The four methods of rate computation described under "Accounting Approach" are relatively easy to apply. As stated earlier, they apparently were developed from various practices of sellers or lenders in crediting to income their service charges on installment and loan contracts. On the same contract, the rates computed depend on the accounting practices used. It seems obvious that all of these rates cannot be accurate from a mathematical standpoint. For that reason, attention is now turned to the methods grouped under the present approach, which are based—not on accounting procedures—but on mathematical concepts.

THE PRESENT-VALUE APPROACH

A true discount (or interest) rate would appear to be one that will make the two purchase plans offered by the seller equivalent at the date of sale. A buyer may obtain the article for \$200 cash or he may buy it on time by paying \$50 down and \$20 a month for 8 months. Basically, the problem appears to be, "At what rate of discount (or interest) can 8 monthly installments of \$20 each be made equal to the difference between the cash price (\$200) and the down payment (\$50)?"

SIMPLE-DISCOUNT METHOD

A rough but easy approach to this problem of discounting future installments to equal the difference between the case price C and the down payment D is to set up an equation using the simple-discount rate d as follows:

$$\begin{aligned}\$200 = \$50 &+ \$20(1-d/12) + \$20(1-2d/12)\\ &+ \cdots + \$20(1-7d/12)\\ &+ \$20(1-8d/12).\end{aligned}$$

Solving for d gives 16.7 per cent. This is the rate shown in column 6 of table 1. There it was obtained by dividing the finance charge (\$10) by one-twelfth of the sum of the assumed beginning-of-the-month balances, starting with \$160 for the first month.[6] It appears that the simple-discount rate can be obtained from the sum of the beginning-of-the-month balances only by including the finance charge as part of the beginning balance.

The simple-discount method, also called the series-of-payments method, is easy to apply. However, rate equivalents computed by this method are not *interest* rates. For example, the present value of a future installment, at simple discount, cannot be treated as an amount that will "grow" at the same percentage rate to an amount equal to the periodic payment when it becomes due. Discount rates are based on maturity values (amounts to be paid), whereas a present value that is computed by simple or compound-interest methods will grow to its maturity value at the computed rate. Rates computed by the simple-discount method are less than comparable rates computed at simple or compound interest.[7] The latter, however, are more difficult to determine.

The general formula for a simple-discount rate equivalent

$$d = \frac{2mI}{pn(n+1)}$$

may be derived by solving the following equation for d

$$\begin{aligned}C = D &+ p(1-d/m) + p(1-2d/m) + \cdots\\ &+ p(1-nd/m).\end{aligned}$$

It may also be obtained by dividing the

[6] See table 2 for details with respect to the first three and last months. The equivalent of this method is given in Rosenberg's *Business Mathematics* (fourth edition), p. 323; in Richtmeyer and Foust's *Business Mathematics* (1950 edition, p. 212; and in Van Tuyl's *Business Arithmetic* (1947 edition), p. 341. It is, however, called an interest rate.

[7] In an article in the July, 1952 issue of this REVIEW (p. 366), Stelson shows that the results of four of the methods are arrayed, from lowest to highest, as follows: (Simple discount) < (Small loan) < (Constant ratio) < (Residuary)