Page 23, equation (4). Replace (-1) by $(-1)^n$.
Page 33, 1st line above (19). Replace (11) by (12).
Page 52, relation (61). Replace $\frac{d}{dw} P(w)$ by $w \frac{d}{dw} P(w)$.
Page 68, 7th line of (*b*). Replace $e^z z^{-1p}$ by $e^z z^{1-p}$.
Page 74, equation (3). Replace $\Gamma(z+a_2)/2)$ by $\Gamma(\,(z+a_2)/2)$.
Page 75. Put $\}$ at end of third line.
Page 78, 5th line. Omit $=$ after $\frac{2^{2x-1}}{\sqrt{\pi}}$.
Page 78, 1st line above series expression for $h(t)$. Replace 22 by 25.
Page 80, 5th line below equation (35). Replace arg z by arg t.
Page 93, 4th line below Fig. 9. Replace $\geqq$ by $\leqq$.
Page 105, 14th line. Replace $f_0(x)$ by of $f_0(x)$.
Page 110, 1st line beneath (82). Replace V by γ.
Page 134, 4th line of 2. Replace $R(z)>0$ by $-\pi<\arg z<0$; also replace "section" by "sector."
In 5th line replace $R(z)<0$ by $0<\arg z<\pi$.

RUDOLPH E. LANGER

LEVY AND ROTH ON PROBABILITY

Elements of Probability. By H. Levy and L. Roth. Oxford, Clarendon Press, 1936. i+196 pp.

This book pretends to be "no more than an elementary treatment," and so makes no effort to cover all the many applications of probability, or even that part of statistics which is probability. It is not an elementary text in the sense in which American authors use the term, but it does begin at the beginning, and makes no mathematical demands on the reader beyond a knowledge of the ordinary calculus and some finite differences.

The first five chapters have to do with the usual matters, definitions of probability, arrangements, Bernoulli's theorem, and what the authors occasionally call the normal law, but usually refer to as the Gaussian law, although it is now known that the credit for it does not belong to Gauss. There is in Chapter VI an attempt at a rigorous presentation of an extension of the definition of probability for discrete numbers to continuous distributions; but surely it cannot be made wholly rigorous without more restrictions on the curve than that it be continuous. The net result is that the probability that a point lie on a certain arc is proportional to the length of that arc. It would seem therefore that this result might better be taken as a definition, for, as it is, one gets the impression that the length of an arc has something to do with the number of points it contains, which is not true, and of course is not an inference which the authors would like to have made. In Chapter VIII various forms of probability distributions are considered, including the Poisson distribution and those represented by the use of Hermite's polynomials.

The last chapter (IX) has to do with "scientific induction." Much of this chapter is too condensed for most readers unless they are familiar with the substance already. It appears to be the culmination toward which the book is working, but on the whole it seemed to the reviewer not so carefully done as the rest. Probability is a tricky subject. An author must be careful in his use of language or else his own words may lead even him astray to say nothing of what they may do for his readers. Now the masterly introductory chapter and the carefully written second chapter on the meaning of probability are not followed by a similarly accurate use of words in this last chapter, perhaps because it seemed less necessary after the authors' ideas had been made clear initially; but there is no part of probability where precision of statement is more necessary than in the discussion of inference. In Chapter II, for example, the authors have stated that there are three kinds of probability which must be distinguished from each other: (1) mathematical probability (for example, the relative number of white balls in a bag); (2) statistical probability (the relative number of white balls that have been drawn from a bag); (3) a measure of psychological expectation (which is a subjective matter). These are discussed carefully and satisfactorily. On the other hand the last words of Chapter IX are not so satisfactory: "It is apparently three times more probable that the two populations are identical than that they are different." In which of these three senses does a hypothetical population have a probability, and if it does have a probability how can this afford a "scientific" basis for inference unless there is first established a relationship between the second kind of probability and the third? Moreover, the sentence just quoted concludes a discussion which apparently approves the use of that very disturbing assumption which has led most authors to discard Bayes' theorem, and which our authors also have condemned in a preceding discussion. There are other vague words and phrases in the chapter, such as (our italics) on page 184: "Suppose that a series of measurements is made of a quantity which in *normal* circumstances would have the value of m." · · · "There are n numbers · · · whose average is x; m is the mean *to be anticipated* if n were of infinite extent and if no factor had operated *to disturb the equilibrium* of the series."

Three tests of significance close the chapter: Fisher's t test, Irwin's test (1935), and Jeffrey's test (1935). The mathematical concepts behind these are given, and the reader is therefore at liberty to evaluate them as he likes, and by reading between the lines he can see, for example, that the tests of Irwin and Jeffrey, instead of being rival ways of looking at essentially the same thing, are somewhat similar ways of looking at different things, but it would be better if it were not necessary to read between the lines. There is room here for critical analysis. The early chapters had led us to expect that it would be keen and searching, but it is missing altogether. Instead, the remarks of the authors are quite casual and may give the impression that here are some tests that have some standing in the literature and that if an investigator does not fancy one of them he may try another. There are several instances throughout the book in which it should be, but is not, stated that the sampling is made one at a time with replacements (see example 1, page 160). This error seems to be due to the fact that in the statement of the Bernoulli theorem (page 58) the authors spoke of n objects as being "defined" as members of a population instead of being selected independently with replacements from it. Perhaps the idea of independence was implicit in the word "defined," but it was not expressed explicitly and so has not been copied in the applications to sampling. The word "exclusive" (page 52) is used in a peculiar sense in the statement of the fundamental product theorem, or else the language is otherwise faulty; for, if the classes were exclusive in the sense that an object could not belong to both, the probability of that object belonging to both would be zero. The table of normal areas is given in terms of multiples of $\sigma/\sqrt{2}$ as an argument instead of σ, as is now generally preferred.

A good deal of attention is paid (Chapter IX) to the problem of what happens to the distribution of observations when the experimenter "sweeps into his reading at say t_1 a number of readings at $t_1 \pm 1$, $t_1 \pm 2$, $\cdots$, and he "acts on the assumption that he is obtaining correct data in the given value of t" (page 147). It is further shown that a discussion of this problem is related to Bayes' theorem. The reviewer thinks that both these matters would be made much clearer if the same letter t were not used both for the true value being observed and for the reading which is being recorded. Using t for the first of these values and u for the second, the theories may be presented in the form of a two-way table, as follows:

u \ t	a			t			b	TOTALS
u				$f\phi$				$F(u)$
TOTALS				$f(t)$				1

Here $f\phi = f(t)\phi(t,u)$, and $F(u) = \int_a^b f(t)\phi(t, u)du$, which corresponds to the authors' expression (page 156)

$$U(t) = \int_a^b V(t + x)p(x)dx.$$

When the theory is thus presented, further applications are also immediately obvious.*

Besides its highly interesting and for the most part carefully written text, the volume contains in addition a large number of ingenious problems and illustrative examples.

BURTON H. CAMP

* The reviewer plans to discuss this in more detail in another paper.