



AIMS VIDEO COURSES  
**SUPPORTING BOOKLET**

# **PROBABILITY & STATISTICS**

WITH  
**PROF DAVID SPIEGELHALTER**

**AIMS**  
SOUTH AFRICA



# African Institute for Mathematical Sciences

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## AIMS Online Courses

The mission of the AIMS academic programme is to provide an excellent, advanced education in the mathematical sciences to talented African students in order to develop independent thinkers, researchers and problem solvers who will contribute to Africa's scientific development.

Teaching at AIMS is based on the principle of learning and understanding, rather than simply listening and writing, during classes, and on creating an atmosphere of increasing our knowledge through class discussions, through small group discussions, by formulating conjectures and assessing the evidence for them, and sometimes going down wrong paths and learning from the mistakes that led us there. The essential features of the classes at AIMS are that, in contrast to formal lecture courses, they are highly interactive, where the students engage with the lecturer throughout the class time, are encouraged to learn together in a journey of questioning and discovery, and where lecturers respond to the needs of the class rather than to a pre-determined syllabus. AIMS teaching philosophy is to promote critical and creative thinking, to experience the excitement of learning from true understanding, and to avoid rote learning directed only towards assessment.

Leading international and local experts offer the courses at AIMS, which are three weeks long (each module consisting of 30 hrs) and collectively form the coursework for a structured masters degree which also includes a research component. The advertised content is a guide, and the lecturers are encouraged, and indeed expected, to adapt daily to meet the current needs of the students.

Over the past ten years AIMS has achieved international recognition for this innovative and flexible approach. It has been the starting point for the remarkable success of our students and alumni and we all benefit from the support of many who have "witnessed the AIMS-magic and keep coming back for more."

This year we have decided to film selected courses and to make them available to a larger audience as an online facility. African universities may choose to use these courses to supplement and enhance their own postgraduate programmes. We believe this would be best achieved through engagement with AIMS. One way for this to happen, would be for AIMS to suggest or nominate a specialist tutor to spend time at the university, guiding students who follow the online programme. Where possible expert lecturers who have taught at AIMS may visit the university to give a short introduction to the course. We would welcome this interaction as well as the contribution our online courses will make to the growth of the mathematical sciences ecosystem in Africa.

Barry Green  
Director & Professor of Mathematics  
African Institute for Mathematical Sciences  
January 2013

### AIMS Council

Ramesh Bharuthram (University of the Western Cape) Hendrik Geyer (Stellenbosch University) Barry Green (AIMS) Grae Worster (Cambridge University) Daya Reddy (University of Cape Town)  
Graham Richards (Oxford University) Stephané Ouvry (Université de Paris Sud XI) Tsou Sheung Tsun (Oxford University) Neil Turok (Perimeter Institute)

PROBABILITY & STATISTICS  
2012

PROF DAVID SPIEGELHALTER  
**DAY 14**



**AIMS**  
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# Bayes theorem

I have 3 cards:

- ① One with two red sides
- ② One with two black side
- ③ One with a red side and a black side

I pick a card at random and flip it.

It comes up a red side.

What is the probability that the other side is also red?

# Professor Risk

# The first head

Two people take it in turns to flip a coin

The one who flips the first head wins

What is the chance that the person who flips *first* wins?

# The King

A King has three sons, A, B and C (he had no imagination)

He wants to give each son an equal chance of inheriting.

He decides to flip a coin until the same side comes up twice in a row

- If two heads comes up first, after an even number of throws (2,4,6,...), then A will be king
- If two tails comes up first, after an even number of throws (2,4,6,...), then B will be king
- If two heads or tails comes up after an odd number of throws (3,5,7,...), then C will be king

Are they all equally likely to inherit?

Switch or not?



## Quantifying your ignorance

I will ask some questions whose answers are (A) or (B)

Think whether you prefer (A) or (B) for each question

Then think of how confident you are with your answer

Give your confidence a number 5 to 10

Score yourself when you hear the correct answer

<b><i>Your 'confidence' in your answer</i></b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b><i>Score if you are right</i></b>	0	9	16	21	24	25
<b><i>Score if you are wrong</i></b>	0	-11	-24	-39	-56	-75

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- 10 **(B)** 41,609,000 vs 46,218,000