

# DEV DIVAS

**History's Heroines of  
Computing**

– Vesna Kovach [@dev\\_divas](#)



**HEDWIG  
EVA MARIE  
KIESLER**

b. 1914 Austria-Hungary

# HEDWIG EVA MARIE KIESLER



Lobby card for film “Extase”  
 (“Ecstasy”), 1933

ANNEE NOX — PIERRE MAY — BOOGIE WODOG EDDY KIESLER  
Musique de CLAUDIO BAGNOLI  
Production Electro-Film

## HEDWIG'S SAYING:

“Any girl can be glamorous.  
All you have to do is stand still and look stupid.”



# 1ST HUSBAND, FRIEDRICH MANDL (1933-7)

- “One of the most sinister figures of the Western Hemisphere” (Milwaukee Journal, 1945)
- Fascist
- Owned armaments factory
- Partied w/ Hitler, Mussolini



# HEDY LAMARR

Invented frequency hopping/  
spread-spectrum technology.  
Patented 1942.

1997: EFF Pioneer Award  
2014: National Inventors Hall of  
Fame

Aug. 11, 1942.

H. K. MARKEY ET AL  
SECRET COMMUNICATION SYSTEM

2,292,387

Aug. 11, 1942.

H. K. MARKEY ET AL  
SECRET COMMUNICATION SYSTEM

2,292,387

Fig. 1

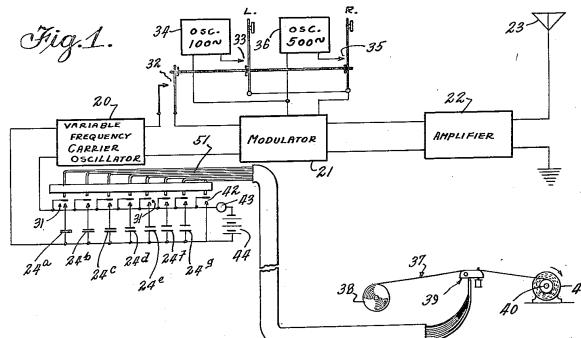


Fig. 2.

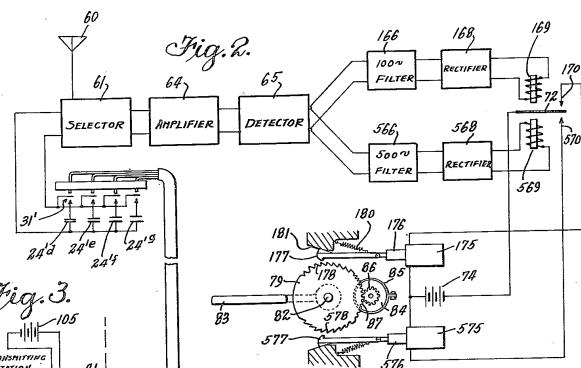


Fig. 3.

*Hedy Kiesler Markey*  
*George Antheil*  
By *Lyon & Lyon*

Aug. 11, 194

H. K. MARKEY ET AL  
SECRET COMMUNICATION SYSTEM

Filed June 10, 194

2 Sheets-Sheet 2

Fig. 7.

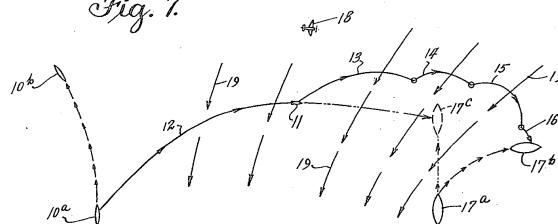


Fig. 4.

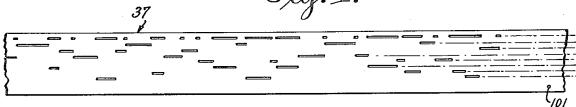


Fig.

# HEDY LAMARR

Not used until 1960s

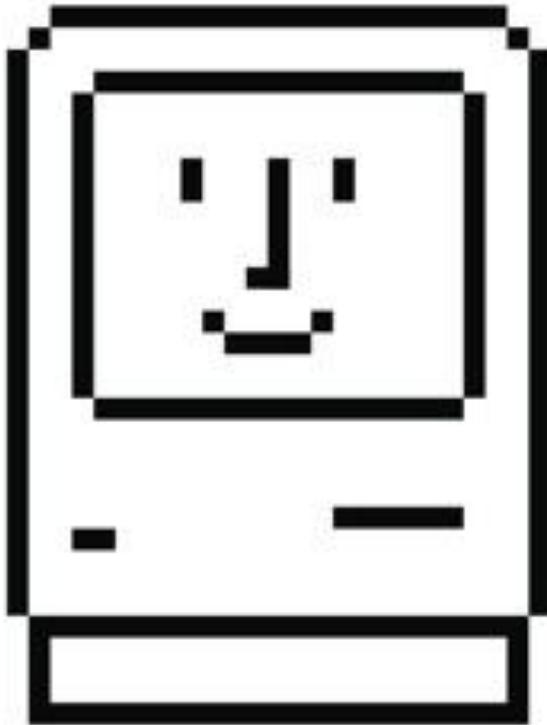
## Used in

- Wi-Fi
  - Bluetooth
  - CDMA

“H. K. Markey” = Hedwig Kiesler Markey (her second husband was Gene Markey). “et al” refers to collaborator George Antheil.



# MACINTOSH TEAM



# SUSAN KARE

- Graphical interface pioneer
- Icons: trash can, Happy Mac, paint brush, paint bucket, “cut” scissors, “Command,” etc. etc. etc.
- Mac fonts: Chicago (for menus), Geneva
- Windows control panel elements, app icons



# JOANNA HOFFMAN

- “[w]hat computers should look like and how they should improve people's lives.”
- Drafted the Mac’s “User Interface Guidelines.”
- Original teams: Macintosh, NeXT
- Played by Kate Winslet in “Steve Jobs,” 2015



# RONY SEBOK

- Macintosh original team.
- 1 Beyond (custom video production equipment) VP of technology since 1997.



# ADELE GOLDBERG

- Xerox PARC team leader
- Smalltalk System (GUI)
- Showed Steve Jobs the system, only under protest ...
- Smalltalk, Dynabook
- Design “templates” (patterns)
- ACM president, fellow
- PC Mag Lifetime Achievement
- Women in Technology Hall of Fame, 2010



# MACINTOSH TEAM

1984

Photo by Norman Seeff for  
Rolling Stone.

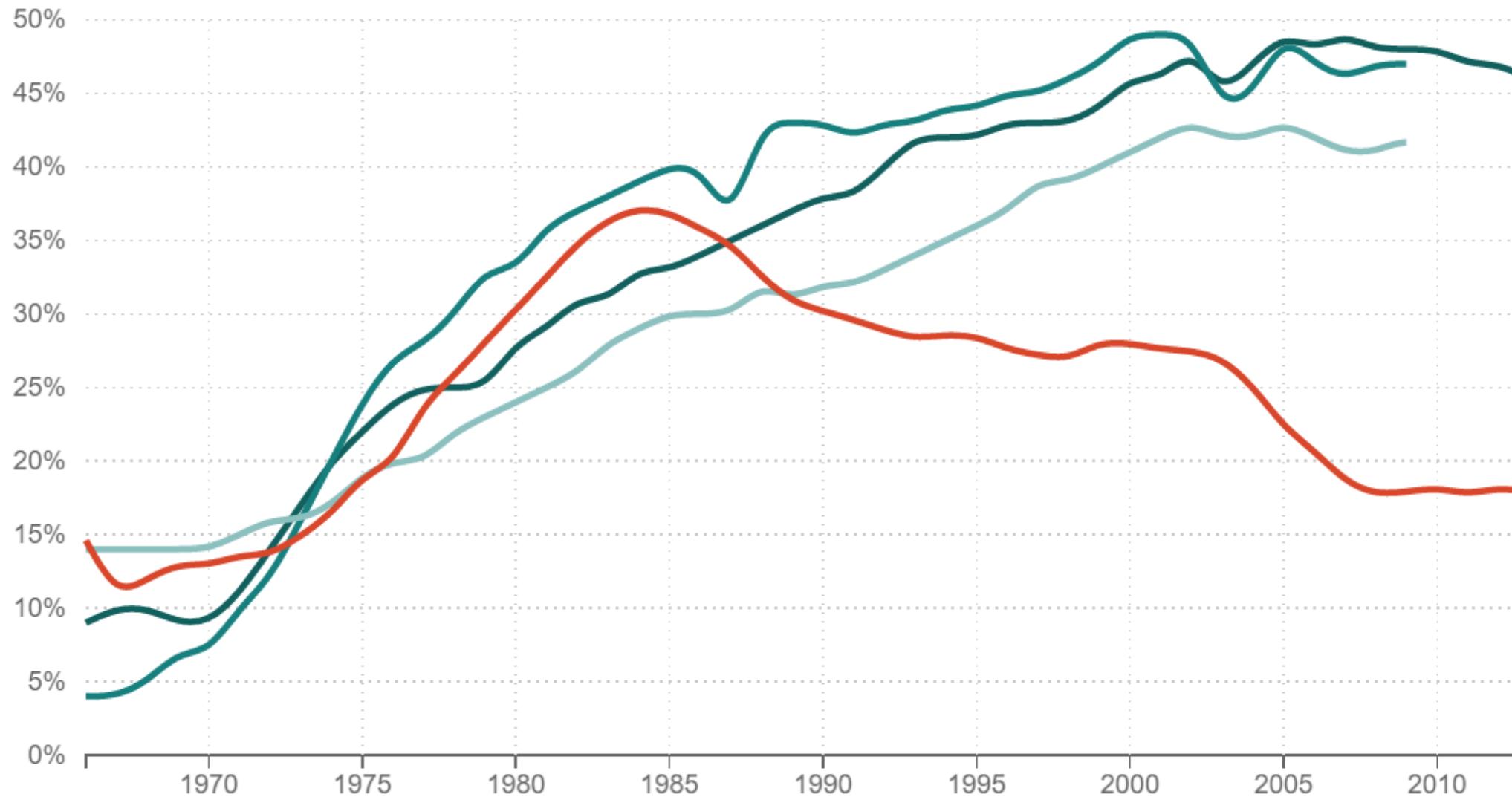


# “MACINTOSH TEAM”

2013  
Hollywood version  
From the motion picture “Jobs”

## % Of Women Majors, By Field

Medical School Law School Physical Sciences Computer science

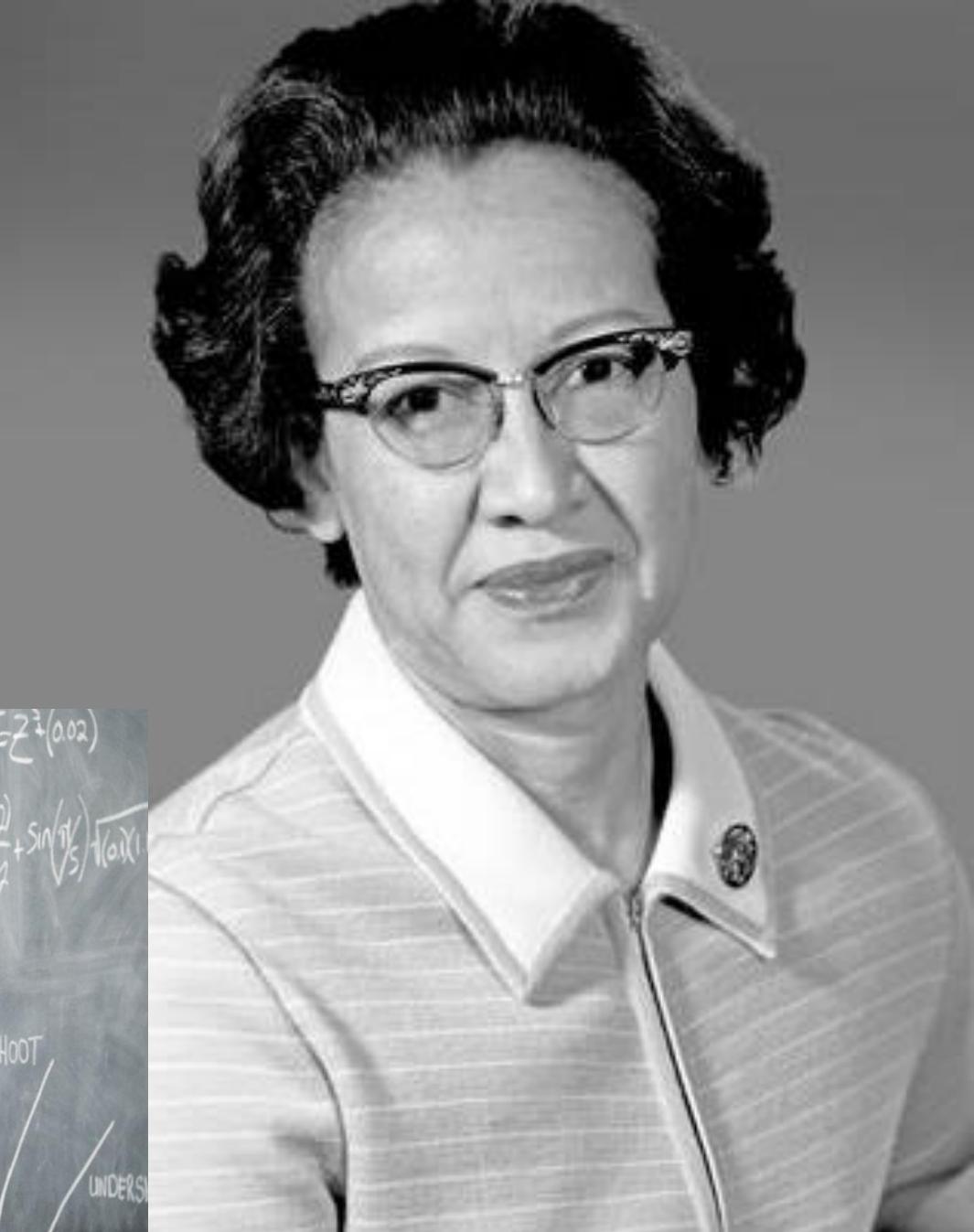
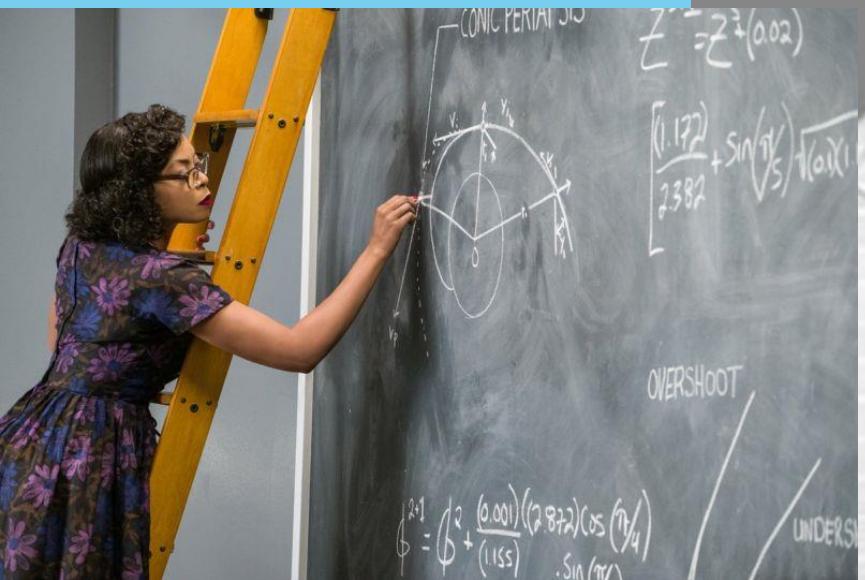


Planet Money, Oct. 2014, When Women Stopped Coding

<http://www.npr.org/sections/money/2014/10/21/357629765/when-women-stopped-coding>

# KATHERINE JOHNSON

- NACA computer, 1953
- NACA became NASA, 1958
- 1960, first Flight Research Div. paper credit for a woman
- “Ran the numbers” for John Glenn, first American in orbit, 1962
- Played by Taraji P. Henson



# KATHERINE JOHNSON

- Retired 1986
- Now 98 years old
- Katherine G. Johnson Computational Research Facility
- Presidential Medal of Honor, 2015
- In new “Women of NASA” Lego series





# MARY JACKSON

NACA computer 1951  
NASA's first black female  
aeronautical engineer, 1958  
Wind tunnel specialist  
NASA Federal Women's  
Program Manager, 1979-85.  
Portrayed by Janelle Monáe



# CHRISTINE DARDEN

NASA 1965-2003  
Data analyst, programmer  
Technical leader, Sonic Boom  
Research Program  
Deputy Manager, TU-144  
Experiments Program  
Air traffic management, wing  
design

# DOROTHY VAUGHAN

NACA computer 1943  
NASA's first African-American manager, 1949-58  
FORTRAN programmer  
Portrayed by Octavia Spencer  
Retired from NASA, 1971





# HARVARD COMPUTERS, 1875-1952

Spectral photometry  
Star classification  
Cepheid period-luminosity relation  
Binary eclipsing stars



# ARMY COMPUTERS, WWI

Aberdeen Proving Grounds,  
Maryland, 1918



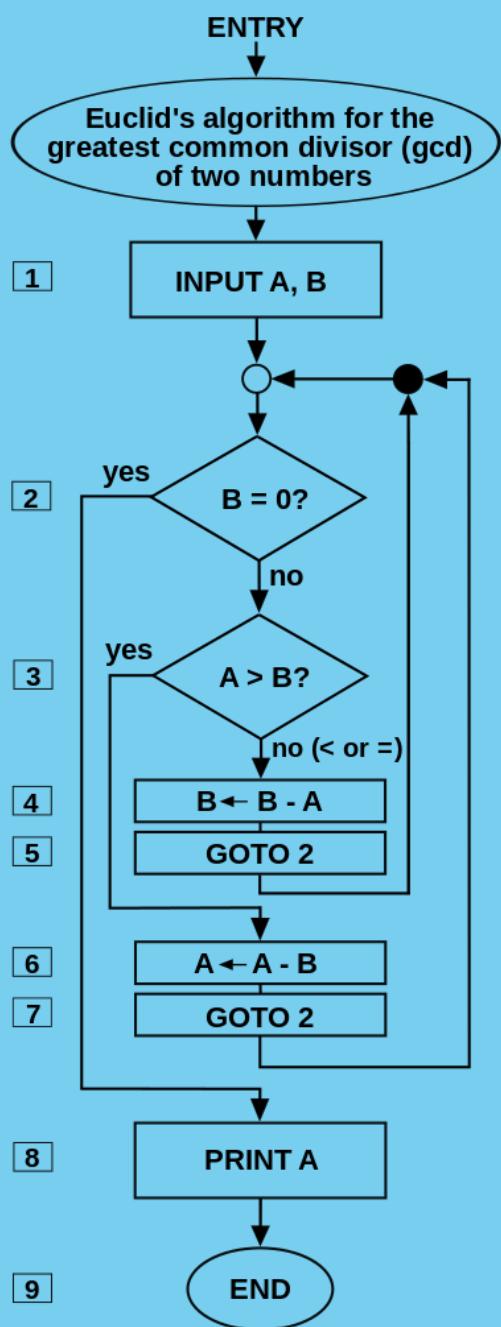
# COMPUTERS OF THE VETERANS BUREAU

Calculating WWI Vet benefits,  
early 1920s



# COMPUTERS OF NASA JET PROPULSION LABORATORY (JPL)

NASA Jet Propulsion Laboratory,  
Pasadena, California.  
Managed by Caltech.  
Read: *Rise of the Rocket Girls*,  
2016



# ALGORITHM

- Well-defined series of steps
- Inputs with preconditions (Ex: must be positive numbers)
- Finite
- Yields correct result



# DORIS BARON

With manometer tape.  
NASA JPL (Jet Propulsion  
Laboratory)



# ELEANOR “GLO” HELIN

Planetary scientist at Caltech  
and JPL

NASA Exceptional Service  
Medal

Planet Glo named after her  
USS Helin (NCC-1692)



# SUE FINLEY

- JPL, since 1958
- Longest-serving female at NASA
- Wrote software for:
  - Deep Space Network
  - All Mars missions
  - Juno and Pioneer (Jupiter)
  - Moon, Venus, etc.
  - Voyager (Solar System +)
- Demoted in 2004, when B.A. degree became mandatory.



