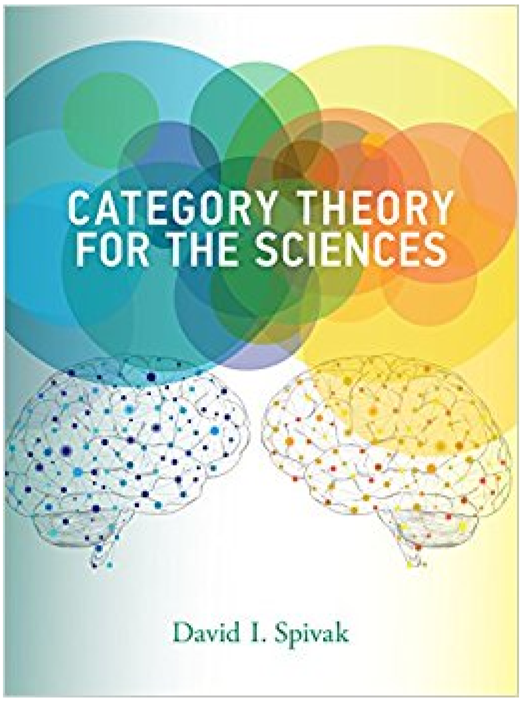
Category Theory For The Sciences (MIT Press)



Synopsis

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.

Book Information

File Size: 14039 KB

Print Length: 496 pages

Publisher: The MIT Press; 1 edition (October 17, 2014)

Publication Date: October 17, 2014

Sold by:Ã Â Digital Services LLC

Language: English

ASIN: B00OPJXVXU

Text-to-Speech: Not enabled

X-Ray for Textbooks: Enabled

Word Wise: Not Enabled

Lending: Not Enabled

Enhanced Typesetting: Not Enabled

Best Sellers Rank: #447,615 Paid in Kindle Store (See Top 100 Paid in Kindle Store) #9 inÃ Â Kindle Store > Kindle eBooks > Nonfiction > Science > Mathematics > Pure Mathematics > Set Theory #81 inÃ Â Books > Science & Math > Mathematics > Pure Mathematics > Set Theory #315 inÃ Â Kindle Store > Kindle eBooks > Nonfiction > Science > Mathematics > Pure Mathematics > Algebra

Customer Reviews

Pros:* Has lots of examples/questions with solutions, which help you clearly understand the concepts being discussed,* Spivak builds up concepts gradually with lots of worked out examples,* Requires little by way of mathematical background. Very suitable for non-mathematicians or those with basic mathematical background.* An early version is available online in PDF format, so you can evaluate before buying. The book contains solutions after every "exercise", not so for the PDF.Cons:* Much of the early part of the book is motivated by "ologs", which I feel have doubtful utility in practical science. I feel this detracts from the overall presentation.* The book takes a long time to actually introduce Categories, because Spivak takes the time to introduce mathematical background. However, this forces the reader wade through a lot of material, which is likely unfamiliar to his target audience and -- I feel -- is less useful in actually understanding Category theory. Overall, I found this "bottom-up" pedagogical approach makes it quite hard to see the forest (broad ideas & thrust of category theory) for the trees (a multitude of newly introduced concepts).I gave up reading Spivak after Chapter 3 and switched to Awodey’s excellent Category Theory book. Awodey’s approach is "top-down", introducing categories almost immediately then examples to flesh out the concepts. It has a far more abstract and intuitive flavor in its presentation compared to Spivak, which is what I like most about it. However, it is also much denser than Spivak, and is a far more challenging read, but should still be accessible to anyone with first year college-level exposure to abstract algebra.

David Spivak is a welcome new breed of MIT lecturer whose passion is to motivate, engage, and facilitate a students learning of a subject.Its predecessors are "Category Theory for Computer Scientists" Barr & Wells, "A First Introduction to Categories" - Lawvere & Schnauel, and"Category Theory" -Awodey. This book is a Rosetta Stone for understanding the forthcoming new applications of Category Theory to real world issues such as the foundations of computer science (e.g., Algebraic Theory of Machines - Jack Rhodes and Ken Khon) and physics (e.g., John Baez).Where was Spivak when one first encountered the new and ethereal Category Theory in the late 1950’s under Dan Kan, Warren Ambrose, andSerge Lang. Closest comparison would be BUD/S training.And let us not forget the esteemed George Whitehead classes (e.g. "Elements of Homotopy Theory"which was based on his lectures): --- Enter the class room; start writing as fast as possible on the blackboard mimicking tap-dancing squirrels, andwhen reaching the end of the blackboards erasing the first board. Carpal Tunnel Syndrome for the few survives of his course.As with Barr & Wells, Spivak supplies answers that facilitate grasping the underlying metaphors of the subject presented with instant feedbackallowing a natural progression of the subject. He smoothly inculcates the reader with the metaphors for further study such as Grothendieck Construction and Topos theory. Peter T. Johnstone's Olympian "Topos Theory " (Dover) and "Sketches of an Elephant" are the ultimate injoyous reading for the mathematically 'deranged' who cannot get enough.Only one kvetch. The printing of the text is so light that one wonders if MIT Press had run out of toner, making reading a chore for older readers.In contrast, Norbert Wiener's "Cybernetics 2", 1960 is still readable because real ink was used.In conclusion Spivak's book is a joy and an important gateway for a scientist of the new emerging fields.

This will be short and to the point, rather different from Mr. Spivak's book. First, I think it is a very good book if you want to see why category theory is useful in computer science. It is not a very good book if you want to learn category theory in general, because it is CLUTTERED with too much, well, clutter, between the actual definitions and theorems. But there are flashes of brilliance in the exposition and it is probably worth the slog through the clutter. A worthwhile effort.(And I agree with another reviewer that "ologs" are not worth all the space Spivak gives them. I think they really add nothing much and might better be a quick aside in the section on databases.)

A little hard to get through at first, as the descriptions of his fundamental concept, ologs, was both wordy and a bit obtuse. But htis is ground breaking in its relationship to the use in computation and that is a big deal. By itself it may not be sufficient to grasp all the essentials of category theory and thus Suanders MacLane's Mathematics Form and Function is still the best overall overview

Phenomenal book. I was looking for a good introduction to category theory for non-mathematicians and this definitely hits the mark. It starts out very accessible with its use of ontology logs (ologs) but subsequently gets very mathematical and rigorous, so you'll definitely need some degree of "mathematical maturity" to appreciate this. A good background in proofs/set theory should suffice. I would recommend "Book of Proof" by Richard Hammack as a prequel to this book. This work covers a lot of interesting ground including set theory, topology, and simplicial complexes.

Been teaching a lunch-time course to my colleagues from this. Really sharpens your thinking and helps you find fuzziness, ambiguity, and errors just about everywhere you look.