# GENIAC STUDY GUIDE

## INTRODUCTION

The original GENIAC kit which was first placed on the market in April 1955 was designed as an introduction to computer circuitry. At that time we offered only one manual " SIMPLE ELECTRIC BRAINS AND HOW TO MAKE THEM" which still comes with your kit.

Since then thousands of eager customers have requested additional experiments information, diagrams and asked many questions.

To answer these questions and to broaden the usefulness of the GENIAC kit we gradually added first a book of labels, then the wiring diagrsm, then "MINDS AND MACHINES" and an excellent survey of the wider fields of automation and computer technology.

Just rescently we have included the GENIAC STUDY GUIDE, a SYMBOLIC ANALYSES of RELAY AND SWITCHING CIRCUITS, plus the BEGINNERS MANUAL.

We hope you enjoy your kit. We designed it to provide material, particularly our two dimensional multi deck switches, which are unavailable elsewhere at a reasonable price. If you have any questions about the operation of any part of the kit send them in to our company, attention COURSE SUPERVISOR.

A variety of new kits are always in design. You will be informed of them regularly, but we would like you ideas as to what material would be helpful to you in furthering your knowledge of science.
If you wish to purchase any of the books in the study guide they are kept in stock at our offices and are available from the book department.

We are also interested in your new designs for GENIAC. We have purchased a number of them at prices ranging from five dollars to one hundred dollars and look forward to your inventions.

## GENIAC STUDY PROGRAM

The manuals have been designed in a stepwise progression from simple ex--periments which teach the way to use the components to more advanced experiments that require more ddvanced techniques for analysis of material. T The bulletin on SYMBOLIC ANALYSIS OF RELAY AND SWITCHING CIRCUITS gives you all the necessary theory for working backwards from the final solution to the original problem. Naturally you can arrive at the circuitru, eq. in Machine for Douglas Mac Donald's Will by intuition. But Symbolic                Analysis gives you a direct regular method. Some designers feel that intuitive process-es are best and , indeed, a theorem of  of advanced circuit analysis states that there is a simpler technique for analyzing any circuit. The problem is to find it.

In general electric or mechanical computers create a reliable replica of
a mathematical process. Analog Computers set up,a system which parallels
in electrical terms a more complicated physical reality. In other words
if a process involves integration the ANALOG COMPUTER will contain a unit
which physically integrates the variables. DIGITAL COMPUTERS just add and
subtract. If an equation calls for integration the machine must be shown
how (programmed) to break the integration down into separate stages of
addition or subtraction.

GENIAC shows how the verbal or computational material can be broken down
into a form that will allow expression of the different aspects in extremely
simple circuitry--without switches, high power sources or expensive components.
For this reason the kits have found wide use in technical, actuarial and
research organisations which have a need that would not normally be met
by much more expensive equipment.

Example 1. One actuarial organisation (the research department of a large
insurance company) uses the GENIAC to have a ready method for analysing
policy claims, much after the pattern of DOUGLAS MACDONALD'S WILL. No other
calculating machine on the market is usable for rapid combination of logical
categories.
Example 2. A researcher for the ATOMIC ENERGY COMMISSION informed us that he
sets up the different categories as elements of a chemical reaction involving
nucleur material. Each part of the reaction is set on one of several dials
of the GENIAC. E.g.:

| Hydrogen plus Proton | Conditions | Reaction Product |
|---|---|---|
| Dial 1 | Dial 2 | Dial 3 | Dial 4 |

He has a ready method for storing information that is quickly accessible,
inexpensive and always exact, saving time and effort over the usual table
searching.
Example 3. A large management research firm uses the GENIACS as sales
demonstratord, to show how even a small computer can simplify routine
decision making.

Thus while the GENIAC does not have the expensive components of advanced
computers, it does a specific useful and unique job within the mechanical
limits of the equipment. The experiments which we listed will get you well
on the way to a solid ability to analyze problems to units which can be set up
in mechanical or electric expression.
The next step is to try and understand how you can extend the range of
problem solving with other components. Here a very helpful device is to review
your physics and see what parallels exist between the electrical or physical
properties of the different systems and logical properties of language or
mathematics.

For a systematic approach to more advanced techniques we offer other courses
at present without kits, and a bibliography of texts in the field.

*HIGH SPEED COMPUTING DEVICES, BY THE STAFF OF ENGINEERING RESEARCH ASSOCS.*
*McGraw Hill,1950---$8.00*

*This excellent text presents both the theory of electronic components
and the numberical analysis necessary to program computers. Discussing
both analog and digital computers, it is both detailed enough to interest
as overall survey of terminology, circuitry and data handling techniques
but is useful to the engineer who needs specific technical information.*

*CHAPTER HEADINGS: Basic Elements of Machine Computation...counters,
switches and gates...a functional approach to machine design...machine
requirements...arithmetic systems...numerical analysis.
Computing systems: Desk Calculators...punched card computing systems...
large scale digital computing systems...analog computing systems...the
form of a digital computer...NPhysical components and methods...
arithmetic elements...transfer mediums...data conversion equipment...
special techniques and equipment for possible use in computing systems...
factors affecting choice of equipment.*

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*ELECTRONIC ANALOG COMPUTERS, BY GRANINO KORN AND THERESA KORN,*
*McGraw Hill,1952 ---$8.00*
*new edition October 1956*

*Covering specifically DC analog computers this text is a companion to
HIGH SPEED COMPUTING DEVICES. Discussion of set up procedures in more
is more explicit than in H.S.C.D. and the techniques discussed for
establishing time scales to solve linear differential equations is at
a professional level. The book is not easy but when accompanied by
construction of the different circuits described will leave the reader
with a solid knowledge of analog computers.*

*CHAPTER HEADINGS: Representation of Mathematic relations...algebraic
operation...electronic integration and differentiation...machine
variables and scale factors...choice of time scales...DC Analog solution
of linear differential equations...DC Analog computer solution of simple
dynamic systems...performance of a dynamic vibration absorber...methods
for solving aircraft flight equations...apppications of DCAnalog computer
solution of design and testing automatic pilots as well as more advanced
material...practical examples of computer amplifier design and construction..
representation of vectors in different coordinate systems.*

DESCRIPTION OF A MAGNETIC DRUM CALCULATOR..Harvard University Press, $9.50
  a detailed and practical discussion of the famous wartime calculator, ENIAC.

SWITCHING RELAY DESIGN, R.L. Peek and H. Wagar, Staff of the Bell
  Telephone Laboratories. D. VAn Nostrand, 1955. $9.50.

Automatic Digital Calculators, by A.D. Booth, Academic Press, $7.50
  This excellent english text belongs in the library of anyone who
  pretends to a knowledge of computing machinery. The text covers
  particularly well the way in which electronic components of a general
  nature, designed for other purposes  are transformed in the computer
  to logical elements. Furthermore these logical elements are related
  to coding and programming procedures in explicit detail so that the reader
  learns how to prepare a functioning program for various solutions of
  mathematical equations.

An Introduction to the        Design of Electronic ANalog Computers,
  Pergamon, Press,        $6.50.

Faster Than Thought, B.V. Bowden., Pitman, $9.50

Introduction to Mathematical Logic, Alonzo Church, Princeton, $8.50.

Mathematical Models, Rolletts et al, Oxford University Press. $8.50

Arithmetical Operations in Digital Computers, W. Owen, R.E. Rciahrds,
  D. Van Nostrand. $9.50

Mathematical Logic, Quine. Harvard University Press. $5.50.

Analog Methods in Computation and Simulation, Walter Soroka, Mc Graw Hill,
                                                                $8.50.


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