## ANN DRUYAN

- Producer, co-writer, *Cosmos* (1980)
- Writer, producer, creator, *Cosmos* (2014)
- Creative Director NASA's Voyager Interstellar Message Project
- Collaborated with Carl Sagan, her husband



# COMPUTERS OF JPL 1943-TODAY

Jet Propulsion Laboratory,  
NASA  
circa 1955



# GERTRUDE BLANCH

- WPA Mathematical Tables Project: “The Handbook of Mathematical Functions”
- The single most widely circulated scientific work, ever
- Oversaw Manhattan Project calculations
- Institute for Numerical Analysis

# THE INTERNAL TEMPERATURE-DENSITY DISTRIBUTION OF THE SUN<sup>1</sup>

G. BLANCH, A. N. LOWAN, R. E. MARSHAK, AND H. A. BETHE

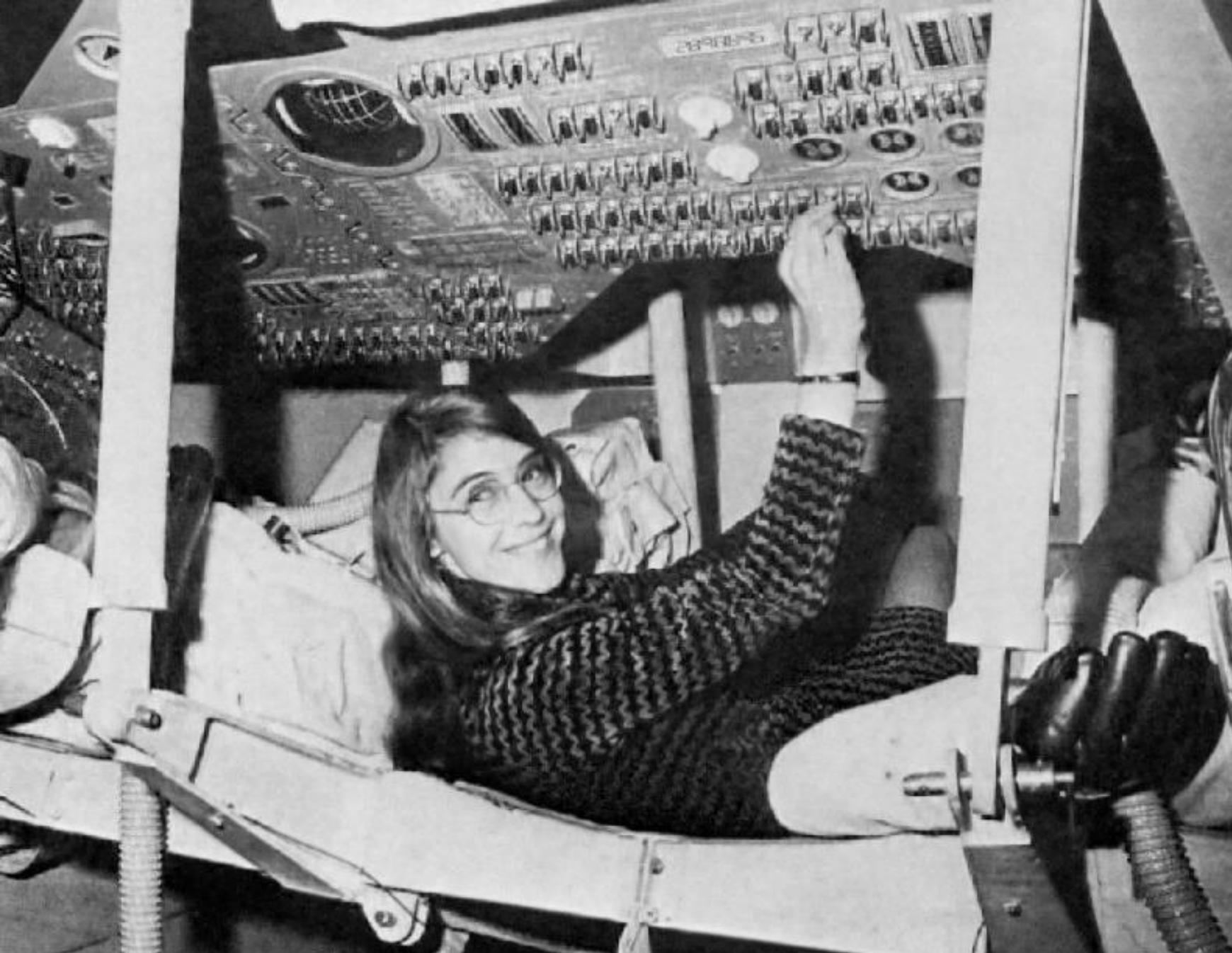
## ABSTRACT

An accurate determination has been made of the internal temperature-density distribution of the sun, using the point-convective model. Account is taken of the variation of the guillotine factor throughout the star in contrast to all previous calculations on this model. The hydrogen content is adjusted so that the radiative envelope fits onto the convective core, where all the energy production is assumed to take place. The integration is started from the surface of the sun, and it turns out that a hydrogen content of 35 per cent by weight gives a good fitting of envelope to core, whereas hydrogen contents of 40 or 30 per cent give obvious lack of fitting in opposite senses. The interface occurs at a distance outward from the center equal to 12 per cent of the total radius. The central temperature is  $25.7 \cdot 10^6$  degrees C, and the central density  $110 \text{ g/cm}^3$ . While the hydrogen content (35 per cent) agrees with the value found with the Eddington standard model, the central temperature and central density are considerably higher than the corresponding Eddington values. If the energy source varies as the seventeenth power of the temperature—a dependence indicated by the astrophysical data and present theories of energy production, then the convective core contributes 98 per cent of the total luminosity. This justifies the use of the point-convective model. Possible improvements in the calculation are discussed.

## I. INTRODUCTION

In order to make a definite decision as to the source of stellar energy, knowledge of the correct temperatures and densities in stellar interiors is essential. In the case of the

# MARGARET HAMILTON



Director, supervisor of computer teams for Apollo and Skylab space flight programs.



# MARGARET HAMILTON

With printout of Apollo Guidance Computer (AGC) source code.

Director, supervisor of computer teams for Apollo and Skylab space flights programs.

# MARGARET HAMILTON

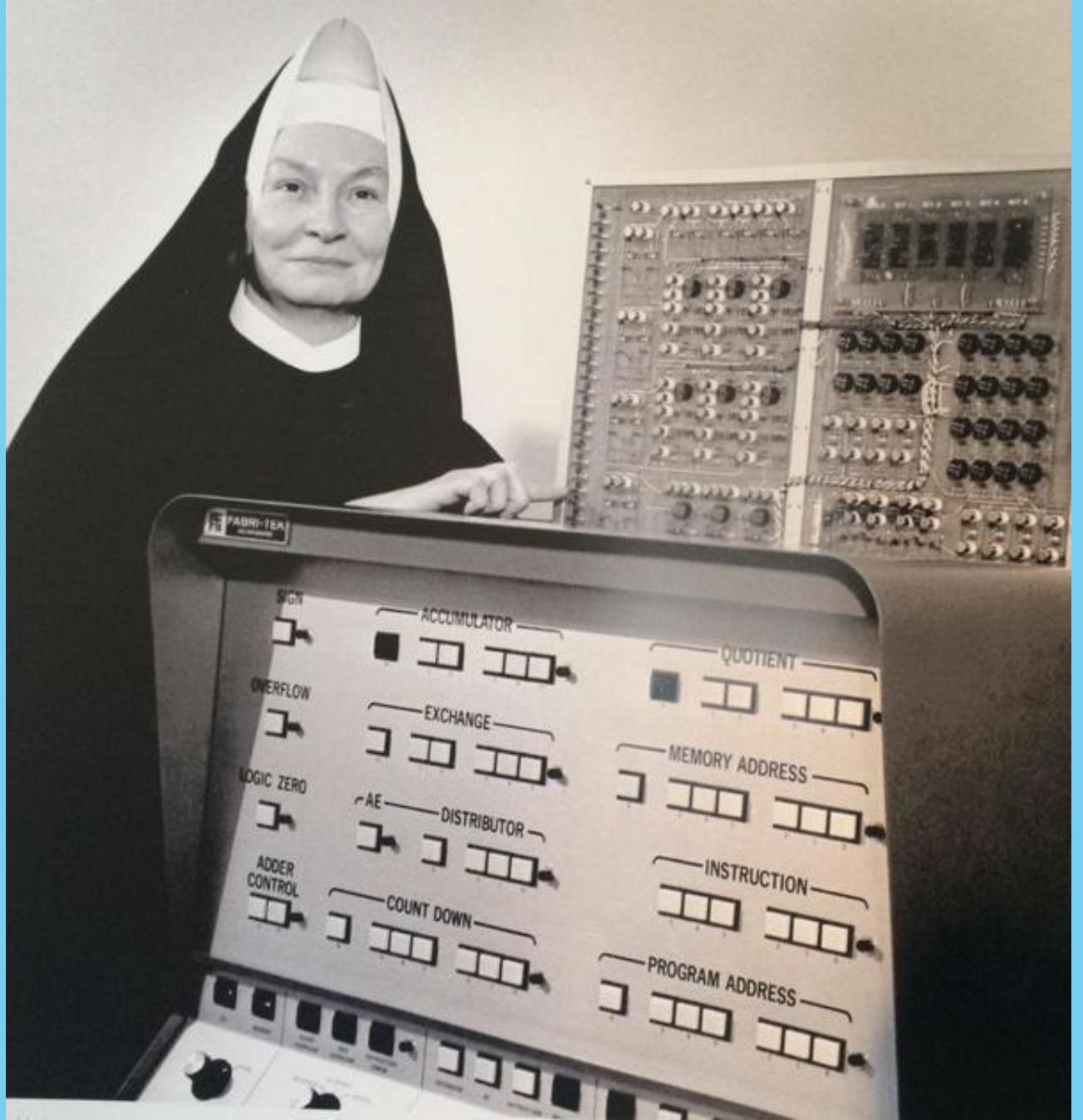
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Director, supervisor of computer teams for Apollo and Skylab space flights programs.



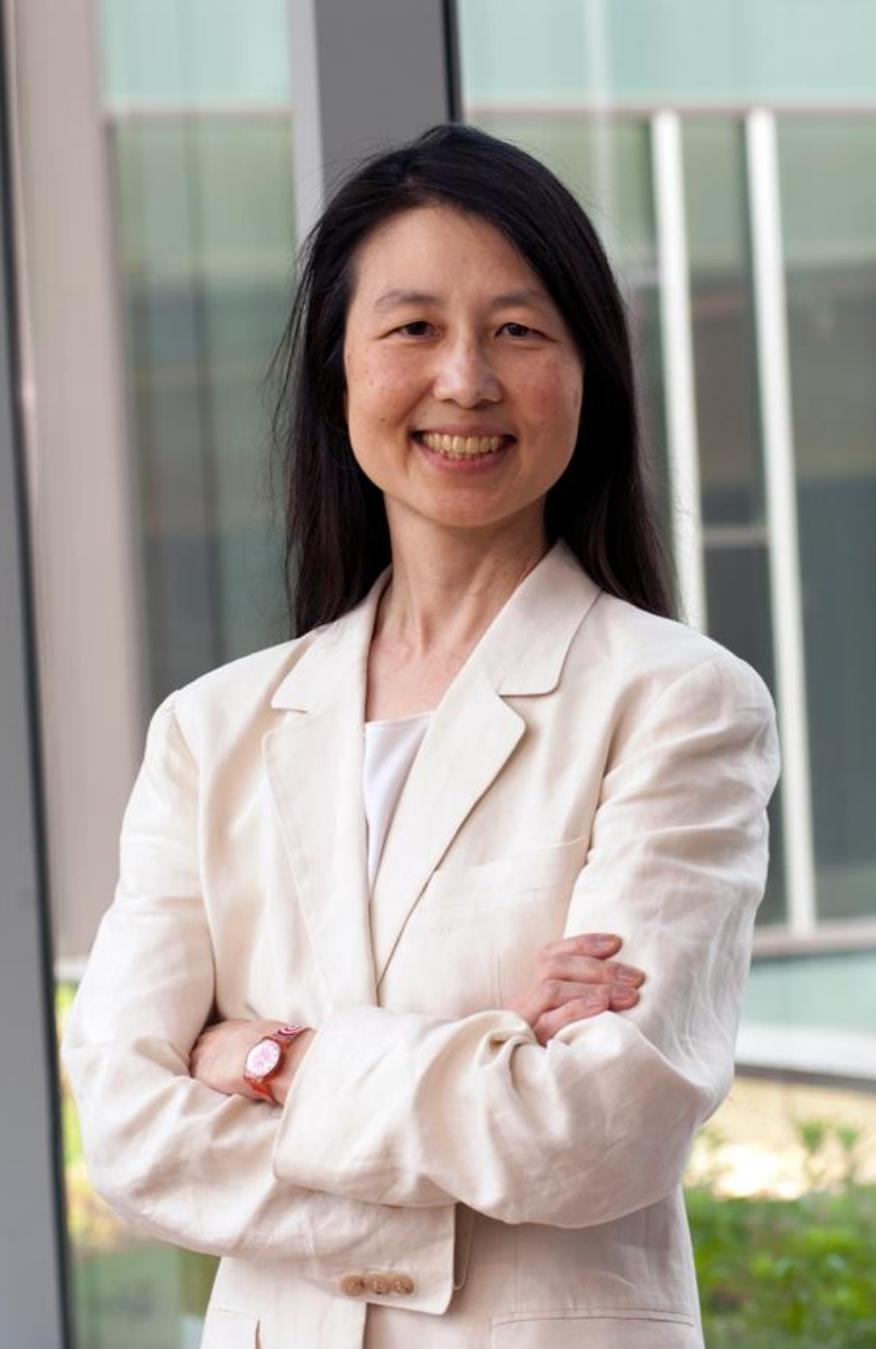
**FIRST IN NEW ERA** — The University of Wisconsin's first doctorate in computer sciences goes to Sister Mary Kenneth Keller, B.V.M., one of two nuns to receive doctor of philosophy degrees at Monday's Commencement. Sister Kenneth is an instructor at Clarke College, Dubuque, Ia.





# SISTER MARY KENNETH KELLER

- First Ph.D. in computer science (one of two, 6/7/1965))
- Contributor to BASIC
- Founded first CS department at a small college



# JEANNETTE WING

- Corporate Vice President of Microsoft Research
- Ran Comp. & Engineering Science Directorate, NSF
- Chaired Carnegie Mellon University Comp. Science Dept.



