

THE ADJUSTMENT AND COMPARISON OF OBSERVATIONS.

Lehrbuch der Ausgleichsrechnung nach der Methode der kleinsten Quadrate. Von Dr. K. J. BOBEK. Stuttgart, J. Maier, 1891. 8vo, pp. viii. + 176.

The Theory of Errors and Method of Least Squares. By WILLIAM WOOLSEY JOHNSON. New York, John Wiley & Sons, 1892. 12mo, pp. x. + 174.

THE text-book of Dr. Bobek is a curiosity as regards its catechetical form and typographical arrangement. In its substance, however, it is clear, sound, and highly practical. All the doubtful points regarding deductions of the law of facility of error, probable errors, and criteria for rejection of observations are passed over in silence, and the author in his 32 answers to questions, 29 explanations, and 52 problems writes with a certainty that should tend to inspire the student with confidence. Many lengthy examples of adjustments of observations in geodesy and physics are carried out in full detail with tabular forms for arranging the computations.

Professor Johnson's work is a careful and scholarly text-book on both the theory and practice of the subject. The doubtful points regarding the deduction of the law of error are not considered, and no place is given to criteria for rejection. More than one half the book, however, is devoted to discussions regarding the probability of errors, and to probable errors and comparisons of precision. The investigations regarding the probability surface and the probable errors of target shooting may be noted as one of these discussions, and another is that regarding the deductions of formulas for probable error. It is clearly pointed out that the probable error should be computed from the original individual observations and not from any weighted groups of these. It is shown that the assumption of the arithmetical mean involves the same law of errors for indirect as for direct observations. The way being thus made clear the whole discussion of indirect observations, both independent and conditioned, is given in the 29 pages of chapter VIII., while the last chapter treats of the solution of normal equations.

The tendency of modern text-books on the method of least squares in the direction of avoiding doubts regarding the deduction of the law of facility of error is clearly shown by the two works before us. The arithmetical mean being boldly assumed, and perhaps the assumption justified by a quotation from Gauss or by the discussion of Encke, the