fields (not occupied by LSE)
50L	50 Lincoln's Inn Fields Portsmouth Street
LCH	Lincoln Chambers Portsmouth Street
LAK	Lakatos Building Portugal Street
LRB	Lionel Robbins Building, Library
NAB	New Academic Building Lincoln's Inn Fields
OLD	Old Building Houghton Street
PAR	Parish Hall Sheffield Street
PEA	Peacock Theatre Portugal Street



POR

1 Portsmouth Street

QUE

Queens House Lincoln's Inn Fields

SAR

Sardinia House Sardinia Street

SAW

Saw Swee Hock Student Centre
Sheffield 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

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

The Venue

Basement, SAW

Vera Anstey Room

Between ground and first floor, Old Building
(Step free access is not available to this venue)

3 Tuns

Ground floor, SAW

Bean Counter

Basement, 32 Lincoln's Inn Fields

Café 54

Ground floor, New Academic Building

Daily Grind

Tower 1/2 Reception

Denning Learning Cafe

First floor, SAW

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

Weston Café

Sixth floor, SAW