# BARBARA LISKOV

- “Liskov Substitution Principle”
- MIT Comp. Science & AI Lab
- 2008 Turing Award

# BASIC PRINCIPLES OF OBJECT-ORIENTED DEVELOPMENT

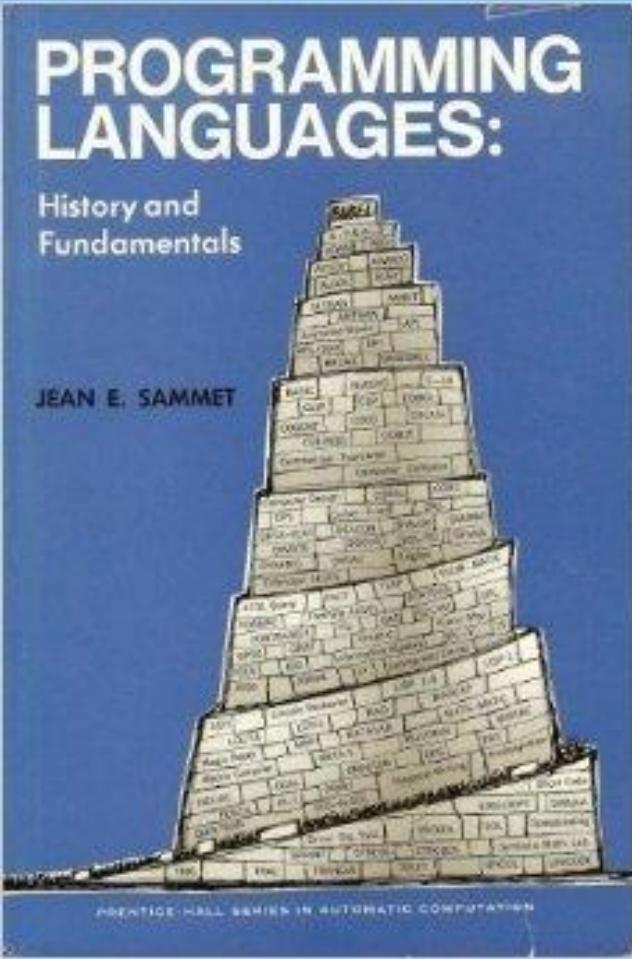
Single responsibility

Open-closed

Liskov substitution

Interface segregation

Dependency inversion



# JEAN SAMMET

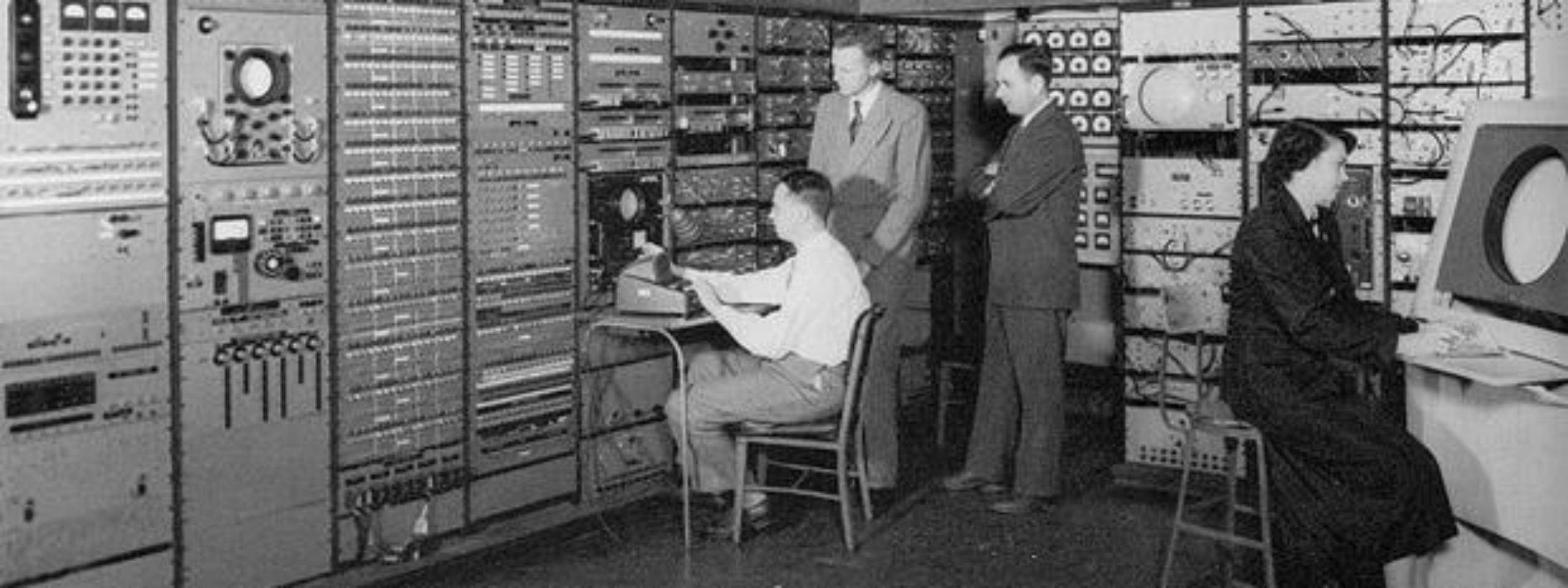
- IBM, 1961
- President, Association of Computing Machinery, 1974-9
- Language creator and historian



# JUDY CLAPP

Pioneering software engineer  
Society of Women Engineers  
Achievement Award, 2001

“We were on the forefront,  
working day and night, inventing  
as we went.”



# JUDY CLAPP

- MIT's Whirlwind, the first real-time computer
- SAGE air defense system
- ADA programming language



# ADELE MILDRED “MILLY” KOSS

- Harvard, 25 years
- A first UNIVAC programmer
- Wrote first report generator
- Early sort routines
- Graphics algorithms
- Databases
- “We did not have huge management teams. We did incredibly new and exciting things and nobody had a problem.”

A black and white studio portrait of Grace Murray Hopper. She is wearing a dark, V-neck dress with a brooch and a corsage on her left shoulder. Her hands are clasped in front of her. She has short, dark hair and is wearing small, dangling earrings.

# REAR ADMIRAL GRACE MURRAY HOPPER

- Mathematics professor,  
Vassar
- Programmer, computer  
scientist, 1944-92

0800 went to start  
 1000 " stopped - arctan ✓ { 1.2700 9.037 847 025  
 13<sup>rd</sup> UC (032) MP - MC ~~1.982147000~~ 9.037 846 795 correct  
 (033) PRO 2 2.130476415  
 correct 2.130676415

Relays 6-2 in 033 failed special speed test  
 in relay " 10.00 test .

1100 Started Cosine Tape (Sine check)  
 1525 Started Multi Adder Test.



1625/630 arctangent started.  
 1700 closed down.

FIRST GLOSSARY  
of  
PROGRAMMING TERMINOLOGY

Committee on Nomenclature

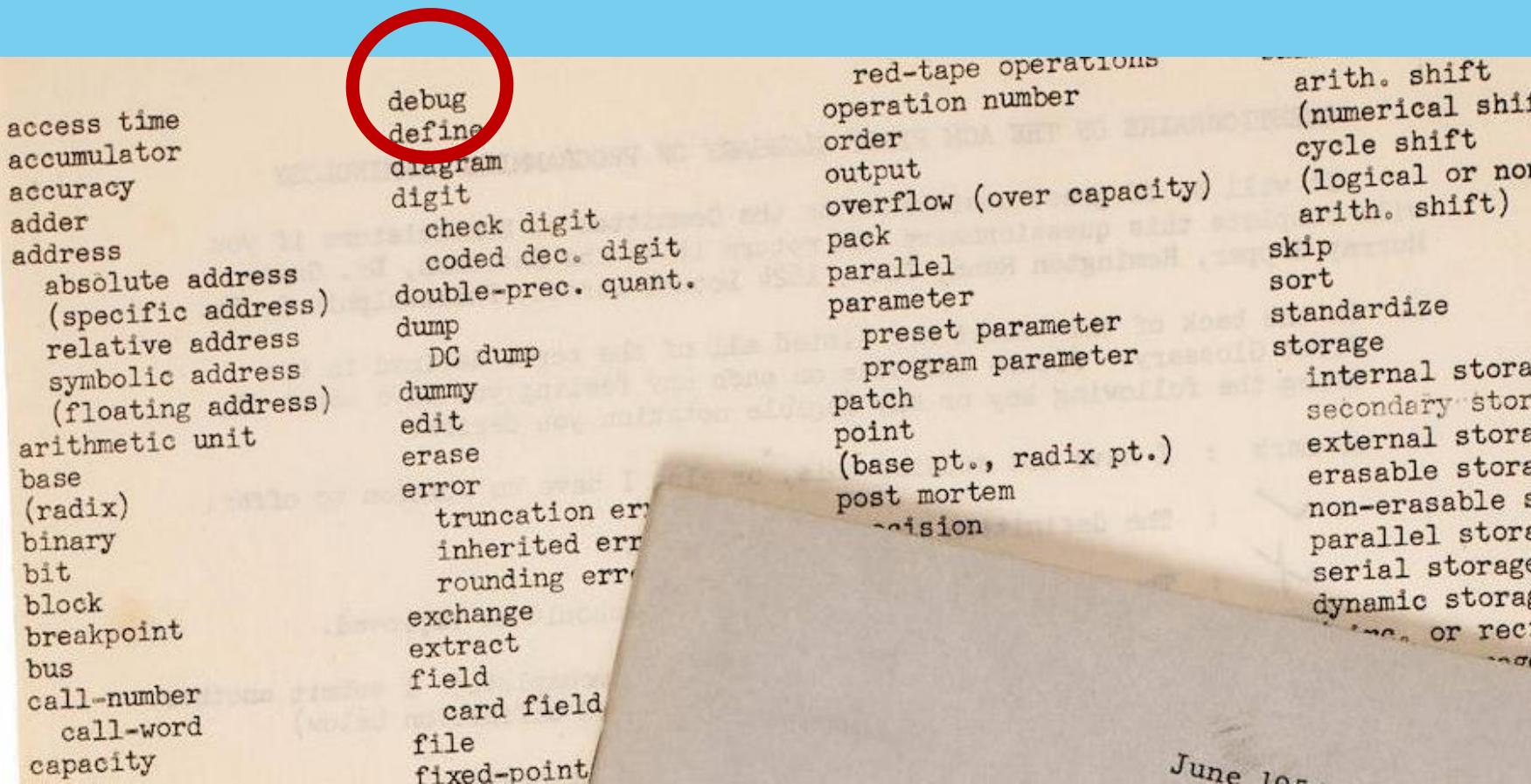
C. W. Adams      R. F. Osborn  
J. W. Backus      G. W. Patterson  
J. W. Carr, III      J. Svigals

Grace Murray Hopper, Chairman

# GRACE MURRAY HOPPER

- Invented the compiler
- Made COBOL happen
- Association for Computing Machinery Nomenclature Committee Chair

# GRACE MURRAY HOPPER

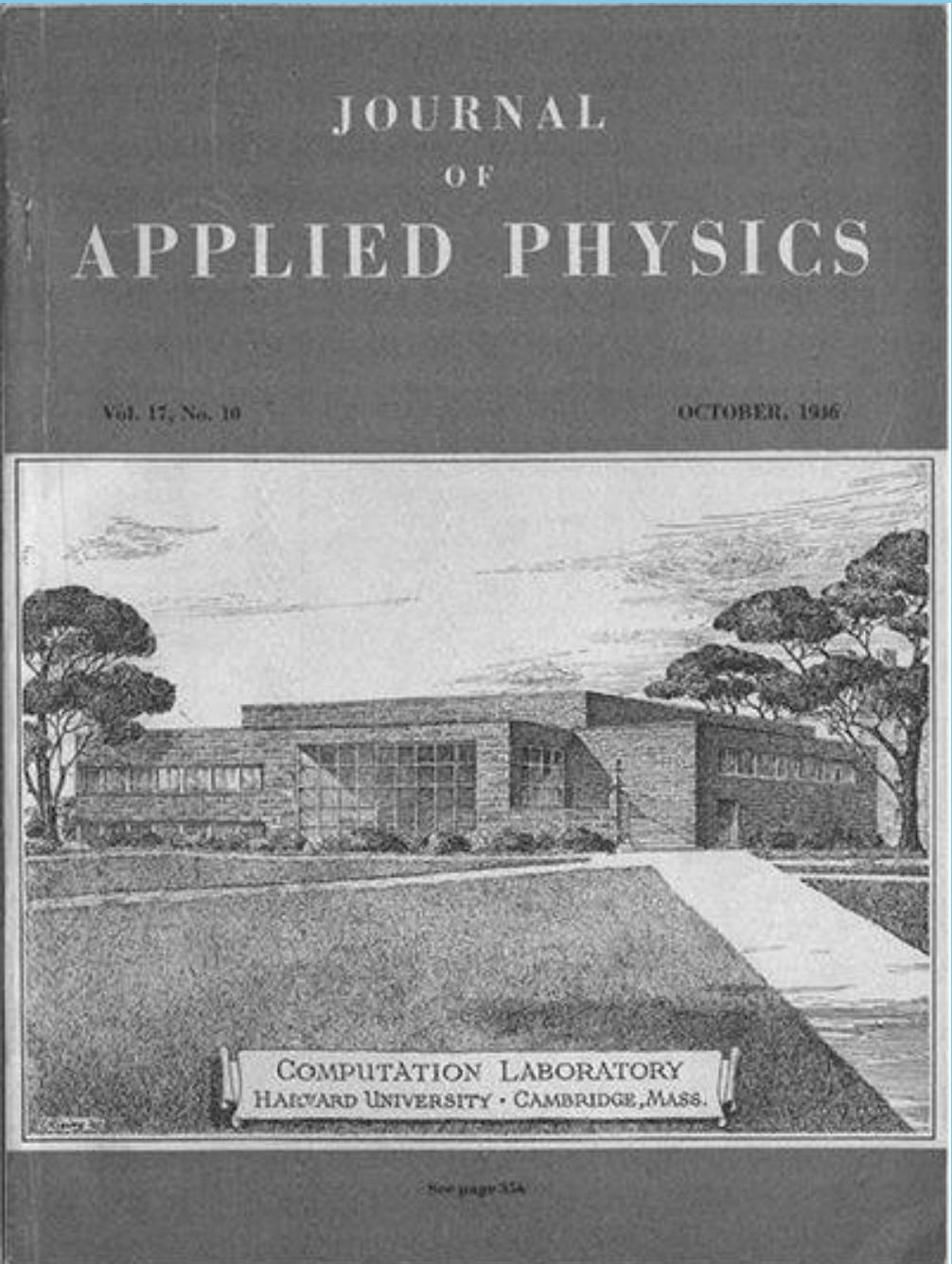


- Invented the compiler
- Made COBOL happen
- Association for Computing Machinery Nomenclature Committee Chair



# HARVARD MARK I

- Electromechanical
- Used punched paper tape
- First general-purpose, programmable device in use.



HARVARD  
COMPUTATION  
LAB, 1946

## Robot Works Problems Never Before Solved



Solving problems which stumped mathematicians throughout history, is all in the day's work to the "world's greatest calculating machine" which gives accurate answers in 23 figures. Above, preparing a problem for the machine on manual tape punch which dictates operation of the "superbrain" with coded perforations. Center, system of holders on which tape moves

Above, tape entering sequence control mechanism shows how problem looks in "punch code." Below, general view of robot which is 51 feet long, 8 feet high. It has 500 miles of wire, 3,000,000 connections, tiers of 72 adding machines. Invented by Cmdr. H. H. Aiken, U.S.N.R., it was built by International Business Machines and presented to Harvard University for use by the Navy. After the war it will solve problems of star movements and algebraic equations hitherto unsolved



# GRACE MURRAY HOPPER

- Ph.D. in Math, Yale
- Vassar professor, 16 years
- First officer, Mark I team
- Led Harvard Computing Symposium



# HARVARD COMPUTERS, 1875-1952

Spectral photometry  
Star classification  
Cepheid period-luminosity relation  
Binary eclipsing stars



# HARVARD COMPUTATION LAB, 1946

**Harvard University Computation Lab, 1946.**



# BETTY SNYDER HOLBERTON

- ENIAC programmer
- Invented flowchart
- First sorting routine
- First computer language, BINAC
- First keyboard input system
- Gray computer color
- COBOL contributor
- FORTRAN contributor
- National Bureau of Standards
- Chief Programmer, ship test facilities

## Electronic Computer Figures Like a Flash

**Qualified Plant Page 1**  
Each day will witness the construction at the others benefitting. Supporting, educational institutions will be available. Aiding Economic Development, the business and commerce will be live longer, more active, more successful. It is estimated that 10,000 people will be employed, and the architect, Mr. Frank D. Johnson, Jr., engineer of the project, has been quite active in the planning of this work.

These estimates were used to calculate the total cost of preparing a large number of test items, which in turn enables the test to be administered without the possibility of disclosure occurring before the test is administered. The results of this study are presented below.

© 2004 Study Weekly

Chap. 6. W. H. Johnson Army  
color measurements, from 20  
selected towns on the Mississippi  
River, and did. Post 26. Color  
measurements (1944). The  
process involved the estimation  
of weight and the projected area  
would carry measurement, but the  
measured in the time taken it  
was necessary and convenient doing  
the work from more accurate  
easy located landmarks. The process  
not be permanently recorded.

After the first year, the average price per unit was \$1.00, and the average price per unit for the second year was \$1.05. The average price per unit for the third year was \$1.10, and the average price per unit for the fourth year was \$1.15.

卷之三

These will be distributed to the public through the *Journal of the American Medical Association*, the *Journal of the National Medical Association*, and the *Journal of the American Dental Association*. The *Journal of the American Medical Association* will also publish a special article on the subject.

Journal of Health Politics, Policy and Law

The results, however, are not clear. It has been claimed by "conservatism" that brought in the "positive evidence factor" in 1972, that the new factor was not adopted, because the new factor, like the conservative, requires individual goals, depending on one's own strengths, interests and aptitudes.

When the problem is presented in a "closed" form, the student may never have to think about the steps involved in its solution.

## NEW ALL-ELECTRONIC COMPUTER AND ITS INVENTORS



The overall view of the NCEG-2 primary observation is that the model is more a hydrochemical problem. In a series of models it does well, which suggests hydrochemistry has limited role to play. The primary problem appears to be related to the way the model is set up at the initial and boundary conditions. It also shows multiple steady states and problems with some equilibrium of states.



