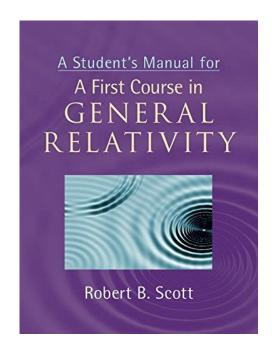
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In a general relativitytextbook world dominated by the insightful, albeit voluminous, Gravitation by Charles Misner, Kip Thorne, and John Wheeler, Bernards book represented a lighter, more tractable introduction to Einsteins realm. In the spirit of full disclosure relevant to this review, I was Charlie Misners teaching assistant the first year he taught from the bound edition of Gravitation, and I wrote solutions to numerous homework problems in the book for his students; they were handed out after the problems were graded. Indeed, I still have the mimeographs you are showing your age if you remember that technology of many of them. I was also Bernard Schutz first graduate student and some of our work in theoretical general relativity was cited by Chandrasekhar in his 1983 Nobel Prize lecture. I have taught general relativity here at the University of Maine using A First Course in General Relativity several times to good effect. Furthermore, I am also a textbook author introductory astronomy texts for nonmajors. Robert B. Scotts A Students Manual for A First Course in General Relativity is written to provide solutions to nearly half of the homework problems in the second edition of Bernards textbook, as well as to provide further exercises and their solutions. According to Scott, A Students Manual is written with several audiences in mind, including "selflearners," and both undergraduate and graduate students. In other words, A Students Manual was written for use by essentially anyone with the background calculus and the motivation and aptitude for understanding the more advanced mathematics presented in Schutz book. The solutions are stated clearly and, for the most part, each step is presented and explained. Useful "hints" are provided for several problems. There are also appendices of acronyms, symbols, and "useful results." So far, so good.

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It is only when one steps back and looks at the bigger picture of textbooks and their contents that the clouds begin to thicken in regard to this book. As a textbook writer, I am leery of books of solutions to the questions in my texts. My reasoning is that many students are taking the introductory courses in astronomy because they need the credit to graduate, rather than because of a deepseated interest in the course content. These students are more than happy to have access to solutions that will help them get better grades on their homework, even if those solutions will not

help them understand the material as fully as they should. This often shows up when such students do not perform as well on exams as they would if they had made the effort to read the book and use it to answer the questions. For more advanced courses, such as introductory general relativity, one could reasonably make the case that the students are highly motivated to understand the material. Therefore, they will make a "best effort" to read the book, parse the content, and work the exercises on their own or with their peers, until they solve all the problems they can. For problems they cannot solve, reference to a book or online file with answers to the exercises, used judiciously and with the instructors permission, would indeed be a good thing. Bernard feels the same way, as he states in a preface to the solutions he released online in 2009 to half the exercises in his text. Such additional exercises, along with their solutions, can be instructive for people who are interested in gaining a deeper understanding of a topic. Indeed, Scotts book is not the first providing new exercises and solutions in general relativity. Schutz cites another book filled with exercises for students to solve Problem Book in Relativity and Gravitation by Alan Lightman, William Press, Richard Price, and Saul Teukolsky Princeton University Press, 1975.

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I notice that this book is not cited in the references provided by Scott. So, who benefits intellectually from a book that provides detailed solutions to exercises set in someone elses advancedlevel textbook. Plausibly, students who cannot solve problems and whose other resources have not helped them, as noted above, and who could use published answers as a last resort. Also, nonstudents interested in a field, who have tried the problems on their own, and if necessary gone to an online chat room to work with others doing the same problems, but who still cannot solve them could find detailed published answers insightful. However, in the case of A First Course in General Relativity, both students and nonstudents can look up Bernards solutions online and work backward from them until they understand the problems. A related issue with having access to stepbystep solutions as in Scotts book is if students submit homework based on those answers, their solutions will not necessarily reflect how well they really understand the material. I could envision one type of ancillary book that could help in this process, for introductory general relativity and many other advanced topics; namely, books that give effective hints for many of the textbook exercises, without giving the answers. Such a book could help guide students in ways that their instructors would find helpful without disrupting the best practices for students working to learn advanced materials. Article views prior to December 2016 are not included. Einsteins General Relativity and Gravitation Solutions to the Field Equations 3. Solutions to. Schutz General relativity has become one of the central pillars of. Hartle Solutions Manual General Relativity, Addison 1 A detailed solution manual and guide for Schutz s First Course in General. Your Shopping Cart is. Compact Track Loader Attachments. Schutz General relativity has become one of the central pillars of theoretical physics.

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This book aims to be mathematically rigorous. For instance he introduces manifolds in Chapter 2 and proves that the tangent vector space has the same dimension as the manifold. I find the book

much less readable than the references above. On the other hand when I read the GR literature, I most often turn to Walds book to make sense of it. Heres a little test to see if this book is for you. Compare the definition of stationary spacetimes given by Wald and those of introductory books like Schutz and Hobson et al.. While Wald states. Schutz and other introductory books state something like. For a stationary spacetime the time derivative of all components of the metric tensor are zero. If you find these two statements equally enlightening perhaps you can skip the introductory books and jump into the deepend with Wald. A good background in differential geometry and analysis, and some knowledge of topological spaces would be very helpful. Updated October 25, 2012. See description below under mathematics books. The pace is more rapid then Schutz2009 or Hobson et al.2006; the section on tensor calculus is surprisingly brief. But the benefit is that he covers more advanced topics, e.g. a very nice section on classical field theory that forms the basis of so much of modern physics. And. Carroll has a real gift for presentation, as is clear from his popular level documentary film in the style of video taped lectures on dark energy and dark matter for the Teaching Company. For more on Carroll and his publications, see Carrolls homepage. In the spirit of Einstein himself, there is a strong emphasis on connecting mathematical ideas with physical experiments. For example the Cartesian coordinates are introduced with the thought experiment due to Einstein 1905 of synchronizing the clocks by passing light signals between them. And there are some gems of differential geometry not normally covered in introductory GR texts.

This makes for great supplementary reading for the student of GR at any level. This is an introductory reference on Einsteins general theory of relativity at a similar level to Schutz 2009 or Hobson et al. 2006 but written by a mathematician. The mathematics is explained very clearly. One needs only basic knowledge of vector calculus. Some of the exercises are very challenging, while most are quite doable. This is not the best book from which to learn GR. The most serious limitation is that Faber avoids defining tensors. I soon got tired of typing out all solutions. Apparently a solution manual exists but its out of print and difficult to get hold of.. Rather than type out solutions for every one, in my notes you will find my complete solutions to some of the more interesting exercises. Email me if youd like to see a particular solution that I havent presented. Ive completed Part I on differential geometry but have no immediate plans to do Parts II or III. Last update May, 2012. Youll also find my extended Index of Symbols and Terms and a List of Definitions, Theorems, and Lemmas. Its a first book on rigorous pure mathematics if you like. It assumes very little background and introduces the foundations of analysis. Its a prerequisit for, for example functional analysis, dynamical systems, measure theory, and much more. This can be frustratingly slow and perhaps youd like to jump ahead to the good stuff. But be careful because if you pickup almost any postgraduate level mathematics book youll have a lot of trouble if you havent put in the hours learning the basics. Hassanis book provides an extremely useful alternative. Here in one single rather large textbook youll find an introduction to much of the mathematics useful to physicists operator theory, Hilbert spaces, manifolds and differential geometry, Lie algebras, and on and on. And its accessible to physics undergraduates.

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