

The History of Women in Tech



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Learning More About These Women in Tech

- Ada Lovelace
- The Ladies of the ENIAC
- Grace Murray Hopper
- Barbara Liskov
- Frances Allen
- Mary Lou Jepsen

Augusta Ada Byron, Lady Lovelace (1815-1852)

- Daughter of Lord Byron, raised by Lady Byron
- Raised in hopes of not becoming a poet
- Focused studies in maths and science
- 1828 – Flying Machine



If you can't give me
poetry, can't you give
me "poetical
science"?

Ada Byron, Lady Lovelace – to her mom

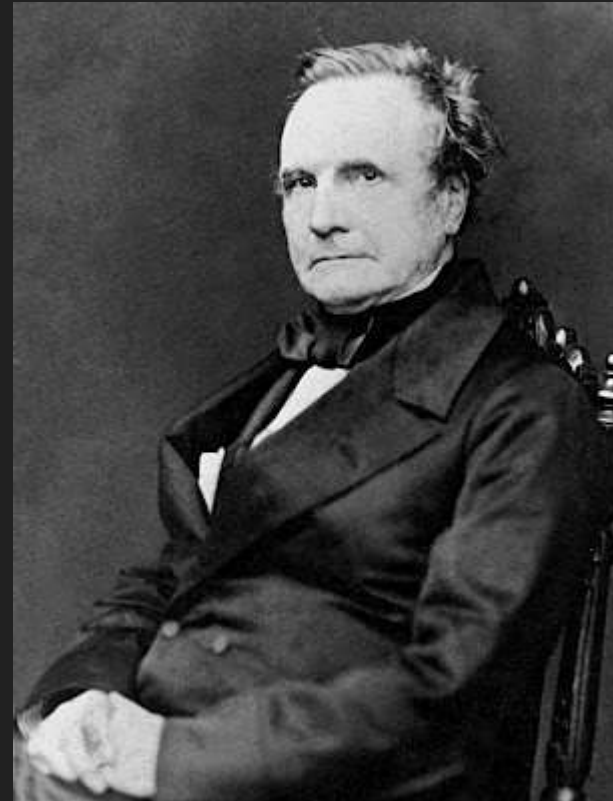


Math
+ Imagination
+ Metaphors

Magic

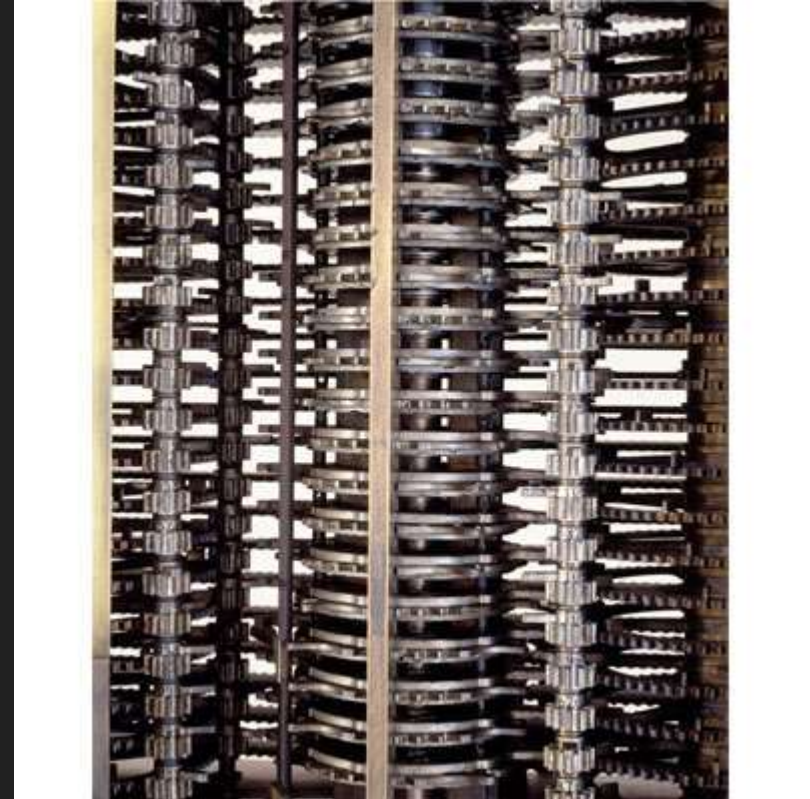
Early Mentoring

