Components in random combinatorial objects

Supervisor: Dudley Stark

Research Group: Combinatorics

Funding: For September 2021 entry: Funding may be available through QMUL Principal's Postgraduate Research Studentships, School of Mathematical Sciences Studentships, and EPSRC DTP, in competition with all other PhD applications.

Studentships will cover tuition fees, and a stipend at standard rates for 3-3.5 years.

We welcome applications for self-funded applicants year-round, for a January, April or September start.

Project description:

Combinatorial objects such as permutations and mappings from a finite set to itself can be decomposed into connected components. In the case of permutations, the components are cycles and in the case of mappings, the components are cycles of rooted trees. Another example of combinatorial objects is set partitions, for which the components are simply subsets with no further structure.

If a combinatorial object is chosen uniformly at random from all the objects on n elements, then the numbers of components of different sizes become random variables and the convergence of these random variables can be investigated as n becomes large. Perhaps the first result along these lines that the probability that a random permutation has no fixed points converges to the reciprocal of the base of the natural logarithm. In fact, the number of cycles of size i converges to a Poisson random variable with mean 1/i.

Permutations and mappings belong to what is called the logarithmic class of decomposable combinatorial objects, while set partitions do not. Membership in the logarithmic class depends on the number of components which can be formed from a given set. General results can be proven for random combinatorial objects which depend only on a single parameter.

In this the project the student will investigate one of several open problems about random combinatorial objects.

References

Arratia, R., Tavare S and Barbour A. D., *Logarithmic Combinatorial Structures: A Probabilistic Approach*, European Mathematical Society, 2003.

Further information:

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