John W. Blawie



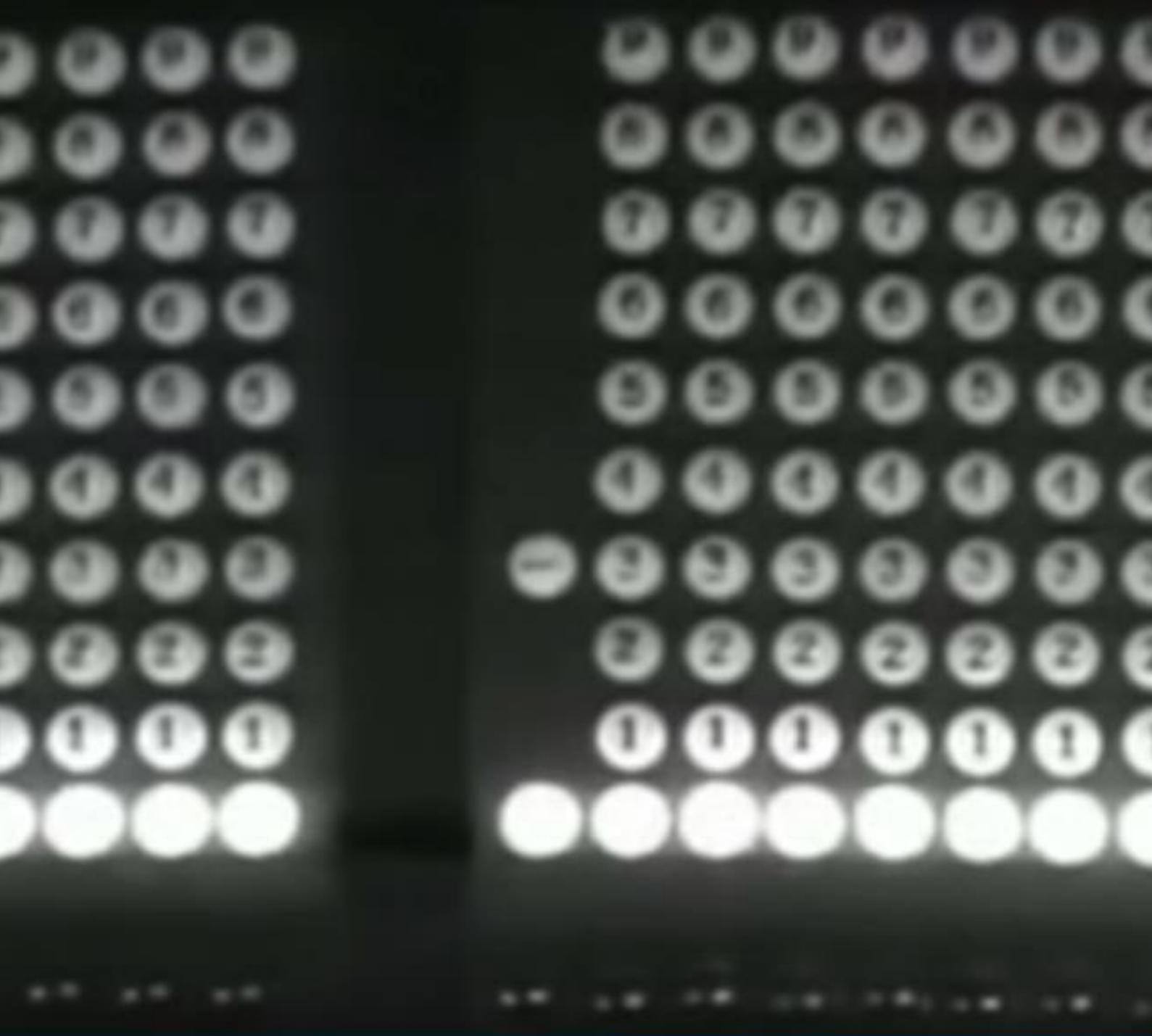
#### 6. Financial statement problems

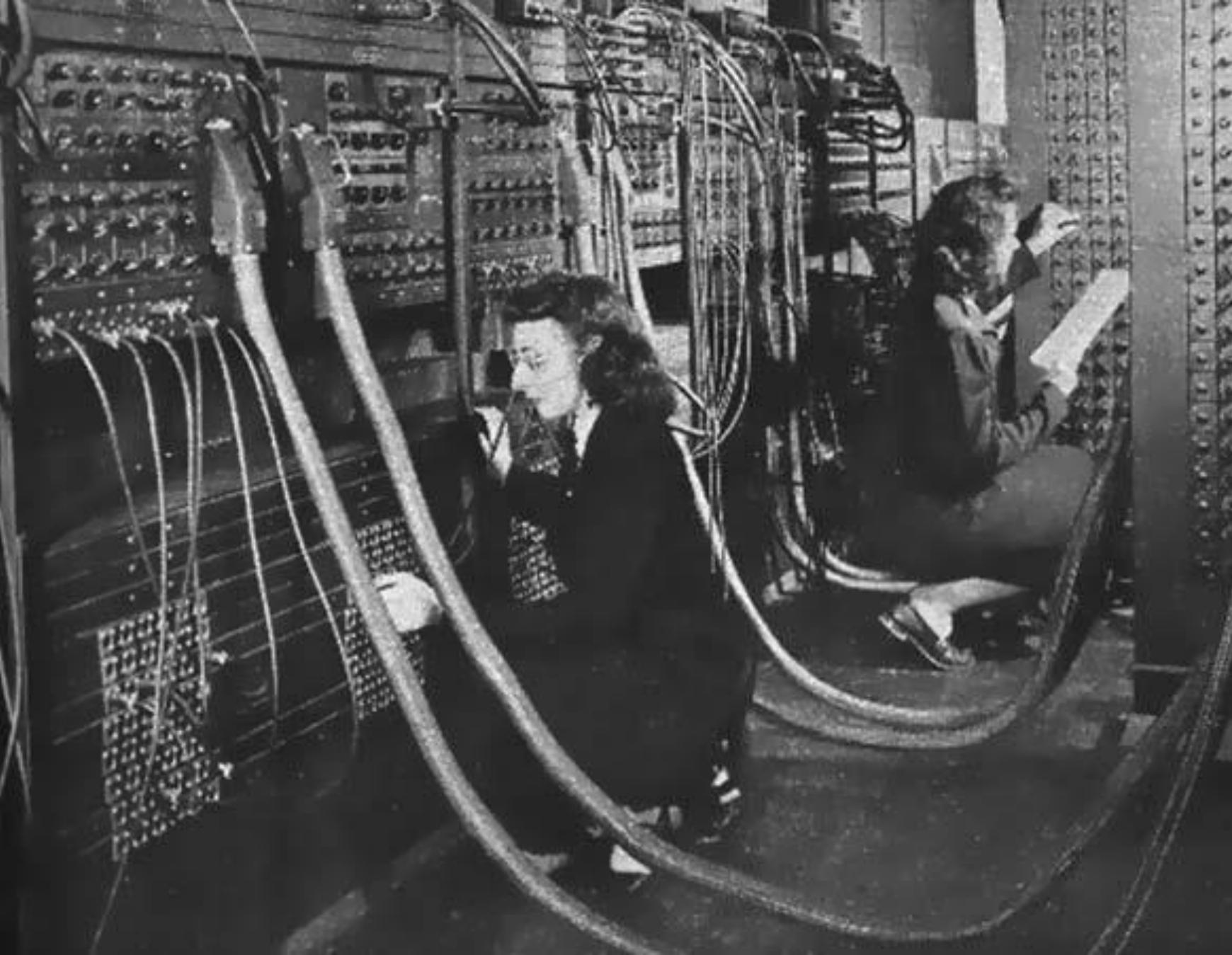
**Shallow Fish Bites**

Many times when fishing near shore, I find myself getting hit by small fish. They are not big enough to eat, so they just bite at my bait. This can be very frustrating, especially if you are fishing for a large fish like a trout or salmon. To avoid this, try using a larger hook or a different type of bait. You can also try changing your fishing spot or time of day.

—  
—

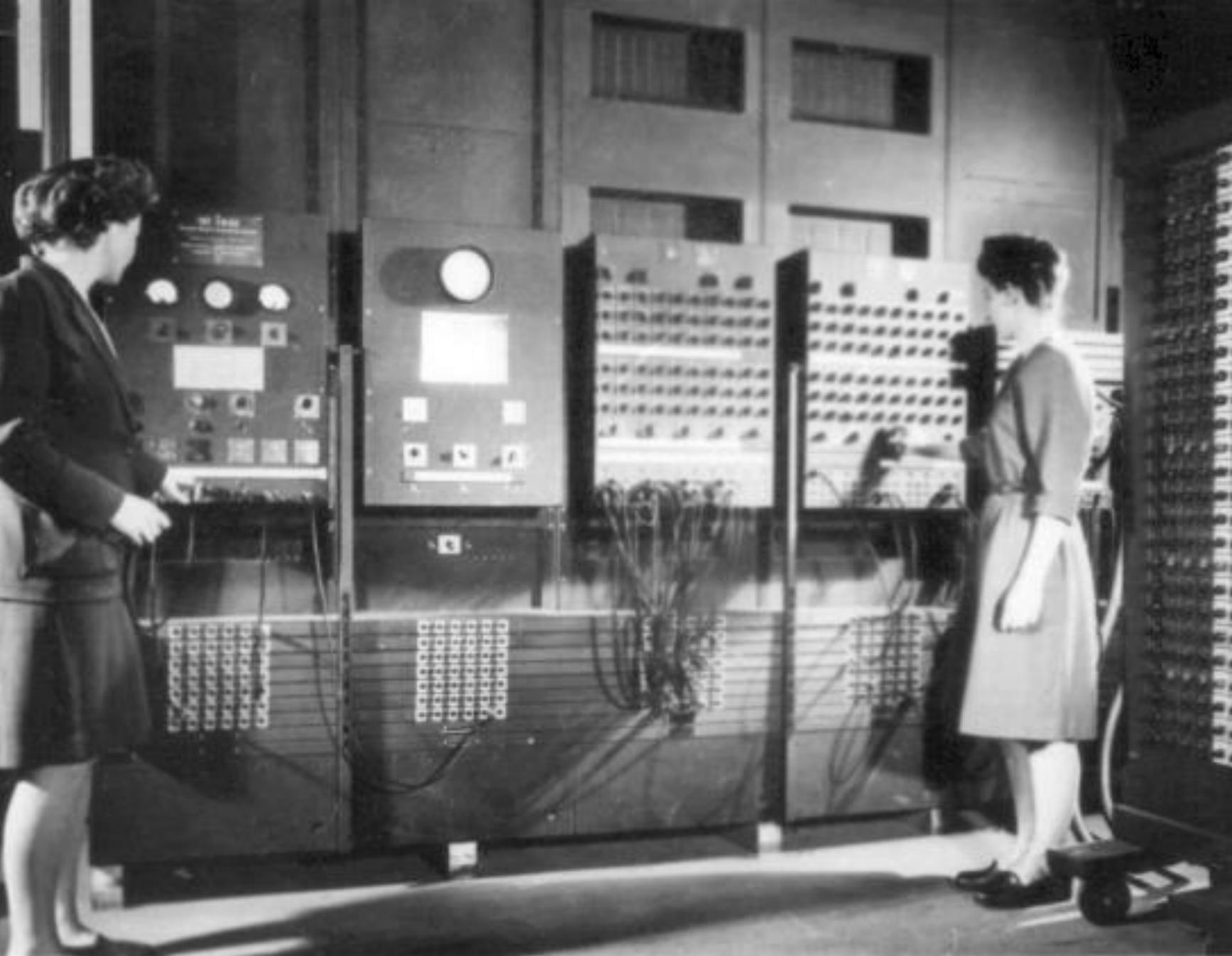
Many more students were seen  
and into the building of the  
new, if temporary, school  
a number of them came  
about fifteen. These were  
well educated, and  
several of them were  
from the upper classes.  
The new school  
is to be built in the  
center of the city, and  
will be completed in  
the fall.





# THE “ENIAC WOMEN”

Kathleen McNulty  
Frances Bilas, Betty Jean  
Jennings, Elizabeth Snyder  
Holberton, Ruth Licherman, and  
Marilyn Wescoff



# THE “ENIAC WOMEN”

Kathleen McNulty  
Frances Bilas, Betty Jean  
Jennings, Elizabeth Snyder  
Holberton, Ruth Licherman, and  
Marilyn Wescoff

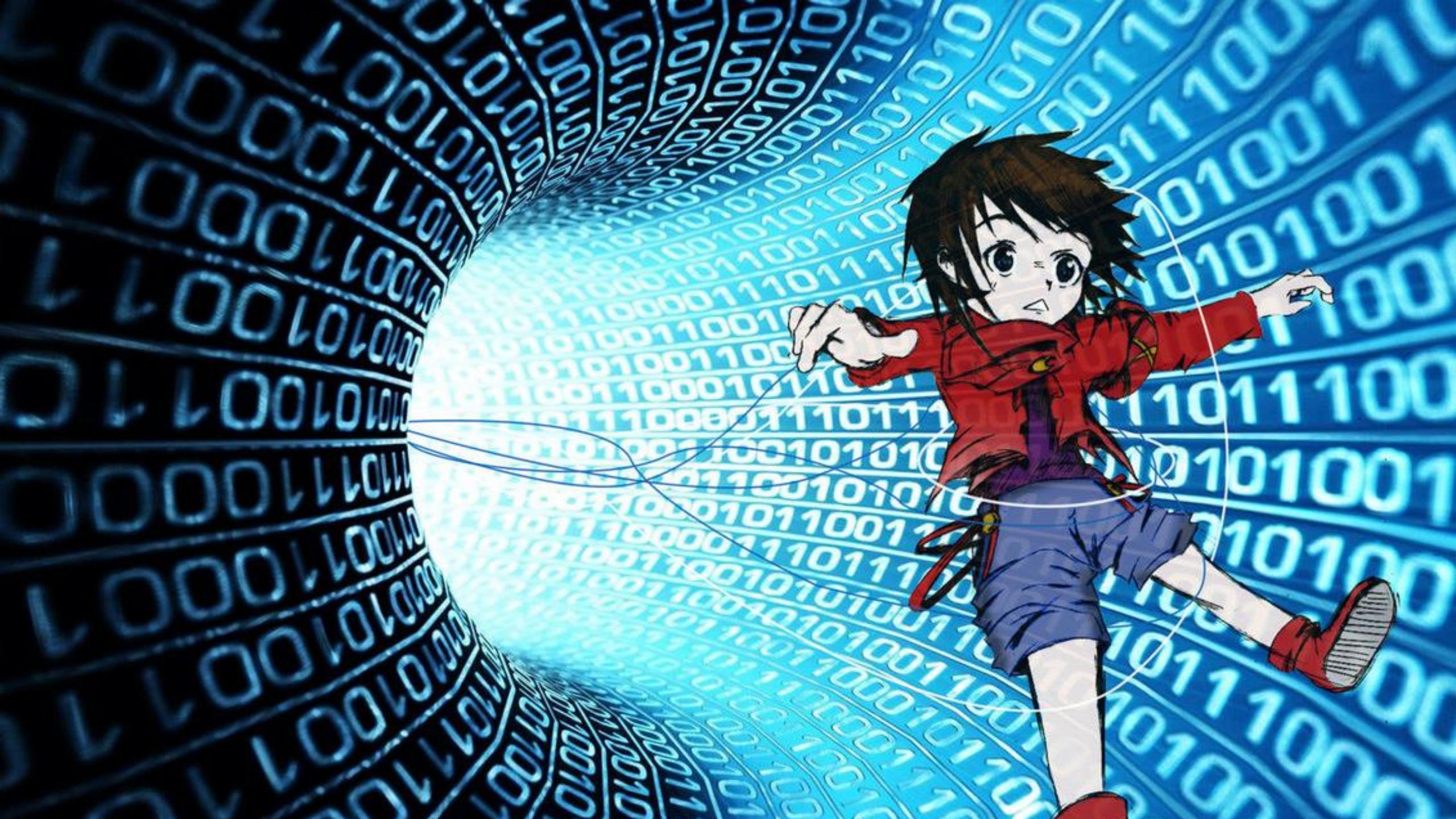
Show: Jean Jennings Bartik and  
Fran Bilas



# THE “ENIAC WOMEN”

Kathleen McNulty  
Frances Bilas, Betty Jean  
Jennings, Elizabeth Snyder  
Holberton, Ruth Licherman, and  
Marilyn Wescoff

, these women have not been remembered by history, with the exception of Adele Goldstine (“Project Mathematician”). We can do little more than remember them here, as literal footnotes to the project’s history. Let the record show that among the women who helped to design and build ENIAC during 1944 were Viola Andreoni, Martha Bobe, Lydia R. Bell, Vava Callison, Nellie T. Collett, O’Bera Darling, Helen Anna De Lacy, Jeanette M. Edelsack (draftswoman), Theresa Fraley, Gertrude E. Gilbert, Ann Gintis, Rita Golden, Margaret Henshaw, Jane Hodes, Virginia Humprey, Mary Ann Isreall, Dorothy F. Keller, Mary Knos, Alice T. Larsen, Alma Markward (assembler), Mary Martin, Anne D. McBride, Cathrine J. McCann (draftswoman), Rose McDonough, Mary E. McGrath, Mary McNetchell, Gertrude Moriarty, Anna Munson, Ann O’Neill, Violet Paige, Jane L. Pepper (draftswoman), Alice Pritchett, Ruth Ruch, Marjorie Santa Maria (draftswoman), Nancy Sellers, Eleanor Simone (technician), Carolyn Shearman, Dorothy K. Shisler, Frances Spurrier, Grace M. Warner, Evangeline E. Werley, Charlotte Widcamp, Sally Wilson, Diana Wrenn, and Isabelle Jay (secretary).