- Met her mentor – Charles Babbage - through Mary Somerville (a Scottish mathematician & astronomer) at the age of 17
- Mentor was mathematician, philosopher, inventor, and mechanical engineer
- Ada had a life outside of this
 - Wife to Earl of Lovelace
 - Mom to 3 kids under 8



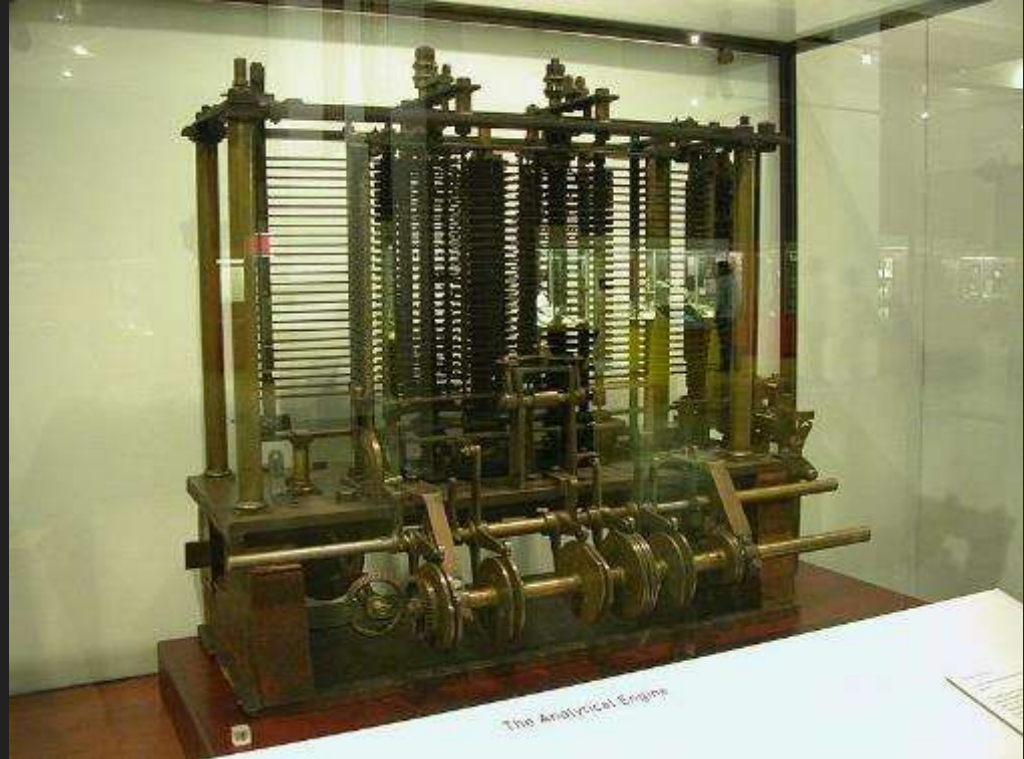
1843 – Predictions for the Analytical Engine

- Compose complex music
- Produce graphics
- Practical & scientific use



Ada & The Analytical Engine

- She documented her mentor's Analytical Engine and included the first program – how to calculate a sequence of Bernoulli numbers with the Engine.
- First individual to conjure a computer algorithm
- 1843 – Published in English science journal as A.A. L. on how codes can be created to handle letters, numbers, and symbols.

