29. E. H. Spanier, *Algebraic topology*, McGraw-Hill, New York, 1966.

30. R. M. Switzer, *Algebraic topology: Homotopy and homology*, Die Grundlehren der Math. Wissenschaften, Band 212, Springer-Verlag, New York-Heidelberg, 1975.

31. O. Veblen, *Analysis situs*, Amer. Math. Soc. Colloq. Publ., no. 5, Amer. Math. Soc., New York, 1931.

32. J. W. Vick, *Homology theory*, Pure and Applied Math., vol. 53, Academic Press, New York-London, 1973.

33. A. H. Wallace, *An introduction to algebraic topology*, Pergamon, Oxford, 1957.

34. G. W. Whitehead, *Elements of homotopy theory*, Graduate Texts in Math., no. 61, Springer-Verlag, New York-Heidelberg, 1978.

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Measurement theory: with applications to decisionmaking, utility, and the social sciences, by Fred S. Roberts, Encyclopedia of Mathematics and its Applications, vol. 7, Addison-Wesley, Reading, Mass., 1979, xxii + 420 pp., $24.50.

Although measurement theory is not widely known academically or within the mathematics community and claims no professional society or exclusive journal, it has developed into a cohesive body of significant proportions during the past few decades. As often happens in areas that undergo a period of intense development, measurement theory has been afforded treatment in several books, the most recent of which is the one under review. Roberts' volume was preceded by Pfanzagl's *Theory of measurement* (1968), Volume I of the *Foundations of measurement* (1971) by Krantz, Luce, Suppes and Tversky (with Volume II nearing completion), and Fishburn's more specialized *Utility theory for decision making* (1970). These earlier works are primarily technical renderings that emphasize the axiomatic approach to measurement. While Roberts also stresses axiomatics, *Measurement theory* devotes considerable space to applications.

Early work in the theory of measurement focused on empirical laws or phenomena in physics – and to a lesser extent perhaps in psychophysics, economics, and other disciplines – that could be represented numerically, and on the special properties of such representations. While empirical phenomena continue to inform and motivate the subject, recent contributions have centered on axioms for qualitative relational systems that enable mappings into numerical systems that preserve the relational structures of the qualitative systems. Major contributors include mathematicians and mathematically oriented investigators in psychology, economics, philosophy, and statistics. A significant proportion of the articles on measurement theory that have appeared in the past twenty years are in the *Journal of Mathematical Psychology*, *Econometrica*, *Psychological Review*, and the *Annals of Statistics*. Mathematically, measurement theory draws heavily upon algebra and functional analysis, and is involved in various ways with discrete mathematics, probability theory, and topology. The relatons used in its axioms are usually binary orderings, either complete or partial.