



UNIVERSITÀ
DEGLI STUDI
DI PADOVA



PHD COURSE
IN STATISTICS

Short Course

September, 2019 | Campus S. Caterina

Linear Algebra over the Integers, with Connections to Some Classic Mathematical Puzzles

Gene Abrams

University of Colorado, USA

Thursday	September 26	12.00 – 13.00	Room Cucconi
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Friday	September 27	12.00 – 13.00	Room Cucconi
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Anyone interested is invited to contact <phd@stat.unipd.it>

DEPARTMENT OF EXCELLENCE 2018-2022

PROJECT "STATISTICAL METHODS AND MODELS FOR COMPLEX DATA"

<http://eccellenza.stat.unipd.it/>

Dipartimento
di eccellenza
2018-2022



Linear Algebra over the Integers, with Connections to Some Classic Mathematical Puzzles

Gene Abrams

Professor | Department of Mathematics | University of Colorado, Colorado Spring, USA

A student's introduction to linear algebra usually includes the hypothesis that all over the scalars come from either the real numbers \mathbb{R} or the complex numbers \mathbb{C} . However, many (but not all!) of the standard ideas of linear algebra (e.g. vector space, matrix, linear transformation, canonical form) can be considered when the scalars come from some other system. In this series of two lectures we'll look at linear algebra ideas where the scalars are required to come from the set of integers \mathbb{Z} .

In Lecture 1 we will begin by reviewing some of the basic ideas of linear algebra over \mathbb{R} . Then we will look at an important idea that is sometimes not included in a standard linear algebra course, namely, the quotient space of a vector space by a subspace. Most of the remainder of Lecture 1 will be taken up by considering the basics of linear algebra over \mathbb{Z} . This will include ideas such as modular arithmetic, and Smith normal form.

'Lecture 2' will in fact be more of an 'Activity Session' than a lecture. We will take many of the ideas from Lecture 1, and see how they apply to some mathematical constructions known as "Mad Veterinarian Puzzles" ("Rompicampi di un Pazzo Veterinario").