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Issue Date: Jan-1927

Publisher: Ohio State University, College of Engineering

Citation: Ohio State Engineer, vol. 10, no. 2 (January, 1927), 10.

URI: http://hdl.handle.net/1811/33853

Appears in Collections: Ohio State Engineer: Volume 10, no. 2 (January, 1927)

Decimal Points in Slide Rule Computations

By Edward C. Heck, '29.

THE location of the decimal point when using a slide rule is one of the biggest problems in its operation. Professor J. T. Rood of the Department of Electrical Engineering at Wisconsin recently published an article in the "Wisconsin Engineer" which gives an interesting and useful method of finding the decimal point in the most complicated multiplications and divisions. The following is a simplified version of Professor Rood's methods:

The theory of the method is that when the slide of the rule projects to the right the number of digits in the product is one less than the sum of the digits in the two factors. When the slide projects to the left the number of digits in the product is equal to the sum of the digits in the factors. This, of course, applies only when the simple **logrithmic** scales are used, and not to folded or inverted scales.

Pull out your slip stick and consider the following multiplications: 2 x 3, 2 x 4, 2 x 5. We see that as long as the slide projects to the right the **maximum** value of the product is ten. (*Note.) Now use the right index and consider these: 9 x 1.2, 9 x 2, 9 x 3, 9 x 4, etc. In these cases the slide projects to the left and the **minimum** value of the product is ten, or the minimum number of digits to the left of the point in the product is two. So we see that in any multiplication the number of digits to the left of the point in the product is equal to the sum of the digits to the left of the point in the factors so long as the slide projects to the left, or to one less than the sum when the slide projects to the right.

For example:
224 x 3.92 = 878. approx. (Slide to the right)
294 x 3.62 = 1064. approx. (Slide to the left)

When the factors have zeros to the right of the point before the significant figures they must be taken into account. Professor Rood considers these zeros separately using a system of positive and negative checks. It seems more simple to consider them merely as negative digits to the left of the point. Thus in the multiplication: 432. x .0065 we would have three digits to the left of the point in the first factor, and negative two digits to the left of the point in the second factor. The algebraic sum would be one; so there would be one digit to the left of the point in the answer. In this case the slide projects to the left. If the slide projects to the right subtract one from the algebraic sum of the digits. Thus .032 x 175 = 5.6.

The following general rule then holds for multiplications: Indicate the multiplication and perform it in the usual way. Whenever the slide projects to the right of the rule place a check over that factor. Find the algebraic sum of the digits to the left of the decimal points, and subtract from that the number of checks you have indicated. The result will be the number of places to the left of the point in the answer.

Example:

√ √ √ √
.0034 x 2.42 x 657 x 8.9 x .00195=.0938 approx.

Algebraic sum of digits = (—8+1+3+1—2) =+1.

Checks are found over 2.42 and .00195, so there are two checks; subtracting these leaves negative one digit to the left of the point in the answer.

DIVISION

In division the theory is similar except that the digits in the denominator are subtracted from the digits in the numerator. The system Professor Rood uses with positive and negative checks requires the subtraction of one summation of three parts from another similar summation. Discarding the positive checks when we consider the zeros to the right of the point as negative digits, the method can be summarized into the following rule:

1. Indicate the division and work on the slide rule in the usual manner. Whenever the slide projects to the right of the rule check that factor.
   (2) Find the algebraic sum of the digits

√ √ √ √
447.2x17.8x18740x.000945x.0018x.0018
√ √ √ √
3.14x3.14x33x84.9x.0015x8.45x.0015 =.8740

2. To place the decimal point.
   a. Make summations.
      (1) Find the algebraic sum of the digits in the numerator. Add to this the number of checks in the denominator.
      (2) Find the algebraic sum of the digits in the denominator. Add to this the number of checks in the numerator.
   b. Subtract (2) from (1).
   c. The result will be the number of digits to the left of the point in the answer.

In the example given the algebraic sum of the digits to the left of the decimal points in the numerator is three. There are three checks in the denominator, so the summation will be six. The algebraic sum of the digits in the denominator is three, and there are three checks in the numerator, so the summation is six. Subtracting the latter from the former the result is zero so there will be zero places to the left of the point in the answer.

—E. C. Heck, '29.

* In case of 2 x 5 the multiplication may be worked with the slide projecting either to the right or left. In such cases consider the slide as projecting to the left.