

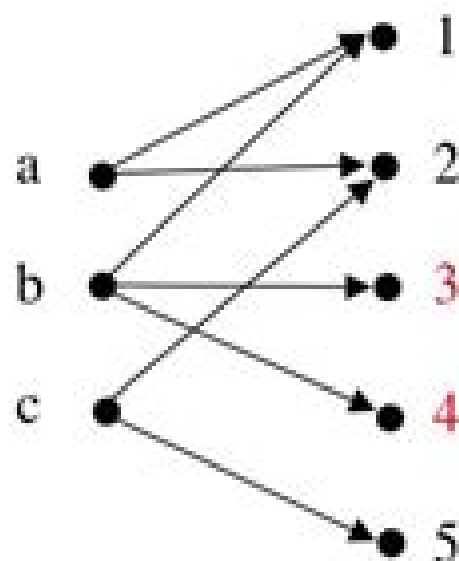
# Examples of Matroids

Given a ground set  $E$ , a **matroid** classifies all subsets in  $E$  as either **independent** or **dependent**.

## ■ Transversal Matroid:

Boys

$E = \{ \text{Girls} \}$



A matroid structure  
on a network

Independence = matchable to boys

# Matroid Theory

**Neil White**



## **Matroid Theory:**

**Matroid Theory** J. G. Oxley, 2006 The study of matroids is a branch of discrete mathematics with basic links to graphs lattices codes transversals and projective geometries Matroids are of fundamental importance in combinatorial optimization and their applications extend into electrical engineering and statics This incisive survey of matroid theory falls into two parts the first part provides a comprehensive introduction to the basics of matroid theory while the second treats more advanced topics The book contains over five hundred exercises and includes for the first time in one place short proofs for most of the subjects major theorems The final chapter lists sixty unsolved problems and details progress towards their solutions

**Matroid Theory** D. J. A. Welsh, 2010-01-01 The theory of matroids connects disparate branches of combinatorial theory and algebra such as graph and lattice theory combinatorial optimization and linear algebra This text describes standard examples and investigation results and it uses elementary proofs to develop basic matroid properties before advancing to a more sophisticated treatment 1976 edition **Matroids: A Geometric Introduction** Gary Gordon, Jennifer

McNulty, 2012-08-02 Matroid theory is a vibrant area of research that provides a unified way to understand graph theory linear algebra and combinatorics via finite geometry This book provides the first comprehensive introduction to the field which will appeal to undergraduate students and to any mathematician interested in the geometric approach to matroids Written in a friendly fun to read style and developed from the authors own undergraduate courses the book is ideal for students Beginning with a basic introduction to matroids the book quickly familiarizes the reader with the breadth of the subject and specific examples are used to illustrate the theory and to help students see matroids as more than just generalizations of graphs Over 300 exercises are included with many hints and solutions so students can test their understanding of the materials covered The authors have also included several projects and open ended research problems for independent study Theory of Matroids Neil White, 1986-04-03 The theory of matroids is unique in the extent to which

it connects such disparate branches of combinatorial theory and algebra as graph theory lattice theory design theory combinatorial optimization linear algebra group theory ring theory and field theory Furthermore matroid theory is alone among mathematical theories because of the number and variety of its equivalent axiom systems Indeed matroids are amazingly versatile and the approaches to the subject are varied and numerous This book is a primer in the basic axioms and constructions of matroids The contributions by various leaders in the field include chapters on axiom systems lattices basis exchange properties orthogonality graphs and networks constructions maps semi modular functions and an appendix on cryptomorphisms The authors have concentrated on giving a lucid exposition of the individual topics explanations of theorems are preferred to complete proofs and original work is thoroughly referenced In addition exercises are included for each topic A Source Book in Matroid Theory KUNG, 2013-11-09 by Gian Carlo Rota The subjects of mathematics like the subjects of mankind have finite lifespans which the historian will record as he freezes history at one instant of time There are

