portion of E, where α satisfies a particular technical condition that occurs unboundedly often below κ^{++}. He then defines a forcing notion $\mathbb{R}(\vec{F}, \vec{\gamma})$ via a coherent sequence of extenders $\vec{F}$ and a suitable sequence of ordinals $\vec{\gamma}$ and shows that, depending upon the exact nature of $\vec{F}$ and $\vec{\gamma}$, $\mathbb{R}(\vec{F}, \vec{\gamma})$ corresponds either to Radin's version of Radin forcing as given in his paper mentioned above or to Mitchell's version of Radin forcing as given in his paper mentioned above.

The fourth of Cummings's papers, written jointly with Foreman and Magidor, is an extensive article discussing different versions of Jensen's combinatorial principle square ($\Box$) and their relationships to scales as found in Shelah's pcf theory and various kinds of stationary reflection principles. It is divided into fourteen sections. I will try to summarize and highlight their contents in what follows, although for brevity, there will be omissions made. Sections 1 and 2 are introductory, containing a discussion on background information, basic terminology, and some known results. Sections 3 and 4 discuss relationships among different principles due to Shelah, weak forms of square, and various reflection properties. Section 5 discusses an improved version of square and limitations on its consistency. Sections 6 and 8 discuss how one forces various kinds of square sequences, with Section 8 containing the surprising result that under certain circumstances, it is possible to do a small forcing that adds a square sequence. Section 7 discusses how to construct a model by forcing in which a certain weak version of square holds at $\aleph_\omega$ yet another weak version of square fails at $\aleph_\omega$. Section 9 shows that even though there are limitations to the kinds of square sequences that can exist above a supercompact cardinal, it is still possible to force and obtain a certain square principle that can hold above a supercompact cardinal. Section 10 contains another discussion about square and reflection principles at $\aleph_\omega$. Section 11 discusses the kind of reflection and scale principles found after Prikry forcing has been done at the measurable cardinal κ. Section 12 shows how to force a strong form of diamond ($\Diamond$) due to Jensen and how to use it to obtain another result about square and reflection principles at $\aleph_\omega$. Section 13 shows how to force over a ground model for a strong form of Martin's Maximum to obtain a model in which one reflection principle holds yet another one fails. Section 14 concludes the paper with a list of open problems and a diagram indicating the relationships among the different square, scale, and stationary reflection principles discussed.

Cummings and his coauthors provide lucid and well-written presentations of important and difficult theorems in the theory of large cardinals and forcing, touching also upon relevant related results in inner model theory and pcf theory. Persistent and dedicated readers of these papers will be richly rewarded for their efforts.

Arthur W. Apter

Department of Mathematics, Baruch College of CUNY, New York, NY 10010, USA. awabb@cunyvm.cuny.edu.

Andreas Blass. *Simple cardinal characteristics of the continuum*. ***Set theory of the reals***, edited by Haim Judah, Israel mathematical conference proceedings, vol. 6, Gelbart Research Institute for Mathematical Sciences, Bar-Ilan University, Ramat-Gan 1993, distributed by the American Mathematical Society, Providence, pp. 63–90.

The paper investigates some of the common cardinal characteristics with respect to the complexity of their definitions in terms of descriptive set theory.

Let Γ denote a pointclass in the sense of descriptive set theory, boldface or lightface or even the whole OD$\mathbb{R}$. The reader should be aware that in the print in the proceedings volume the boldface Greek letters appear as lightface, and either think harder or get a version of the article where the TeX comes out as originally intended (e.g. the version posted on http://www.math.lsa.umich.edu/~ablass).

The following definitions are the starting point: An uncountable cardinal κ is a Γ-characteristic if there is a family of κ sets, each in Γ, such that ${}^\omega\omega$ is covered by the family