# AUGUSTA ADA BYRON KING, COUNTESS OF LOVELACE



# CHARLES BABBAGE

- “Many discrepancies occurred...I exclaimed, 'I wish to God these calculations had been executed by steam!'”

of mathematics. These numbers can be defined by the power series

$$\frac{z}{e^z - 1} = \sum_{n=0}^{\infty} B_n \frac{z^n}{n!}, \quad |z| < 2\pi$$

where all numbers  $B_n$  are zero with odd index  $n > 1$ . The even-indexed rational numbers  $B_n$  alternate in sign. The first values are

## BERNOULLI NUMBERS

**Diagram for the computation by the Engine of the Numbers of Bernoulli.** See Note G. (page 722 *et seq.*)

Number of Operations.	Nature of Operations.	Variables acted upon.	Variables receiving results.	Indication of change in the value on any Variable.	Statement of Results.	Data		Working Variables.										Result Variables.				
						$V_1$	$V_2$	$V_3$	$V_4$	$V_5$	$V_6$	$V_7$	$V_8$	$V_9$	$V_{10}$	$V_{11}$	$V_{12}$	$V_{13}$	$V_{14}$	$V_{15}$	$V_{16}$	$V_{17}$
1	X	$V_1 \times V_2$	$V_1, V_2, V_3$	$\{V_2 = V_2\}$	$-2n$	...	2	n	2n	2n	2n	...	...	...	...	...	...	...	...	...	...	
2	-	$V_1 - V_2$	$V_1$	$\{V_2 = V_2\}$	$-2n-1$	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3	+	$V_3 + V_1$	$V_1$	$\{V_3 = V_3\}$	$-2n+1$	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4	+	$V_4 + V_1$	$V_1$	$\{V_4 = V_4\}$	$\frac{2n-1}{2n+1}$	...	...	...	0	0	...	...	...	...	...	...	...	...	...	...	...	
5	+	$V_5 + V_1$	$V_1$	$\{V_5 = V_5\}$	$\frac{1-2n-1}{2-2n+1}$	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6	-	$V_{10} - V_9$	$V_{10}$	$\{V_{10} = V_{10}\}$	$-\frac{1-2n-1}{2-2n+1} = A_0$	...	...	...	...	...	...	...	...	...	...	...	0	...	...	$-\frac{1-2n-1}{2-2n+1} = A_0$	...	
7	-	$V_9 - V_1$	$V_{10}$	$\{V_9 = V_9\}$	$n-1 (= 3)$	1	...	n	...	...	...	...	...	...	...	...	...	n-1	...	...	...	...
8	+	$V_2 + V_1$	$V_2$	$\{V_2 = V_2\}$	$-2+0=2$	...	2	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...
9	+	$V_4 + V_1$	$V_1$	$\{V_4 = V_4\}$	$\frac{2n}{2} = A_1$	...	...	...	...	...	...	2n	2	...	...	...	...	...	...	...	...	...
10	X	$V_{10} \times V_9$	$V_{10}$	$\{V_{10} = V_{10}\}$	$B_1 \cdot \frac{2n}{2} = B_1 A_1$	...	...	...	...	...	...	...	...	...	...	...	...	$\frac{2n}{2} = A_1$	...	...	...	
11	+	$V_{11} + V_{10}$	$V_{11}$	$\{V_{10} = V_{10}\}$	$-\frac{1-2n-1}{2-2n+1} + B_1 \cdot \frac{2n}{2}$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	-	$V_{10} - V_1$	$V_{10}$	$\{V_1 = V_1\}$	$n-2 (= 2)$	1	...	...	...	...	...	...	...	...	...	...	...	n-2	...	...	...	...
13	-	$V_4 - V_1$	$V_4$	$\{V_4 = V_4\}$	$-2n-1$	1	...	...	...	...	...	...	2n-1	...	...	...	...	...	...	...	...	...
14	+	$V_1 + V_2$	$V_2$	$\{V_1 = V_1\}$	$-2+1=3$	1	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...
15	+	$V_6 + V_1$	$V_1$	$\{V_6 = V_6\}$	$\frac{2n-1}{3}$	...	...	...	...	...	2n-1	3	$\frac{2n-1}{3}$	...	...	...	...	...	...	...	...	...
16	X	$V_8 \times V_{10}$	$V_{11}$	$\{V_8 = V_8\}$	$\frac{2n}{2} \cdot \frac{2n-1}{3}$	...	...	...	...	...	...	...	0	...	...	...	$\frac{2n}{2} \cdot \frac{2n-1}{3}$	...	...	...	...	
17	-	$V_4 - V_1$	$V_4$	$\{V_4 = V_4\}$	$-2n-2$	1	...	...	...	...	...	2n-2	...	...	...	...	...	...	...	...	...	...
18	+	$V_1 + V_2$	$V_1$	$\{V_1 = V_1\}$	$-2+1=4$	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...
19	+	$V_4 + V_2$	$V_4$	$\{V_4 = V_4\}$	$\frac{2n-2}{4}$	...	...	...	...	...	2n-2	4	$\frac{2n-2}{4}$	...	...	...	...	$\left\{ \frac{2n-2}{4}, \frac{2n-1}{3}, \frac{2n-2}{3} \right\}$	...	...	...	
20	X	$V_9 \times V_{10}$	$V_{10}$	$\{V_9 = V_9\}$	$-\frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{4} = A_2$	...	...	...	...	...	...	...	0	...	...	...	...	$-\frac{2n}{2} = A_2$	...	...	...	
21	X	$V_{10} \times V_{11}$	$V_{11}$	$\{V_{10} = V_{10}\}$	$B_1 \cdot \frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{4} = B_1 A_2$	...	...	...	...	...	...	...	...	...	...	...	0	$B_1 A_2$	...	...	$B_2$	
22	+	$V_{10} + V_{11}$	$V_{10}$	$\{V_{10} = V_{10}\}$	$A_2 + B_1 A_2 + B_2 A_2$	...	...	...	...	...	...	...	...	...	...	...	0	$\{A_2 + B_1 A_2 + B_2 A_2\}$	...	...	...	
23	-	$V_{10} - V_1$	$V_{10}$	$\{V_1 = V_1\}$	$n-3 (= 1)$	1	...	...	...	...	...	...	...	...	...	...	...	n-3	...	...	...	...
24	+	$V_{10} + V_{11}$	$V_{11}$	$\{V_{10} = V_{10}\}$	$= B_2$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	$B_2$
25	+	$V_1 + V_2$	$V_1$	$\{V_1 = V_1\}$	$-n+1=4+1=5$	1	...	n+1	...	...	0	0	...	...	...	...	...	...	...	...	...	...

Here follows a repetition of Operations thirteen to twenty-three.

Diagram for the computation by the Engine of the Numbers of Bernoulli. See Note G. (page 722 *et seq.*)



*Lady Byron*

*Pub. June 1. 1806 by Davis & Munday 53, Strand.*

# LORD AND LADY BYRON, AND THEIR DAUGHTER, ADA



# AUGUSTA ADA BYRON

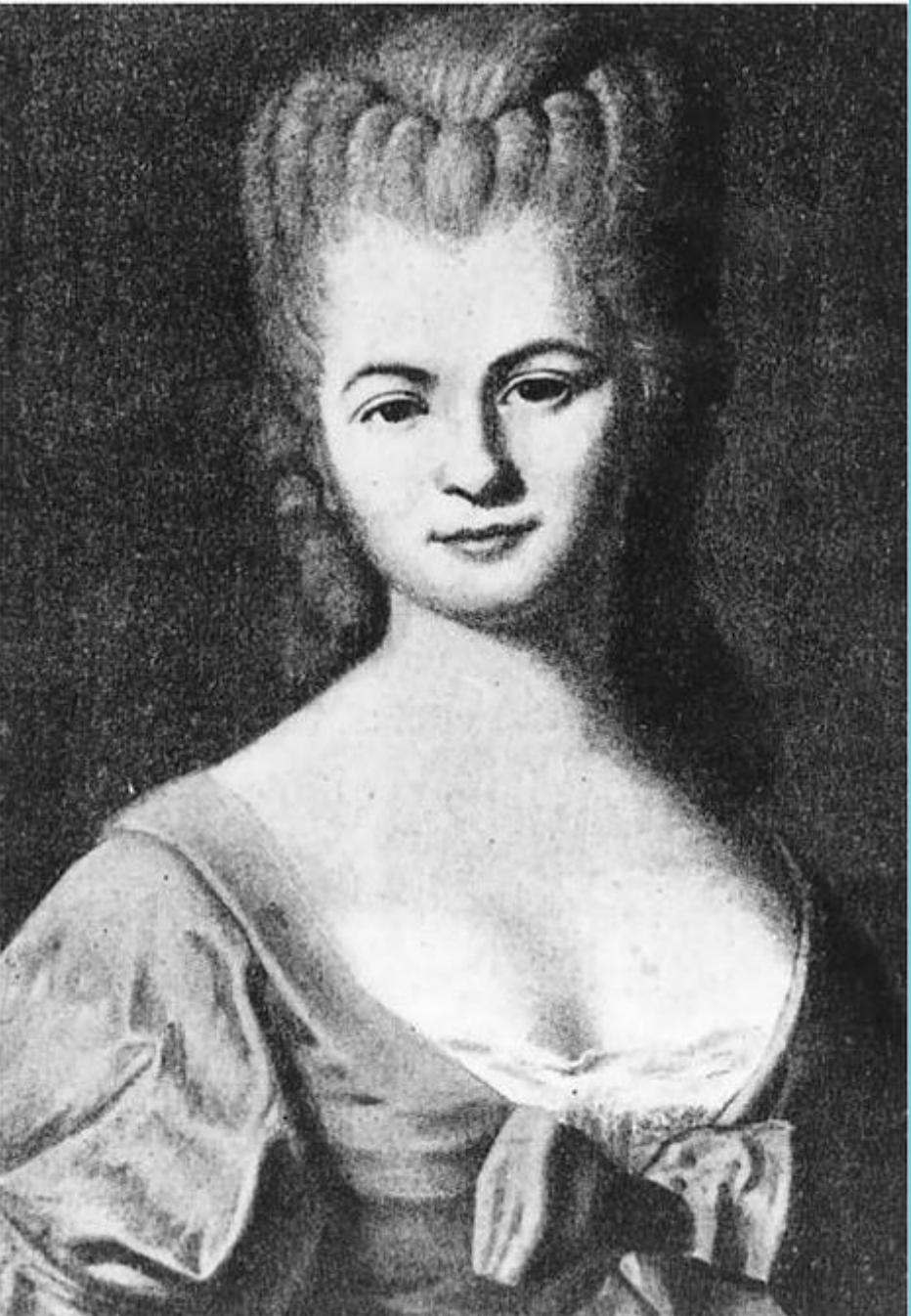
Age 17, the year she met Babbage.



# MARY SOMERVILLE

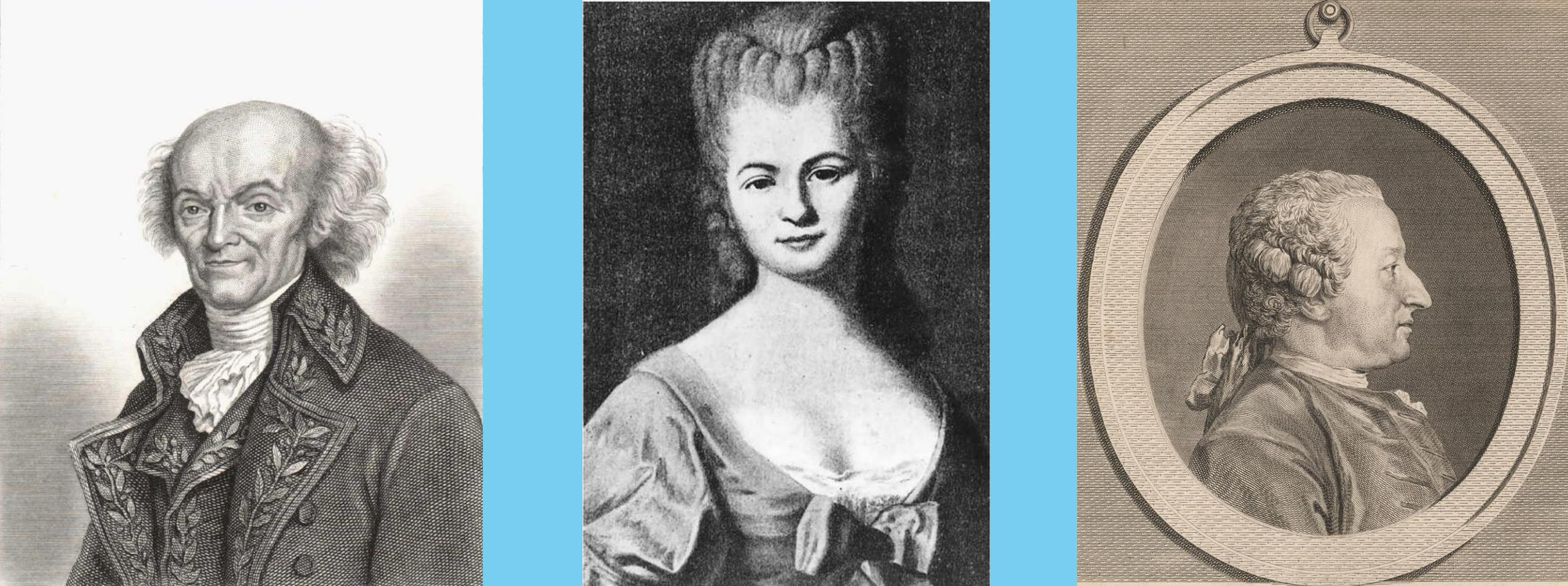
The word “scientist” coined to describe her:

- Mathematician
- Astronomer
- Molecular scientist
- Geographer
- Published, translated



# NICOLE-REINE ÉTATION DE LA BRIÈRE LEPAUTE

- Astronomer
- Mathematician
- Scientific Academy of Béziers, member
- Mapped 1764 solar eclipse at 15-minute intervals
- Asteroid: “7720 Lepaute”
- Lunar crater: “Lepaute”



# JÉRÔME LALANDE, NICOLE-REINE LEPAUTE & ALEXIS CLAIRAULT

Proved Edmund Halley correct:  
Halley's Comet is a single object  
Calculated return of the comet  
within 1 month (1759).



# JÉRÔME LALANDE & ALEXIS CLAIRAULT

Proved Edmund Halley correct:  
Halley's Comet is a single object  
Calculated return of the comet  
within 1 month. (1759)



## The Computer Girls

BY LOIS MANDEL

A trainee gets \$8,000 a year  
...a girl "senior systems analyst"  
gets \$20,000—and up!  
Maybe it's time to investigate....

Ann Richardson, IBM systems engineer, designs a bridge via computer. Above (left) she checks her facts with fellow systems engineer, Marvin V. Fuchs. Right, she feeds facts into the computer. Below, Ann demonstrates on a viewing screen how her facts designed the bridge, and makes changes with a "light pen."

Twenty years ago, a girl could be a secretary, a school teacher . . . maybe a librarian, a social worker or a nurse. If she was really ambitious, she could go into the professions and compete with men . . . usually working harder and longer to earn less pay for the same job.

Now have come the big, dazzling computers—and a whole new kind of work for women: programming. Telling the miracle machines what to do and how to do it. Anything from predicting the weather to sending our billing notices from the local department store.

And if it doesn't sound like women's work—well, it just is.

"I had this idea I'd be standing at a big machine and pressing buttons all day long," says a girl who programs for a Los Angeles bank. I couldn't have been further off the track. I figure out how the

computer can solve a problem, and then instruct the machine to do it."

"It's just like planning a dinner," explains Dr. Grace Hopper, now a staff scientist in systems programming for Univac. (She helped develop the first electronic digital computer, the Eniac, in 1946.) "You have to plan ahead and schedule everything so it's ready when you need it. Programming requires patience and the ability to handle detail. Women are 'naturals' at computer programming."

What she's talking about is *aptitude*—the one most important quality a girl needs to become a programmer. She also needs a keen, logical mind. And if that zeroes out the old Billie Burke-Gracie Allen image of femininity, it's about time, because this is the age of the Computer Girls. There are twenty thousand of them in the United (*cont. on page 54*)



Photos by Henry Grossman. Dress by Gino Charles.

"Twenty years ago, if [a woman] was really ambitious, she could go into the professions and compete with men...usually working harder and longer to earn less pay for the same job.

"Now have come the big, dazzling computers and a whole new line of work for women: programming. Telling the miracle machines what to do and how to do it.

"And if it doesn't sound like women's work—well, it just is."

Lois Mandel, *The Computer Girls*,  
*Cosmopolitan*, April 1967



*Photos by Henry Grossman, Dress by Gino Charles.*

**“THIS IS THE AGE OF THE COMPUTER  
GIRLS. THERE ARE 20,000 IN THE U.S.”**

*“Aptitude: the one most important quality a girl needs to be a programmer. She also needs a keen, logical mind.”*

# Susie Meyer meets PL/I

The story of how a single language answers the question, "Can a young girl with no previous programming experience find happiness handling both commercial and scientific applications, without resorting to an assembler language?" Let's face it. The cost of programming just keeps going up. So for some time to come, how well you do your job depends on how programmers like Susie Meyer do theirs.

That's the reason for PL/I, the high-level language for both scientific and commercial applications.

With PL/I, programmers don't have to learn other high-level languages. They can concentrate more on the job, less on the language.

