

$i=1, 2$ . Although the  $H_{1/8}^{(i)}(x)$  are triple-valued functions, the  $h_i(z)$  are single-valued.

There is a thorough discussion of the properties of the functions. The computation time was forty-five days. It is stated that without the calculator years would have been necessary for this task. This fact gives some indication of the capacity of the machine.

E. R. LORCH

*A manual of operation for the automatic sequence controlled calculator.*

Cambridge, Harvard University Press; London, Oxford University Press, 1946. 6+561 pp. \$10.00.

The "analytical engine" of Babbage has finally been realized in the Harvard Calculator described in this book. This device, a brilliant engineering achievement, was constructed and donated by the International Business Machines Corporation.

The Calculator is designed to carry out any sequence of calculations. A tape is punched in accordance with a certain code and this is inserted in the sequence control mechanism, a complicated arrangement of relays. Under the control of the sequence mechanism are a large number of storage counters which also function as adders, a "multiply-divide" unit, and various function units for  $\log_{10} x$ ,  $10^x$ , and  $\sin x$ . The sequence mechanism arranges for the transfer of a number in one unit to another, directs the operation of the various units and appropriately stores the result. The machine will print the tables it calculates.

The present volume is intended as a manual of operation for this device. Accordingly, we find a complete set of coding and plugging instructions and a chapter devoted to the solution of examples.

There are however a number of aspects of the present volume which are of more general interest. For instance, the descriptions of the relay controls, the multiply-divide unit, the storage counters and the function units would certainly appeal to many who are not concerned with the operation of the calculator.

In addition there is a long bibliography on numerical methods. The historical introduction in Chapter 1 is quite interesting and undoubtedly serves the present purpose, but it is not a complete history of even the direct ancestors of the present device.

Thanks are due to Professor Aiken and his associates for the preparation of this manual in a form which will permit a wide circulation.

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