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Category Theory Lecture Notes - The University of Edinburgh

These are lecture notes for an undergraduate seminar covering Category Theory, taught by the author at Northwestern University. The book we roughly follow is Category Theory in

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Category Theory Lecture Notes by Daniele Turi. Publisher: University of Edinburgh 2001

Number of pages: 61. Description: These notes were written for an eighteen lectures course in category theory. The course was designed to be self-contained, drawing most of the examples from category theory itself.

Category Theory Lecture Notes - Download link

arXiv:1912.10642v5 [math.CT] 25 Aug 2020 Notes on Category Theory with examples from basic mathematics Paolo Perrone [www.paoloperrone.org](http://www.paoloperrone.org) Last update: August 2020

Notes on Category Theory - arXiv

lations in different areas of mathematics, which led them to develop category theory. Category theory is really about building bridges between different areas of mathematics. 1.1 Definitions

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and examples This is just about setting up the terminology. There will be no theorems in this chapter. Definition 1.1. A category  $C$  consists of

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School of Computer Science and Information Technology, University of Nottingham, 2001.

M.Barr and C.Wells. Category Theory. Lecture Notes for ESSLLI, 1999. M.Fiore. Rough notes on presheaves. Notes for a postgraduate mini-course, PPS, Universite Paris Diderot - Paris 7, 2001. J.van Oosten. Basic Category Theory. Department of Mathematics ...

Category Theory for Computer Science

These notes were originally developed as lecture notes for a category theory course. They should be well-suited to anyone that wants to learn category theory from scratch and has a scientific mind. There is no need to know advanced mathematics, nor any of the disciplines where category theory is traditionally applied, such as algebraic geometry or theoretical computer science.

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Categories represent abstractions of other mathematical concepts. Many areas of mathematics can be formalised by category theory as categories. Hence category theory uses abstraction to make it possible to state and prove many intricate and subtle mathematical results in these fields in a much simpler way. A basic example of a category is the category of sets, where the objects are sets and the arrows are functions from one set to another.

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A short introduction ideal for students learning category theory for the first time.

Introduction to concepts of category theory – categories, functors, natural transformations, the Yoneda lemma, limits and colimits, adjunctions, monads – revisits a broad range of mathematical examples from the categorical perspective. 2016 edition.

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Category Theory has developed rapidly. This book aims to present those ideas and methods which can now be effectively used by Mathematicians working in a variety of other fields of Mathematical research. This occurs at several levels. On the first level, categories provide a convenient conceptual language, based on the notions of category, functor, natural transformation, contravariance, and functor category. These notions are presented, with appropriate examples, in Chapters I and II. Next comes the fundamental idea of an adjoint pair of functors. This appears in many substantially equivalent forms: That of universal construction, that of direct and inverse limit, and that of pairs of functors with a natural isomorphism between corresponding sets of arrows. All these forms, with their interrelations, are examined in Chapters III to V. The slogan is "Adjoint functors arise everywhere". Alternatively, the fundamental notion of category theory is that of a monoid -a set with a binary operation of multiplication which is associative and which has a unit; a category itself can be regarded as a sort of generalized monoid. Chapters VI and VII explore this notion and its generalizations. Its close connection to pairs of adjoint functors illuminates the ideas of universal algebra and culminates in Beck's theorem characterizing categories of algebras; on the other hand, categories with a monoidal structure (given by a tensor product) lead inter alia to the study of more convenient categories of topological spaces.

Containing example exercises, this reference to category theory is suitable for researchers and graduates in philosophy, mathematics, and computer science. With definitions of concepts, and proofs of propositions and theorems, the text makes the ideas of this topic understandable

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to the broad readership.

Basic Category Theory for Computer Scientists provides a straightforward presentation of the basic constructions and terminology of category theory, including limits, functors, natural transformations, adjoints, and cartesian closed categories. Category theory is a branch of pure mathematics that is becoming an increasingly important tool in theoretical computer science, especially in programming language semantics, domain theory, and concurrency, where it is already a standard language of discourse. Assuming a minimum of mathematical preparation, Basic Category Theory for Computer Scientists provides a straightforward presentation of the basic constructions and terminology of category theory, including limits, functors, natural transformations, adjoints, and cartesian closed categories. Four case studies illustrate applications of category theory to programming language design, semantics, and the solution of recursive domain equations. A brief literature survey offers suggestions for further study in more advanced texts. Contents Tutorial □ Applications □ Further Reading

A wide coverage of topics in category theory and computer science is developed in this text, including introductory treatments of cartesian closed categories, sketches and elementary categorical model theory, and triples. Over 300 exercises are included.

An introduction to category theory as a rigorous, flexible, and coherent modeling language that

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can be used across the sciences. Category theory was invented in the 1940s to unify and synthesize different areas in mathematics, and it has proven remarkably successful in enabling powerful communication between disparate fields and subfields within mathematics. This book shows that category theory can be useful outside of mathematics as a rigorous, flexible, and coherent modeling language throughout the sciences. Information is inherently dynamic; the same ideas can be organized and reorganized in countless ways, and the ability to translate between such organizational structures is becoming increasingly important in the sciences. Category theory offers a unifying framework for information modeling that can facilitate the translation of knowledge between disciplines. Written in an engaging and straightforward style, and assuming little background in mathematics, the book is rigorous but accessible to non-mathematicians. Using databases as an entry to category theory, it begins with sets and functions, then introduces the reader to notions that are fundamental in mathematics: monoids, groups, orders, and graphs—categories in disguise. After explaining the “big three” concepts of category theory—categories, functors, and natural transformations—the book covers other topics, including limits, colimits, functor categories, sheaves, monads, and operads. The book explains category theory by examples and exercises rather than focusing on theorems and proofs. It includes more than 300 exercises, with solutions. *Category Theory for the Sciences* is intended to create a bridge between the vast array of mathematical concepts used by mathematicians and the models and frameworks of such scientific disciplines as computation, neuroscience, and physics.

This book develops the theory of infinite-dimensional categories by studying the universe, or

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□-cosmos, in which they live.

Category theory is unmatched in its ability to organize and layer abstractions and to find commonalities between structures of all sorts. No longer the exclusive preserve of pure mathematicians, it is now proving itself to be a powerful tool in science, informatics, and industry. By facilitating communication between communities and building rigorous bridges between disparate worlds, applied category theory has the potential to be a major organizing force. This book offers a self-contained tour of applied category theory. Each chapter follows a single thread motivated by a real-world application and discussed with category-theoretic tools. We see data migration as an adjoint functor, electrical circuits in terms of monoidal categories and operads, and collaborative design via enriched profunctors. All the relevant category theory, from simple to sophisticated, is introduced in an accessible way with many examples and exercises, making this an ideal guide even for those without experience of university-level mathematics.

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