the old subjects loaded with distinctions and honors As their problems are solved away and the applications reaped by engineers and other money men ponderous treatises gather dust in library basements awaiting the day when a generation as yet unborn will rediscover the lost paradise in awe Then there are the middle aged subjects You can tell which they are by roaming the halls of Ivy League universities or the Institute for Advanced Studies Their high priests haughtily refuse fabulous offers from eager provincial universities while receiving special permission from the President of France to lecture in English at the College de France Little do they know that the load of technicalities is already critical about to crack and submerge their theorems in the dust of oblivion that once enveloped the dinosaurs Finally there are the young subjects combinatorics for instance Wild eyed individuals gingerly pick from a mountain of intractable problems childishly babbling the first words of what will soon be a new language Childhood will end with the first Seminaire Bourbaki It could be impossible to find a more fitting example than matroid theory of a subject now in its infancy The telltale signs for an unfailing diagnosis are the abundance of deep theorems going together with a paucity of theories

**Matroid Theory** Joseph Edmond Bonin, 1996 This volume contains the proceedings of the 1995 AMS IMS SIAM Joint Summer Research Conference on Matroid Theory held at the University of Washington Seattle The book features three comprehensive surveys that bring the reader to the forefront of research in matroid theory Joseph Kung's encyclopedic treatment of the critical problem traces the development of this problem from its origins through its numerous links with other branches of mathematics to the current status of its many aspects James Oxley's survey of the role of connectivity and structure theorems in matroid theory stresses the influence of the Wheels and Whirls Theorem of Tutte and the Splitter Theorem of Seymour Walter Whiteley's article unifies applications of matroid theory to constrained geometrical systems including the rigidity of bar and joint frameworks parallel drawings and splines These widely accessible articles contain many new results and directions for further research and applications The surveys are complemented by selected short research papers The volume concludes with a chapter of open problems Features Self contained accessible surveys of three active research areas in matroid theory Many new results Pointers to new research topics A chapter of open problems Mathematical applications Applications and connections to other disciplines such as computer aided design and electrical and structural engineering

**Introduction to the Theory of Matroids** R. v. Randow, 2012-12-06 Matroid theory has its origin in a paper by H Whitney entitled On the abstract properties of linear dependence 35 which appeared in 1935 The main objective of the paper was to establish the essential abstract properties of the concepts of linear dependence and independence in vector spaces and to use these for the axiomatic definition of a new algebraic object namely the matroid Furthermore Whitney showed that these axioms are also abstractions of certain graph theoretic concepts This is very much in evidence when one considers the basic concepts making up the structure of a matroid some reflect their linear algebraic origin while others reflect their graph theoretic origin Whitney also studied a number of important examples of matroids The next major development was brought about in the forties by R Rado

s matroid generalisation of P Hall's famous marriage theorem. This provided new impulses for transversal theory in which matroids today play an essential role under the name of independence structures of the treatise on transversal theory by L. Mirsky [26]. At roughly the same time R. P. Dilworth established the connection between matroids and lattice theory. Thus matroids became an essential part of combinatorial mathematics. About ten years later W. T. Tutte [30] developed the fundamentals of matroids in detail from a graph theoretic point of view and characterised graphic matroids as well as the larger class of those matroids that are representable over any field.

*Matroid Theory and its Applications in Electric Network Theory and in Statics* András Recski, 2013-06-29

The concept of a matroid has been known for more than five decades. Whitney (1935) introduced it as a common generalization of graphs and matrices. In the last two decades it has become clear how important the concept is for the following reasons:

1. Combinatorics or discrete mathematics was considered by many to be a collection of interesting, sometimes deep but mostly unrelated ideas. However, like other branches of mathematics, combinatorics also encompasses some general tools that can be learned and then applied to various problems. Matroid theory is one of these tools.
2. Within combinatorics, the relative importance of algorithms has increased with the spread of computers. Classical analysis did not even consider problems where only a finite number of cases were to be studied. Now such problems are not only considered but their complexity is often analyzed in considerable detail. Some questions of this type, for example, the determination of when the so-called greedy algorithm is optimal, cannot even be answered without matroidal tools.