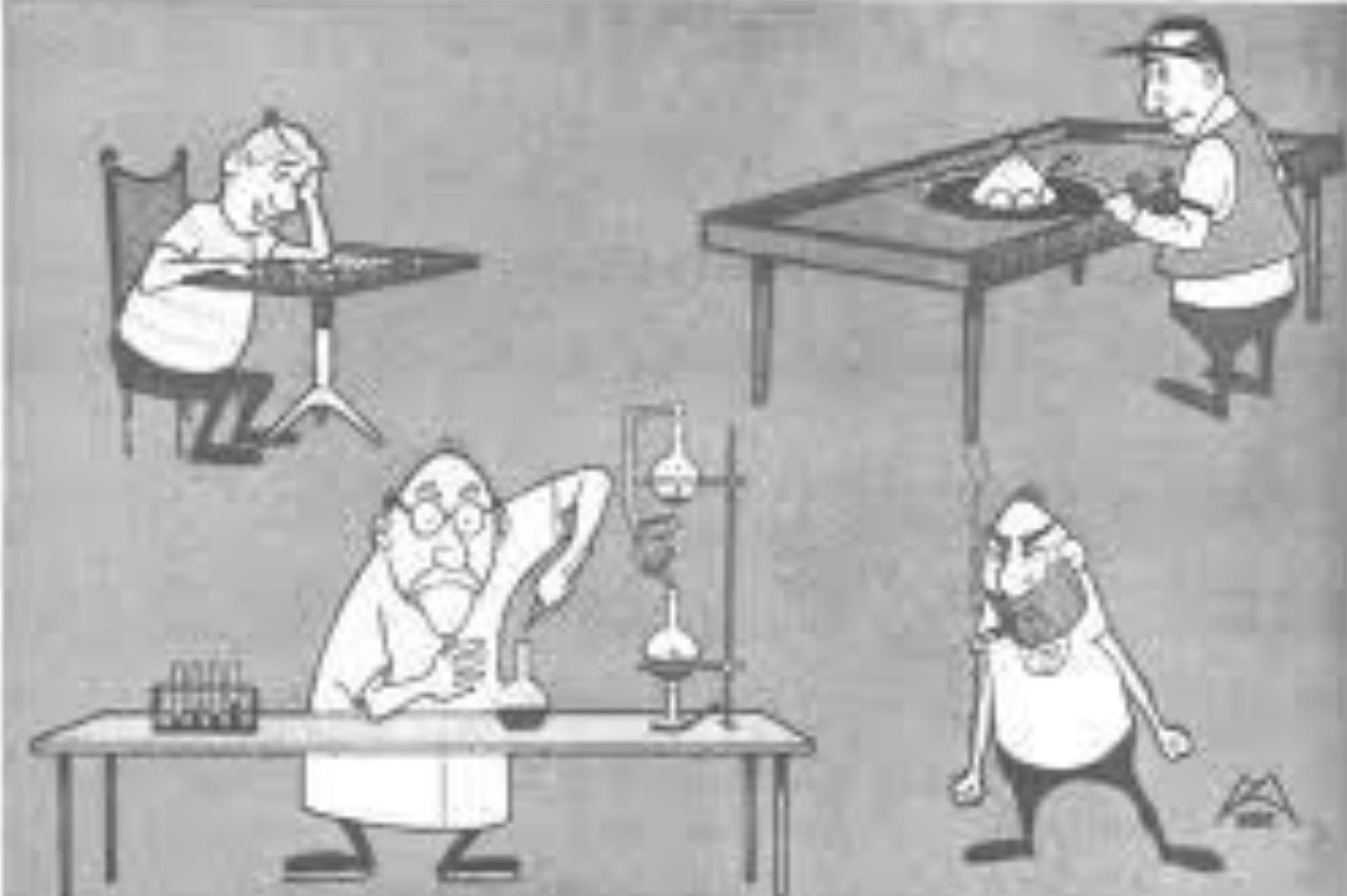
So think about PL/I. Not just in terms of training, but in terms of the total impact it can have on your operation.



The story of how a single language answers the question, "Can a young girl with no previous programming experience find happiness handling both commercial and scientific applications, without resorting to an assembler language?"

Let's face it. The cost of programming just keeps going up.

IBM Corporation, 1968



**Figure 2: Programmers are crazy about puzzles, tend to like research applications and risk-taking, and don't like people.**

William M. Cannon and Dallis K. Perry, "A Vocational Interest Scale for Computer Programmers"

— Proceedings of the Fourth SIGCPR Conference on Computer Personnel Research (Los Angeles: Association for Computing Machinery, 1966), 61-62

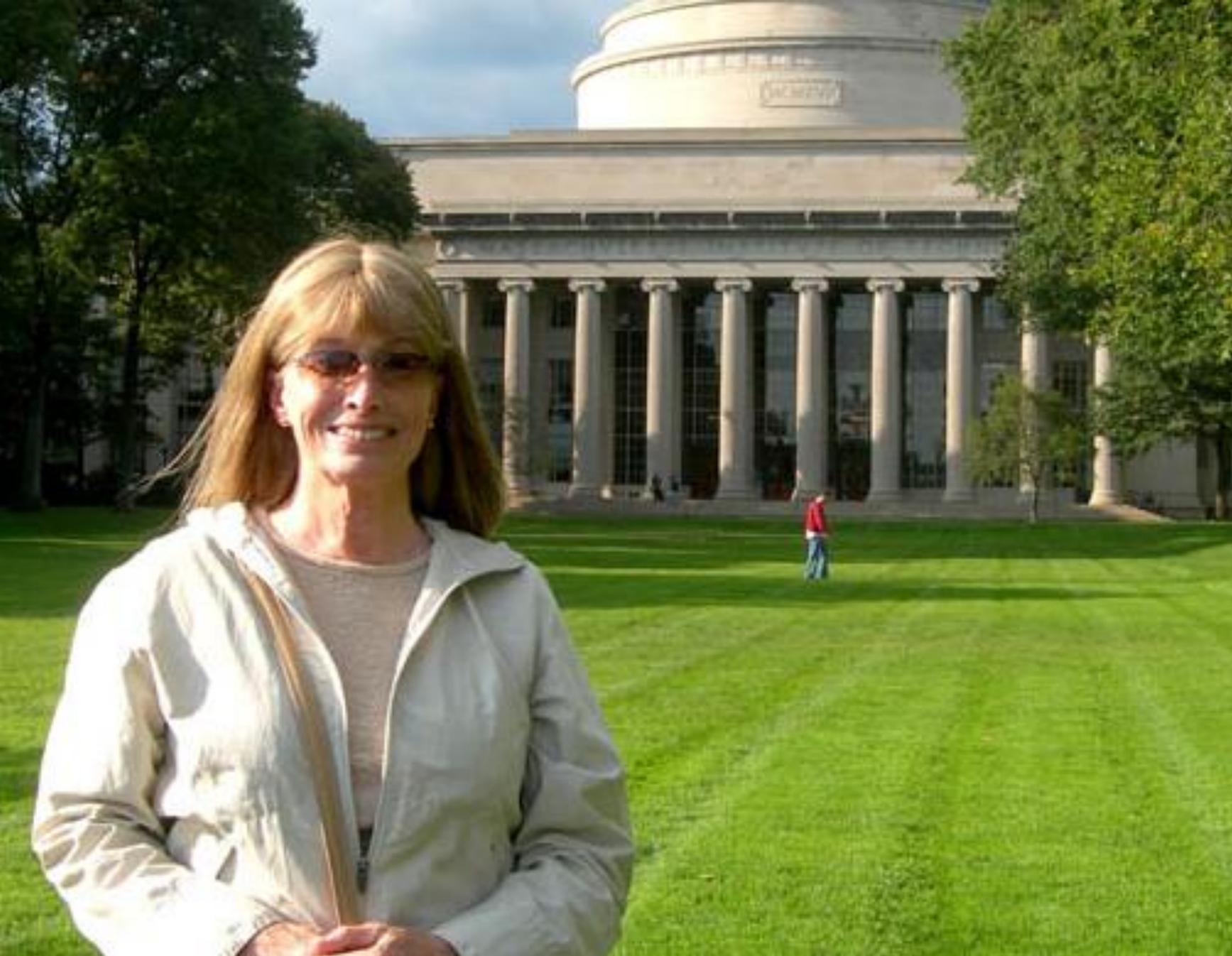


Datamation magazine, 1963



# REAR ADMIRAL GRACE MURRAY HOPPER

- Harvard Mark I programmer, 1944
- Invented the compiler
- Responsible for COBOL
- Championed women and minorities in computing



# LYNN CONWAY

- IBM, 1964-68
- Fired because transgender
- Started over in “stealth mode”
- XEROX Palo Alto Research Center
- DARPA, DoD
- Microchip architecture



# RADIA PERLMAN

- Invented Spanning Tree
- 100 patents
- TORTIS (LOGO for kids)
- 2x *Data Communications* mag's 20 Most Influential People in the Industry
- “Mother of the Internet”



# ROBERTA WILLIAMS

Sierra On-Line  
Invented graphic adventure  
game

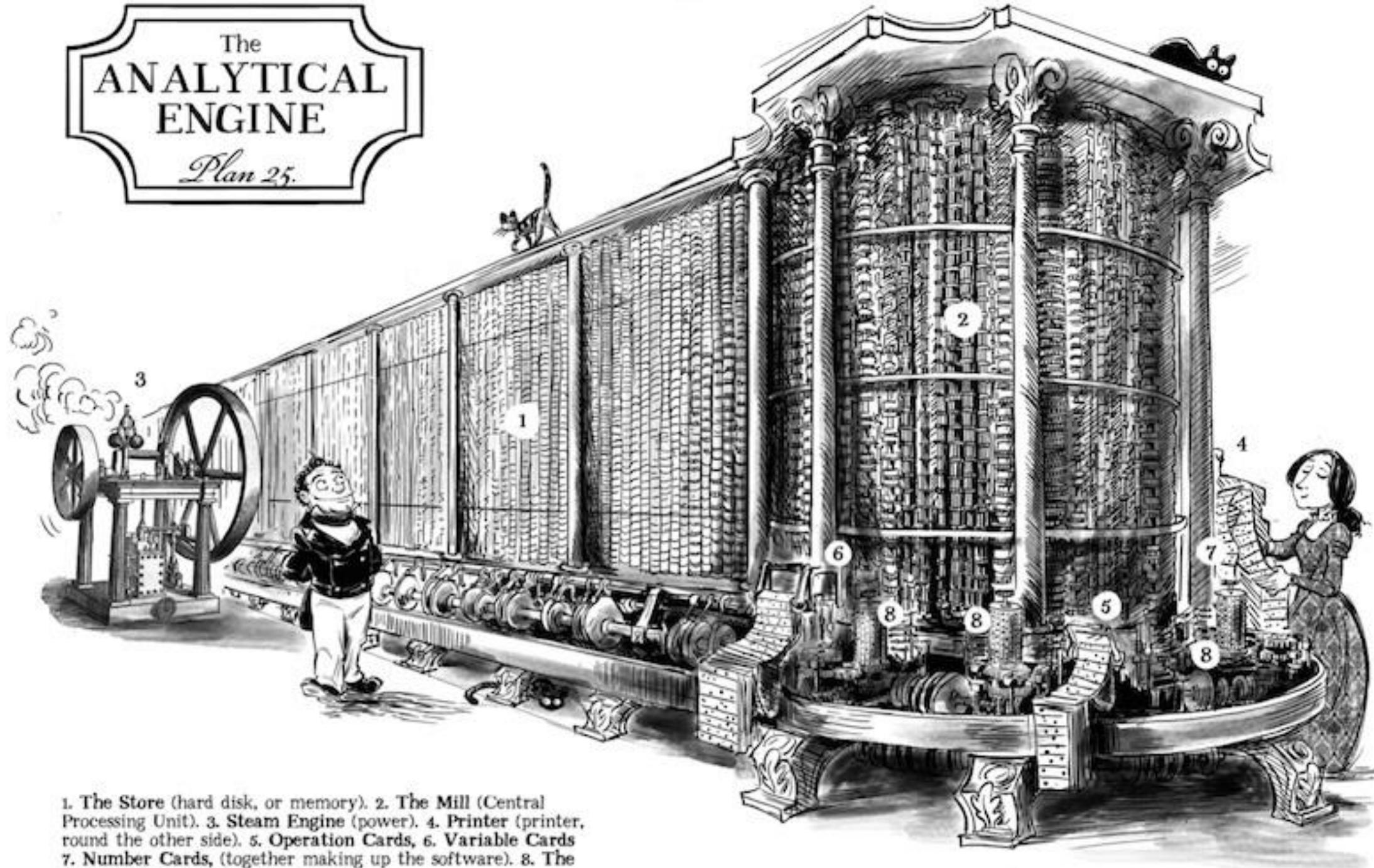
- King's Quest
- Mystery House
- Phantasmagoria
- Leisure Suit Larry



# THELMA ESTRIN

- Electrical engineer
- Co-built WEIZAC, first in Israel
- Medical informatics pioneer
- First female IEEE vice president

The  
**ANALYTICAL  
ENGINE**  
*Plan 25.*



1. The Store (hard disk, or memory).
2. The Mill (Central Processing Unit).
3. Steam Engine (power).
4. Printer (printer, round the other side).
5. Operation Cards.
6. Variable Cards.
7. Number Cards, (together making up the software).
8. The Barrel Controllers (microprograms).



# HYPATIA

History's first known female  
mathematician, astronomer,  
philosopher  
circa 350-415 C.E.

# RECOMMENDED READING & VIEWING

The Thrilling Adventures of Lovelace & Babbage

Sydney Padua

Fantastic graphic novel and webcomic

When Computers Were Human

David Alan Grier

Grace Hopper interview on David Letterman

<https://www.youtube.com/watch?v=1-vcErOPofQ>

Authors@Google: Kurt Beyer

[https://www.youtube.com/watch?v=lY6Hk8\\_eiKs](https://www.youtube.com/watch?v=lY6Hk8_eiKs)

Great talk by the author of Grace Hopper and the Invention of the Information Age

# INITIATIVES, ALLIES & GATHERINGS

Links at DevDivas.com

PHP Women

Tech Inclusion Conference

Anita Borg Institute

Grace Hopper Celebration

BlackGirlsCode

Code For Progress

Girls Who Code

Model View Culture

Finding Ada

Code Liberation

The Mary Sue

Systers

Alterconf

Ada Lovelace Day

GeekGirlTechCon.com

Women and Tech

Women's Coding Collective

Girls In Tech

YWeb Academy (Madison)

Ladies Learning Code

IEEE Women in Engineering

GirlDevelopIt

“Born With Curiosity”  
Grace Hopper film project

“The Computers” film

“Code” film

Men In Tech

“Ada. Ada. Ada.” show

# ABOUT ME



Vesna Vuynovich Kovach runs DevDivas.com, a website celebrating the rich history of women in technology.

She is part of the agile PHP development team that powers OfficeSupply.com, an ecommerce store headquartered in Columbus, Wisconsin.

She tweets at [@Vesna V K.](https://twitter.com/Vesna_V_K)



?



## RATE THIS TALK

<https://joind.in/14775>

Visit [DevDivas.com](http://DevDivas.com) for

- Further reading and viewing
- Resources consulted
- Initiatives that help girls and women in STEM
- Ideas for building diversity in your workplace

## STAY IN TOUCH

- [@dev\\_divas](https://twitter.com/dev_divas)
- [Via web form](https://www.DevDivas.com/stay-in-touch)



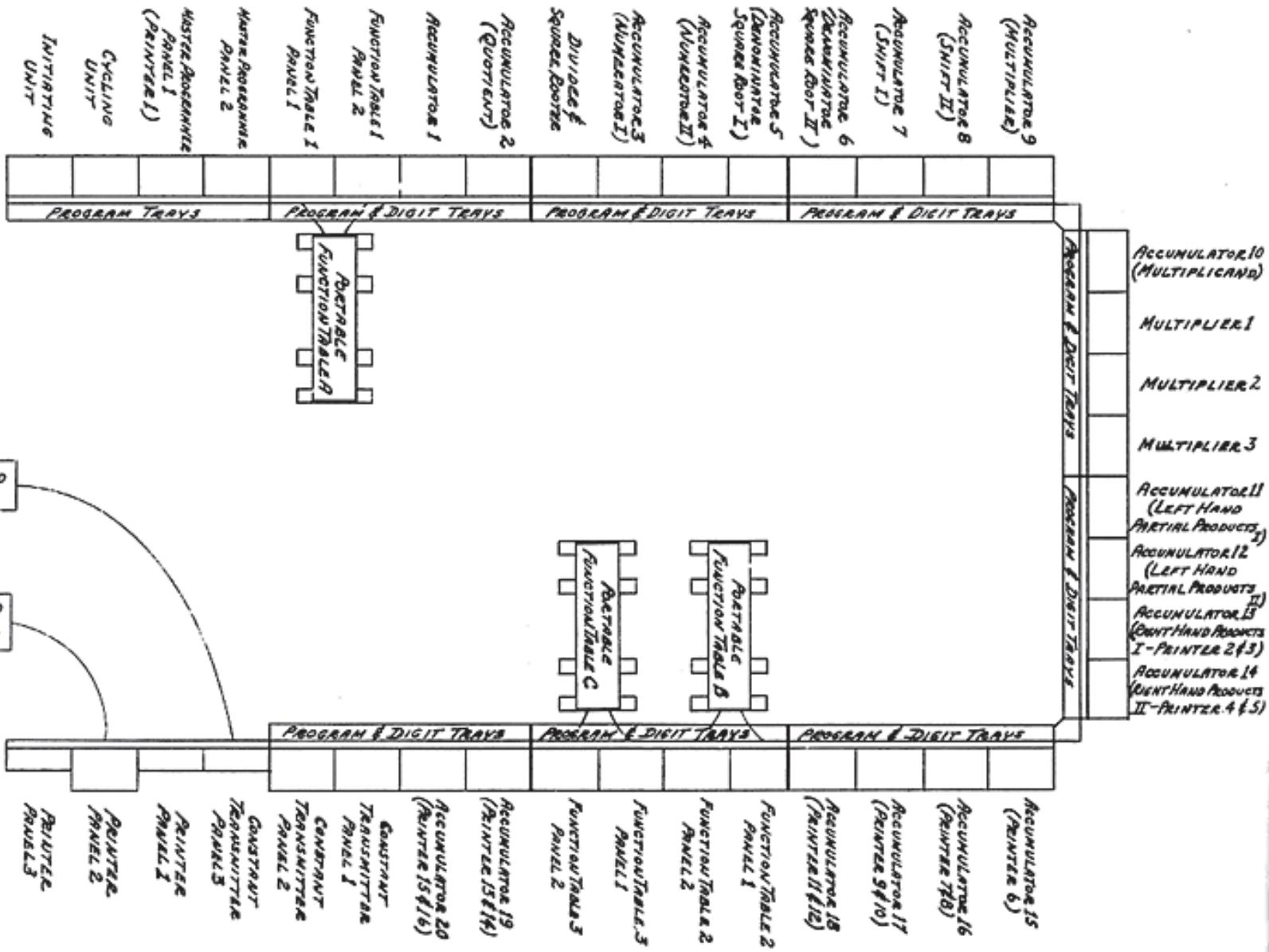
## LISKOV SUBSTITUTION PRINCIPLE

If It Looks Like A Duck, Quacks Like A Duck, But Needs Batteries - You  
Probably Have The Wrong Abstraction

