Lecture Notes in Mathematics 2012

Editors:
J.-M. Morel, Cachan
B. Teissier, Paris

Subseries:
École d'Été de Probabilités de Saint-Flour

Saint-Flour Probability Summer School

The Saint-Flour volumes are reflections of the courses given at the Saint-Flour Probability Summer School. Founded in 1971, this school is organised every year by the Laboratoire de Mathématiques (CNRS and Université Blaise Pascal, Clermont-Ferrand, France). It is intended for PhD students, teachers and researchers who are interested in probability theory, statistics, and in their applications.

The duration of each school is 13 days (it was 17 days up to 2005), and up to 70 participants can attend it. The aim is to provide, in three high-level courses, a comprehensive study of some fields in probability theory or Statistics. The lecturers are chosen by an international scientific board. The participants themselves also have the opportunity to give short lectures about their research work.

Participants are lodged and work in the same building, a former seminary built in the 18th century in the city of Saint-Flour, at an altitude of 900 m. The pleasant surroundings facilitate scientific discussion and exchange.

The Saint-Flour Probability Summer School is supported by:

– Université Blaise Pascal
– Centre National de la Recherche Scientifique (C.N.R.S.)
– Ministère délégué à l'Enseignement supérieur et à la Recherche

For more information, see back pages of the book and
http://math.univ-bpclermont.fr/stflour/

Jean Picard
Summer School Chairman
Laboratoire de Mathématiques
Université Blaise Pascal
63177 Aubière Cedex
France

Alison Etheridge

Some Mathematical Models from Population Genetics

École d'Été de Probabilités
de Saint-Flour XXXIX-2009

Springer

Alison Etheridge
University of Oxford
Department of Statistics
1 South Parks Road
Oxford OX1 3TG
United Kingdom
etheridg@stats.ox.ac.uk

ISBN: 978-3-642-16631-0 e-ISBN: 978-3-642-16632-7
DOI: 10.1007/978-3-642-16632-7
Springer Heidelberg Dordrecht London New York

Lecture Notes in Mathematics ISSN print edition: 0075-8434
ISSN electronic edition: 1617-9692

Cover design: SPi Publisher Services

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

These notes on mathematical models from population genetics reflect the 16 h of lectures that I delivered in St Flour in July 2009. Other than minor corrections and clarifications, they have changed very little in the year that has elapsed since then. Although it was tempting to add more material, I concluded that not only would this lead to unacceptable delays, but it would also be redundant. Whereas there are few references of which I am aware that present the material covered here in a self-contained way, there are now many texts that cover, for example, coalescent theory in more detail.

The notes are intended for graduate students in mathematics. They aim to introduce the reader to a range of mathematical models that have their origins in theoretical population genetics. Some date right back to the origins of the subject and some were introduced in the last few years. All share a rich mathematical structure. Research on the more recent models, notably the Λ-coalescents and their spatial analogues, is progressing at a breathtaking speed and so it is impossible to provide a comprehensive survey of what is known. Instead I have aimed to explain some of the reasons that such models are interesting biologically and to equip the reader with enough background to be able to browse the literature as it appears.

There are many people to whom I owe thanks. My interest in population genetics stems from a collaboration with Nick Barton (IST Austria and the University of Edinburgh). Working with Nick over many years has been a privilege and a pleasure and almost all the material covered here I first learned about through conversations with him. I am grateful to Leif Döring, Bjarki Eldon, Bob Griffiths, Habib Saadi and the many others who read and commented on parts of the manuscript. Special thanks are due to Amandine Véber, who went through several iterations of the whole document in tremendous detail and undoubtedly improved the notes beyond recognition. I was fortunate to spend the first four months of 2009 visiting Université Paris Sud in Orsay. My thanks go to everyone there, especially Yves Le Jan for making that possible. While I was in Orsay, Jean-François Le Gall persuaded me to give a masters course as a dry run for (at least part of) this course. The experience was extremely valuable and my thanks go to Jean-François and to the enthusiastic audience. Jean Picard quietly ensured that everything at St Flour ran extremely smoothly and the

participants were tremendous. I simply had a lot of fun. Finally, as always, I thank Lionel, Charlotte and Matthew Mason for all their support and understanding.

Oxford, August 2010 *Alison Etheridge*

Contents