**Topics in Matroid Theory** Leonidas S. Pitsoulis, 2013-10-24

Topics in Matroid Theory provides a brief introduction to matroid theory with an emphasis on algorithmic consequences. Matroid theory is at the heart of combinatorial optimization and has attracted various pioneers such as Edmonds, Tutte, Cunningham, and Lawler, among others. Matroid theory encompasses matrices, graphs, and other combinatorial entities under a common solid algebraic framework, thereby providing the analytical tools to solve related difficult algorithmic problems. The monograph contains a rigorous axiomatic definition of matroids along with other necessary concepts such as duality, minors, connectivity, and representability as demonstrated in matrices, graphs, and transversals. The author also presents a deep decomposition result in matroid theory that provides a structural characterization of graphic matroids and shows how this can be extended to signed graphic matroids as well as the immediate algorithmic consequences.

Matroid Theory László Lovász, András Recski, 1985

**Combinatorial Geometries** Neil White, 1987-09-24

This book is a continuation of Theory of Matroids, also edited by Neil White, and again consists of a series of related surveys that have been contributed by authorities in the area. The volume begins with three chapters on coordinatisations, followed by one on matching theory. The next two deal with transversal and simplicial matroids. These are followed by studies of the important matroid invariants. The final chapter deals with matroids in combinatorial optimisation, a topic of much current interest. The whole volume has been carefully edited to ensure a uniform style and notation throughout and to make a work that can be used as a reference or as an introductory

textbook for graduate students or non specialists     Matroid Theory and Its Applications A. Barlotti, 2011-06-08 Lectures T H Brylawski The Tutte polynomial D J A Welsh Matroids and combinatorial optimisation Seminars M Barnabei A Brini G C Rota Un'introduzione alla teoria delle funzioni di Möbius A Brini Some remarks on the critical problem J Oxley On 3 connected matroids and graphs R Peele The poset of subpartitions and Cayley's formula for the complexity of a complete graph A Recski Engineering applications of matroids T Zaslavsky Voltage graphic matroids     **Introduction to the Theory of Matroids** W. T. Tutte, 1971     *Matroid Applications* Neil White, 1992-03-05 This volume the third in a sequence that began with *The Theory of Matroids and Combinatorial Geometries* concentrates on the applications of matroid theory to a variety of topics from engineering rigidity and scene analysis combinatorics graphs lattices codes and designs topology and operations research the greedy algorithm     *Matrices and Matroids for Systems Analysis* Kazuo Murota, 2009-10-27 A matroid is an abstract mathematical structure that captures combinatorial properties of matrices This book offers a unique introduction to matroid theory emphasizing motivations from matrix theory and applications to systems analysis This book serves also as a comprehensive presentation of the theory and application of mixed matrices developed primarily by the present author in the 1990's A mixed matrix is a convenient mathematical tool for systems analysis compatible with the physical observation that fixed constants and system parameters are to be distinguished in the description of engineering systems This book will be extremely useful to graduate students and researchers in engineering mathematics and computer science From the reviews The book has been prepared very carefully contains a lot of interesting results and is highly recommended for graduate and postgraduate students András Recski Mathematical Reviews Clippings 2000m 93006

**Matroid Theory and Its Applications** Adriano Barlotti, 1982     **Algorithmic Learning Theory** Klaus P. Jantke, Shigenobu Kobayashi, Etsuji Tomita, 1993-10-20 Annotation This volume contains the papers that were presented at the Third Workshop on Algorithmic Learning Theory held in Tokyo in October 1992 In addition to 3 invited papers the volume contains 19 papers accepted for presentation selected from 29 submitted extended abstracts The ALT workshops have been held annually since 1990 and are organized and sponsored by the Japanese Society for Artificial Intelligence The main objective of these workshops is to provide an open forum for discussions and exchanges of ideas between researchers from various backgrounds in this emerging interdisciplinary field of learning theory The volume is organized into parts on learning via query neural networks inductive inference analogical reasoning and approximate learning     **Matroid Theory** James G. Oxley, 1992     Matroid Theory László Lovász, András Recski, 1985     **Extremal and Characterization Problems in Matroid Theory** George Walter Dinolt, 1972

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