BARBARA  
LISKOV

# ENIAC

20,000 vacuum tubes  
 5,000 additions/second  
 First electronic programmable computer  
 Became first with stored memory – that was added later



# BASIC PRINCIPLES OF OBJECT-ORIENTED DEVELOPMENT

Single responsibility

Open-closed

Liskov substitution

Interface segregation

Dependency inversion



# BARBARA LISKOV

- Institute Professor,  
Dept. of Electrical  
Engineering and Computer  
Science
- MIT Comp. Science & AI Lab  
Programming Methodology  
Group
- 2008 Turing Award



# BARBARA LISKOV

- “Liskov Substitution Principle”
- MIT Comp. Science & AI
- 2008 Turing Award

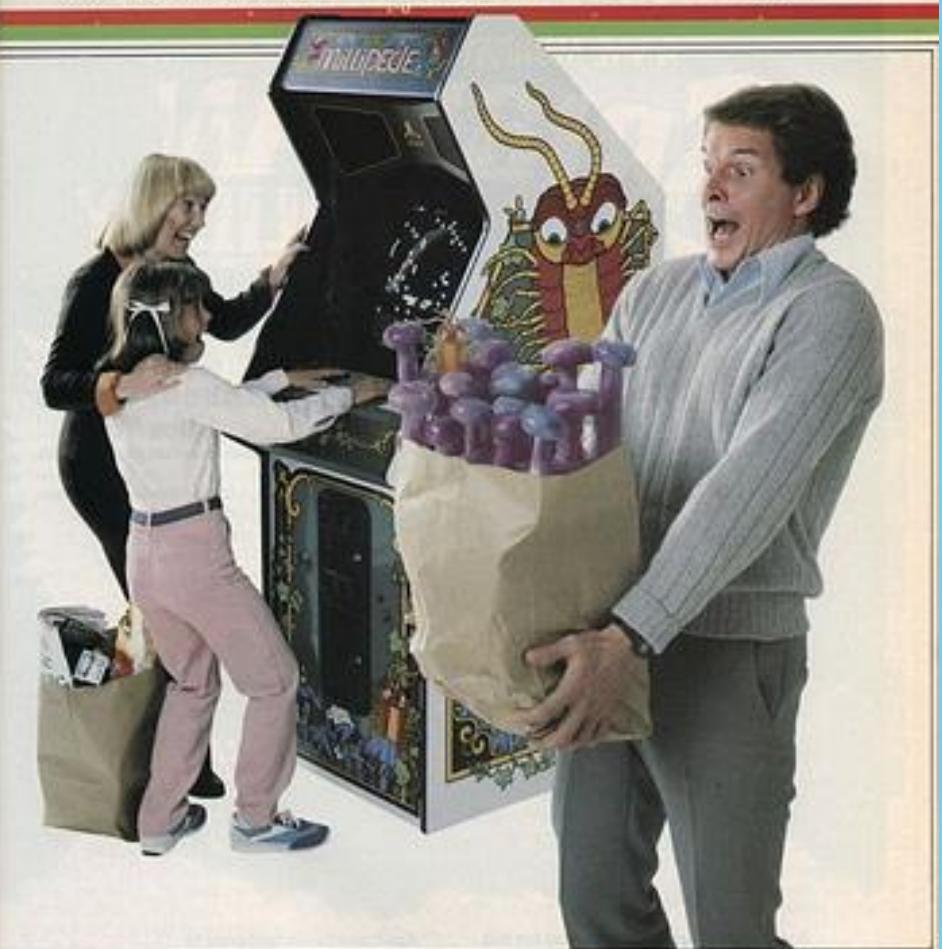




# JEANNETTE WING

Published Liskov Substitution  
Principle with Barbara Liskov in  
1993

# New Atari® Millipede™. More magic!



Millipede puts more magic in your business bag. More profit magic! The kind of Special profits you always get every day from ATARI games.

Millipede is a fantastic new video adventure fantasy that continues and multiplies the sizzling profit tradition and excitement of ATARI Centipede™.

Millipede's even hotter. It's faster, more colorful high energy action. With new critters, new sounds, new player starting score select mode and a variety of new options that let you "program" Millipede for maximum profits. Best of all, it's challenging entertainment that appeals to all your

customers—kids of all ages.

The action is non-stop. Armed only with a bow and arrows, the player must shoot through a forest of colossal wild mushrooms to hit the advancing Millipede. Giant spiders, inchworms, earwigs, beetles, and waves of "bombing" bees, dragonflies and mosquitoes also add to the fun.

Millipede is one of today's highest earning games. So don't miss out. Ask your operator for new Millipede from



Entertainment Communications Company

Atari now! Or send the coupon for more information fast.

Mr. Don Osborne  
Vice President, Marketing and Sales  
Atari, Inc.  
790 Sylvanov Dr., P.O. Box 906  
Milpitas, CA 95035  
Name \_\_\_\_\_

Store/Co Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Zip \_\_\_\_\_ Telephone \_\_\_\_\_

Chain       Independent

Dept PC

## Millipede magazine ad, 1982



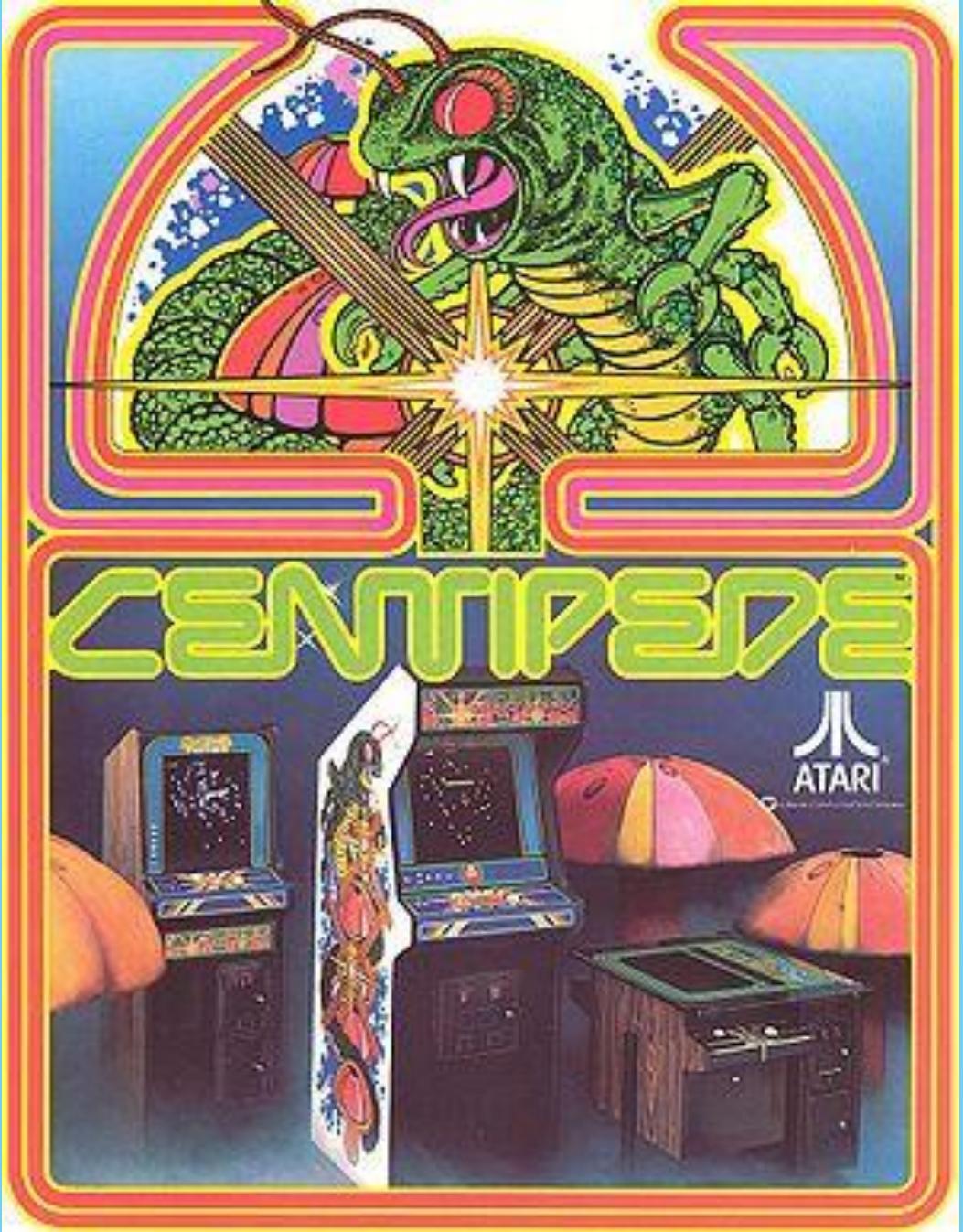
# ROBERTA AND KEN WILLIAMS

Sierra On-Line, co-founders

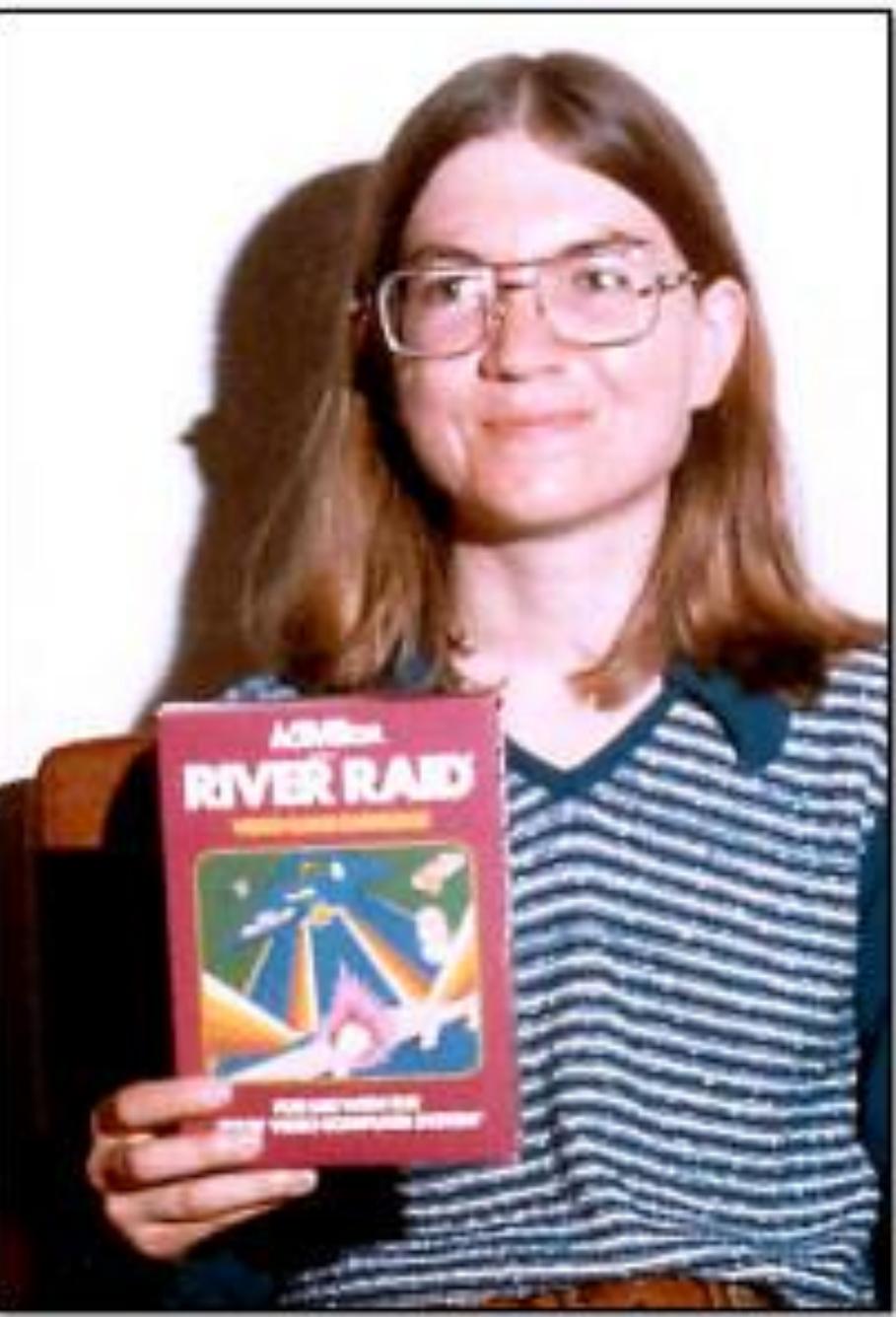


# DONA BAILEY, CENTIPEDE CREATOR

Atari, software engineer



DONA BAILEY



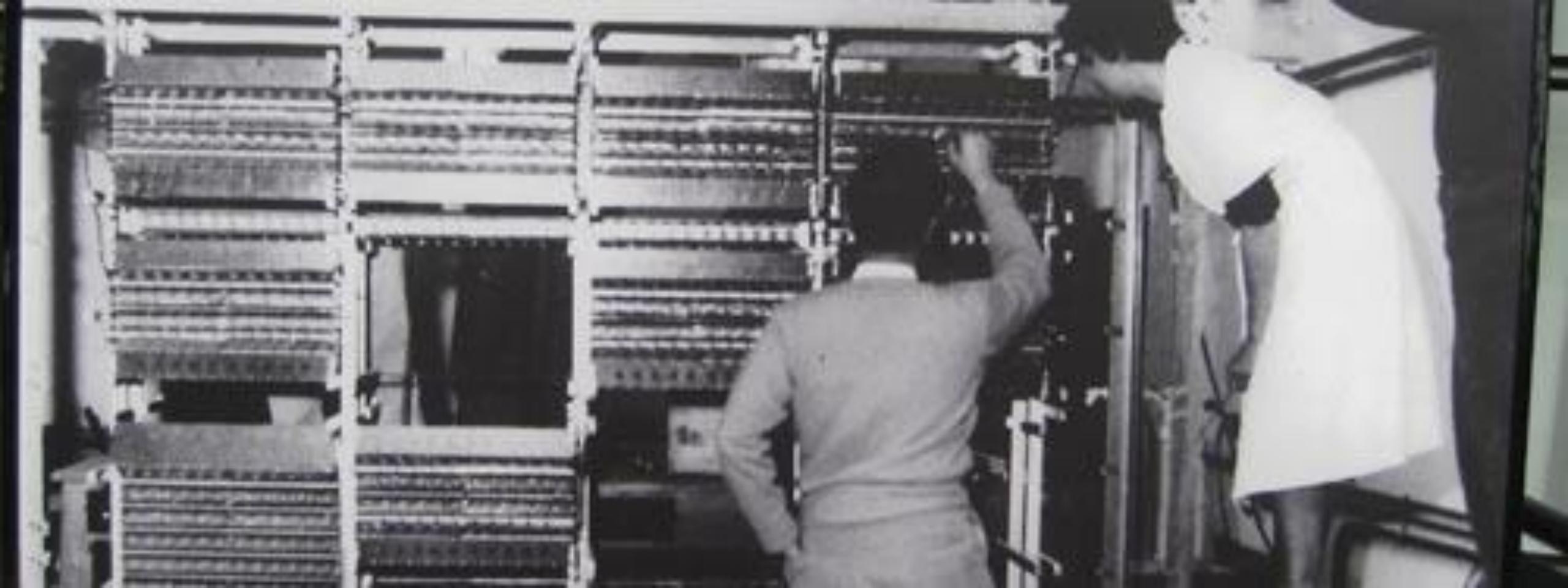
# CAROL SHAW

Software engineer, Atari  
- Tic-Tac-Toe  
- River Raid



# DIANE C. PIROG SMITH

- Query languages
- Data modeling
- Commercial + theory



# THELMA ESTRIN

- Electrical engineer
- Co-built WEIZAC, first in Israel
- Medical Informatics pioneer



# FRANCES ALLEN

- First female Turing Award recipient
- IBM liaison to the CIA
- Compiler development



# KAREN SPÄRCK-JONES

- Information retrieval
- Natural language processing
- Cryptography
- Weighting for search
- Only female winner of British Computer Society's Lovelace Award
- Karen Spärck-Jones Award



# SHAFI GOLDWASSER SHOWN WITH SILVIO MICALI

- 2012 co-recipient with Micali, Turing Award
- Cryptography
- Complexity theory
- MIT, Weizmann Institute



# ANITA BORG

- Systers: first email network for women, 1987
- Co-founded Institute for Women and Technology (Now the Anita Borg Institute)
- Co-founded Grace Hopper Celebration of Women in Computing

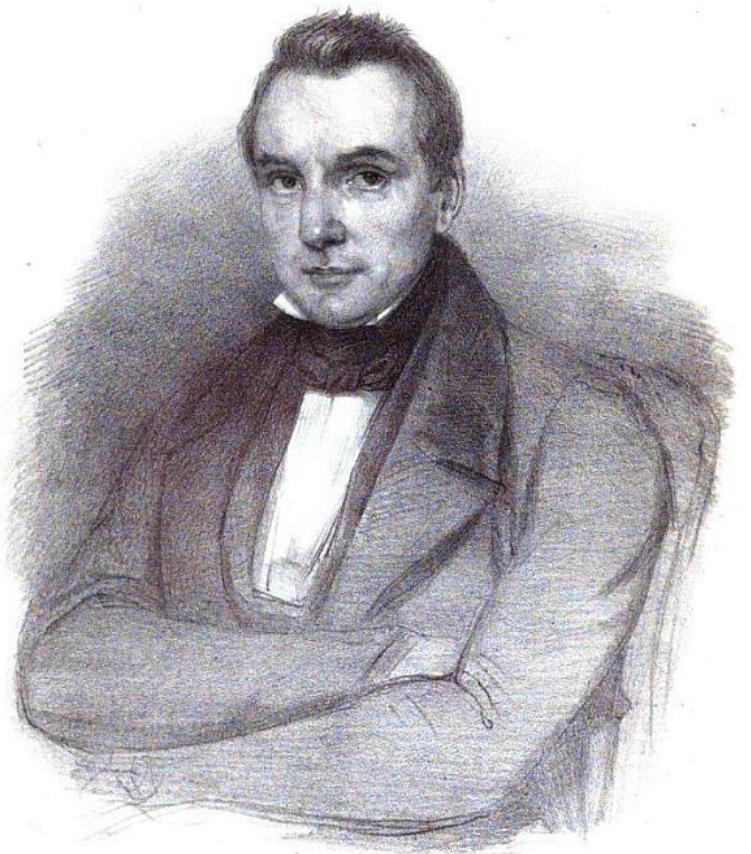


# ALAN TURING



# EVELYN BOYD GRANVILLE

- IBM programmer, 1950s
- Wrote software for Vanguard, Mercury, Apollo space projects
- National Bureau of Standards
- Trajectory analyst



*Charles Babbage*

*E. Lovell del vero  
Liberaria V. Battelli & C°  
David Castellini litograpf.*

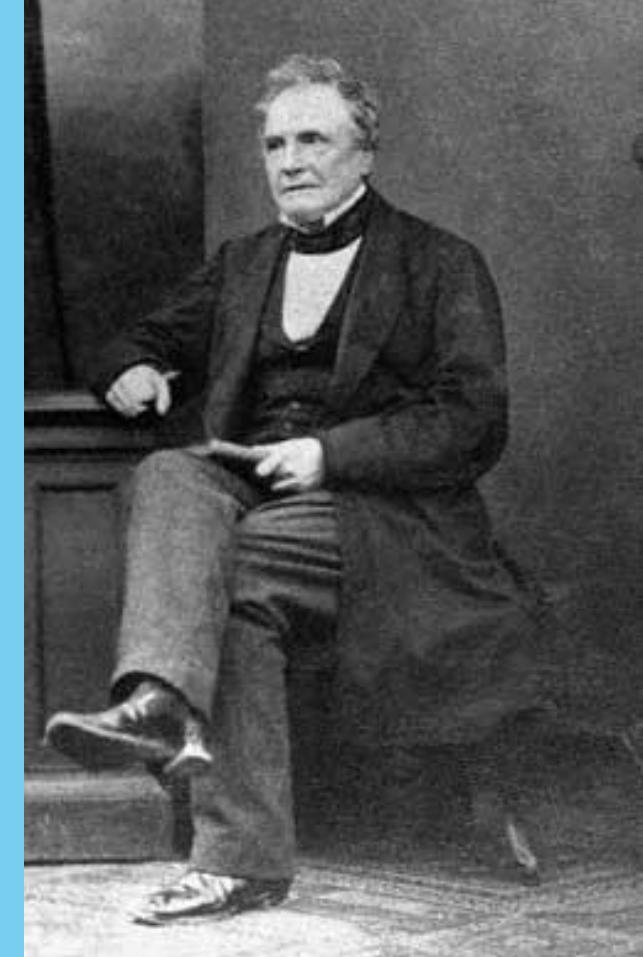
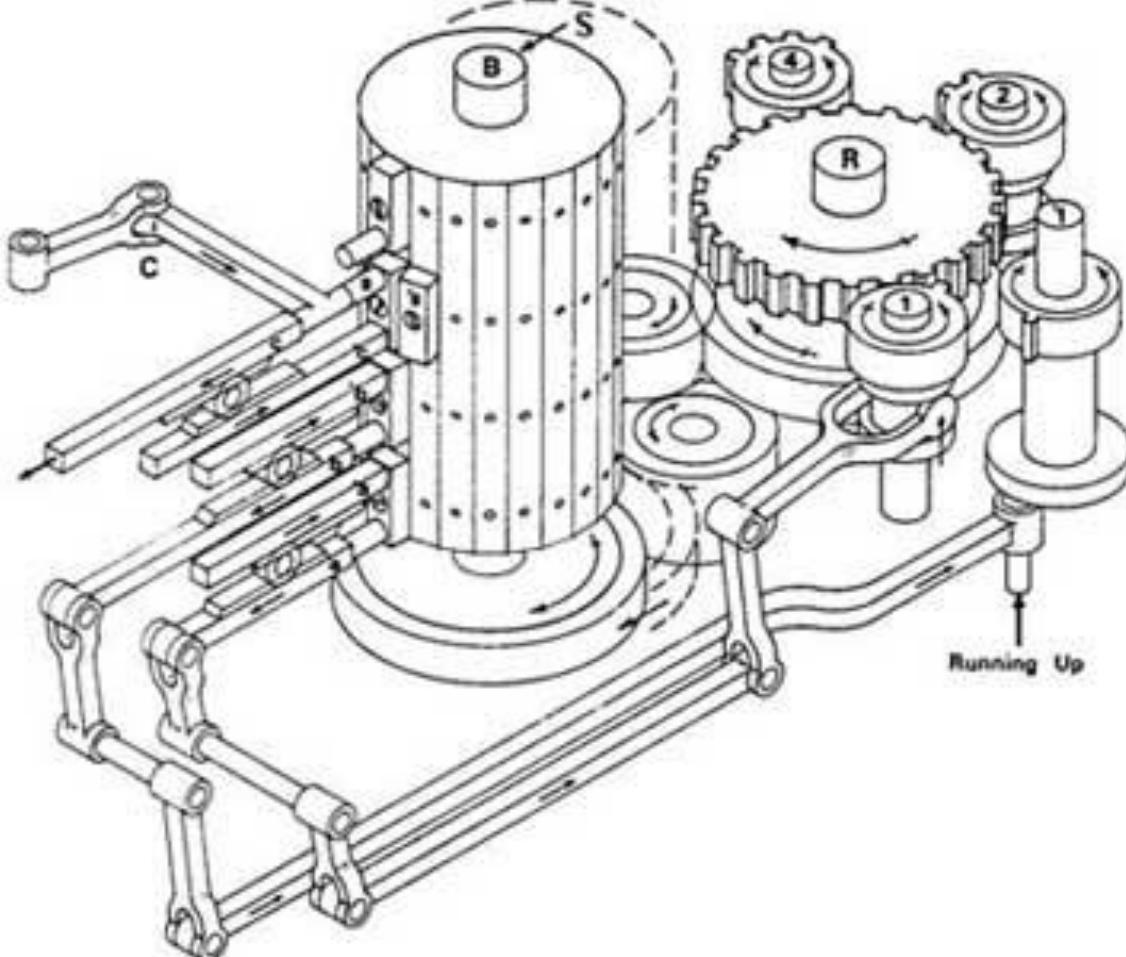
Digitized by Google

# CHARLES BABBAGE

- Lucasian Chair of Mathematics, Cambridge
- Built part of an enormous calculator
- Threw great parties!

$n$	0	1	2	4	6	8	10	12	14	16	18	20
$B_n$	1	$-\frac{1}{2}$	$\frac{1}{6}$	$-\frac{1}{30}$	$\frac{1}{42}$	$-\frac{1}{30}$	$\frac{5}{66}$	$-\frac{691}{2730}$	$\frac{7}{6}$	$-\frac{3617}{510}$	$\frac{43867}{798}$	$-\frac{174611}{330}$
$\frac{B_n}{n}$		$\frac{1}{12}$	$-\frac{1}{120}$	$\frac{1}{252}$	$-\frac{1}{240}$	$\frac{1}{132}$	$-\frac{691}{32760}$	$\frac{1}{12}$	$-\frac{3617}{8160}$	$\frac{43867}{14364}$	$-\frac{174611}{6600}$	

# BERNOULLI NUMBERS



# THE ANALYTICAL ENGINE

Could the information revolution have begun 100 years sooner?

Diagram: Sydney Padua



330



*Lady Byron.*

*Pub. June 1. 1806 by Davis & Munday 53 Strand.*

# LORD AND LADY BYRON



# THE ANALYTICAL ENGINE

Could the information revolution  
have begun 100 years sooner?

# COSMOPOLITAN

April, 1967 • 50¢

Sex and the  
Japanese  
Single Girl

A Secretary  
Tells How a  
Con Man  
Took Her Money

Vanessa Redgrave—  
Zap!

The Unfaithful Wife  
—A New Study

Here Comes Twiggy!  
Britain's New, Super Model  
by John Fowles

---

Mystery Novel—Complete  
by Patricia Highsmith





# REAR ADMIRAL GRACE MURRAY HOPPER

Showing Dave a nanosecond.  
Fantastic interview at  
<https://www.youtube.com/watch?v=1-vcErOPofQ>



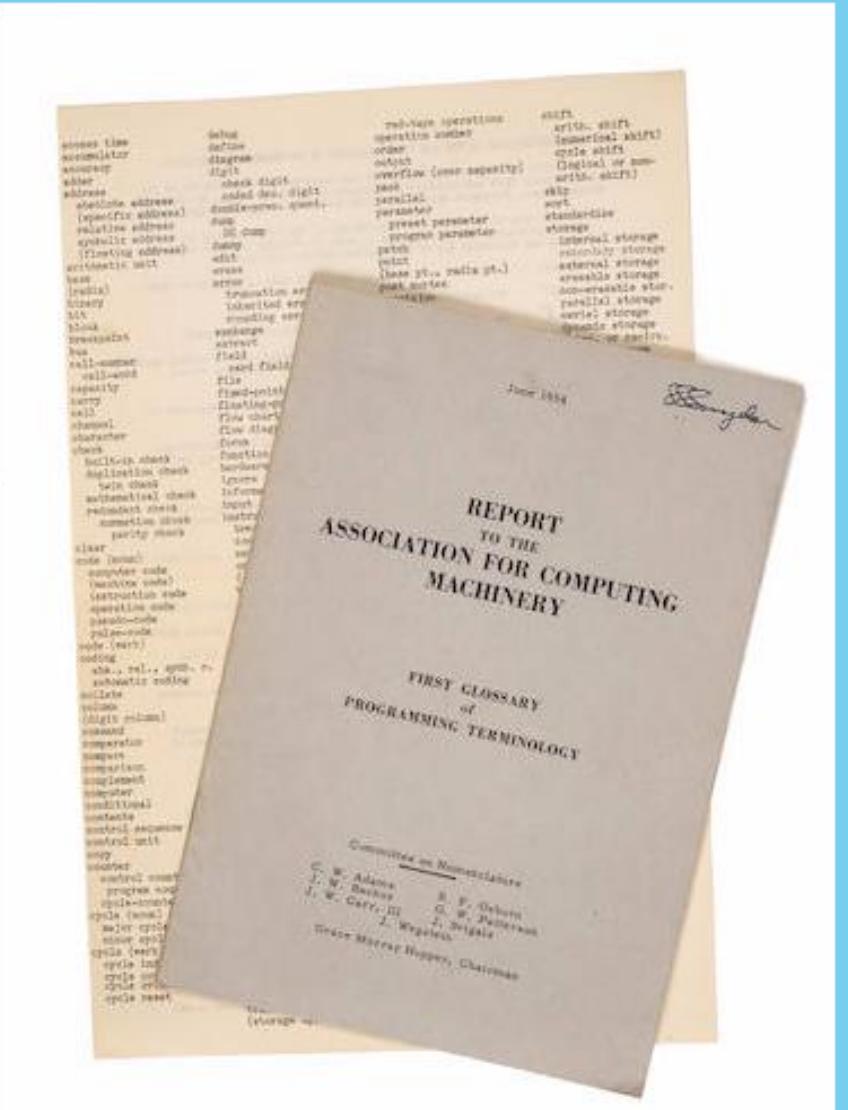
# GRACE MURRAY HOPPER

1957, with a UNIVAC



# GRACE MURRAY HOPPER

Her first day's assignment:  
“Compute the interpolation  
coefficients for the arctangent to  
an accuracy of 23 decimal  
places. In one week!”

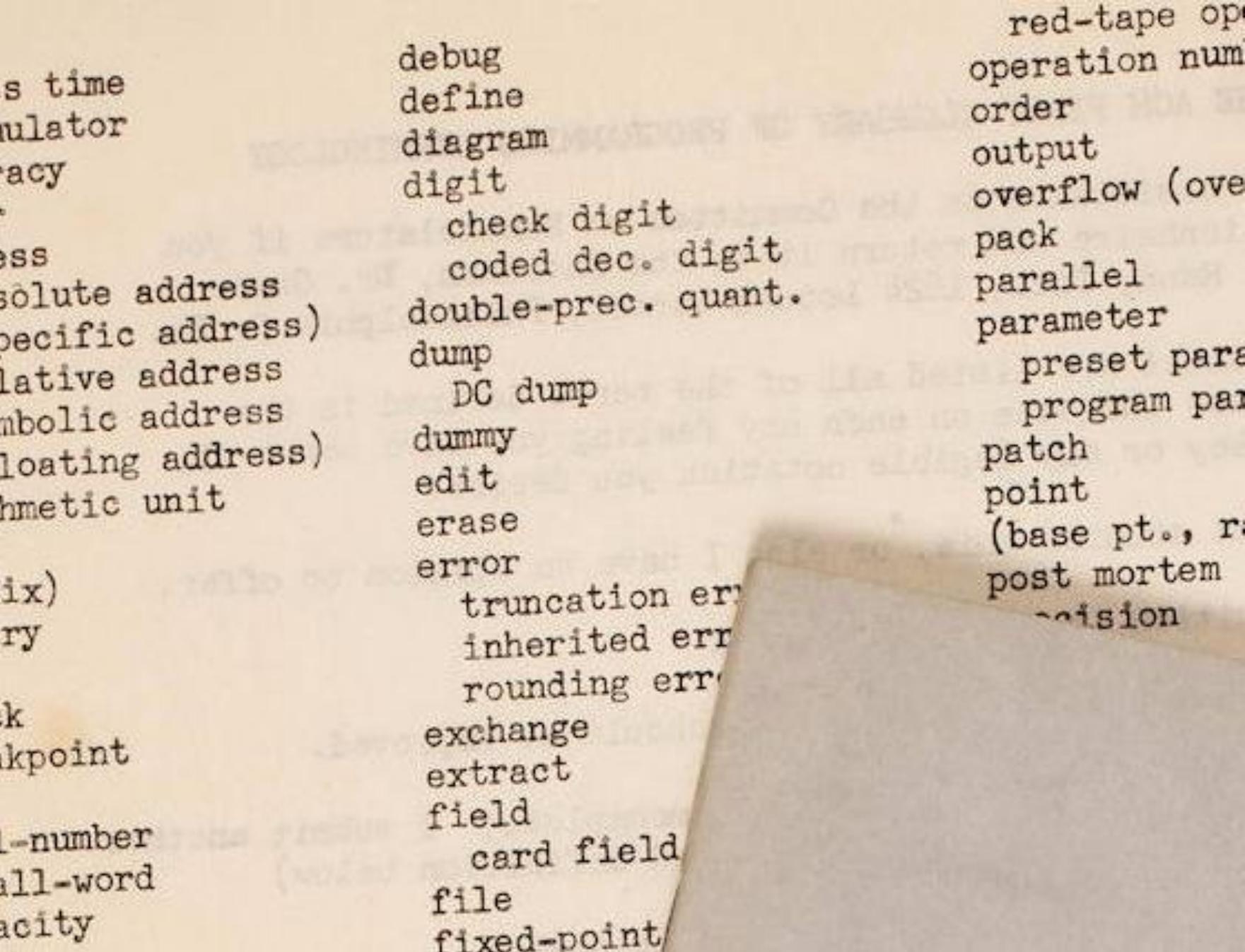


# GRACE MURRAY HOPPER

- Invented the compiler
  - Responsible for COBOL
  - Association for Computing Machinery Nomenclature Committee Chair

# GRACE MURRAY HOPPER

- Invented the compiler
- Responsible for COBOL
- Association for Computing Machinery Nomenclature Committee Chair



# ALYCE MCLAINE HALL



- *Front, far left*
- ENIAC programmer
- Math professor at Aberdeen Ground
- Main Line NAACP chapter
- National Council of Teachers of Mathematics



# ALMA MCLAIN WHITE

- ENIAC statistician



# MARGARET HAMILTON

Director and supervisor of computer teams for Apollo and Skylab.

# SISTER MARY KENNETH KELLER



- Department chair 20 years
- Wrote textbooks
- Founding member, Association Supporting Computer Users in Education