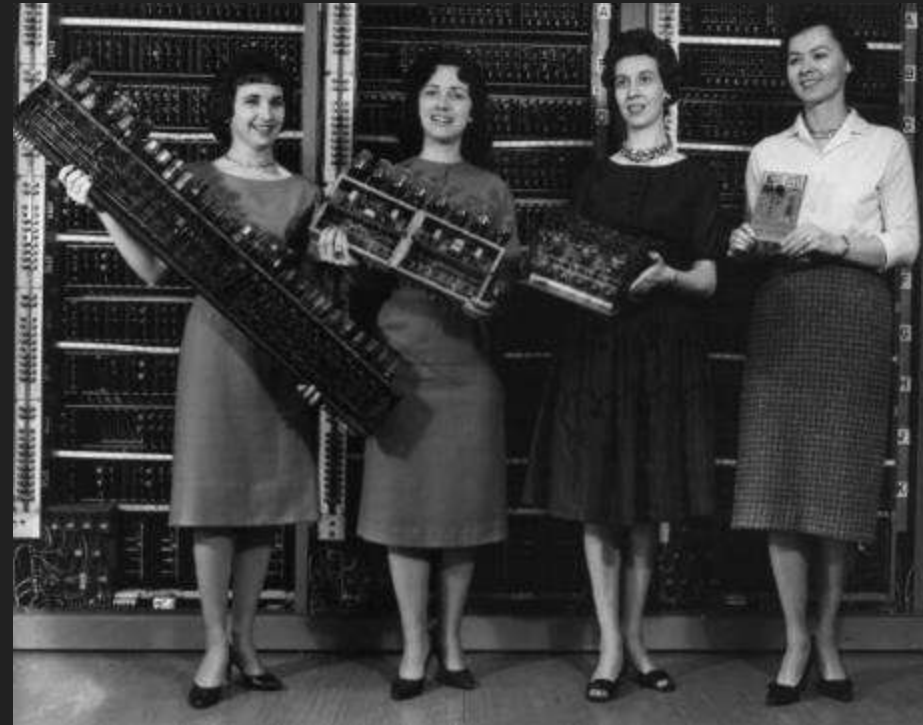
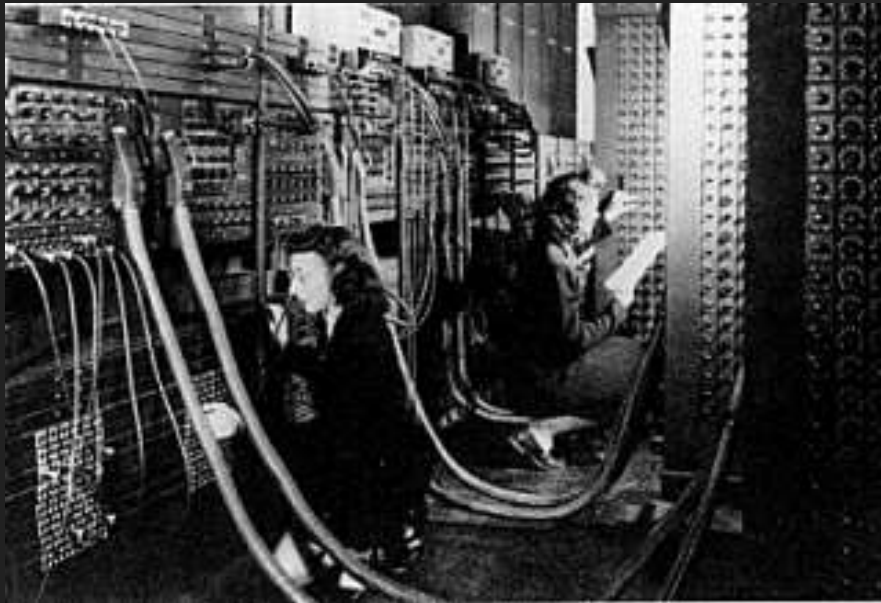


Lessons from Ada

- Follow your passion. Her poetical science eventually led her to success.
- Moms can work while maintaining a social life and a career.
- Choose a mentor who you're interested in learning from and feed off of and into their energy.

The Original Ladies of the ENIAC

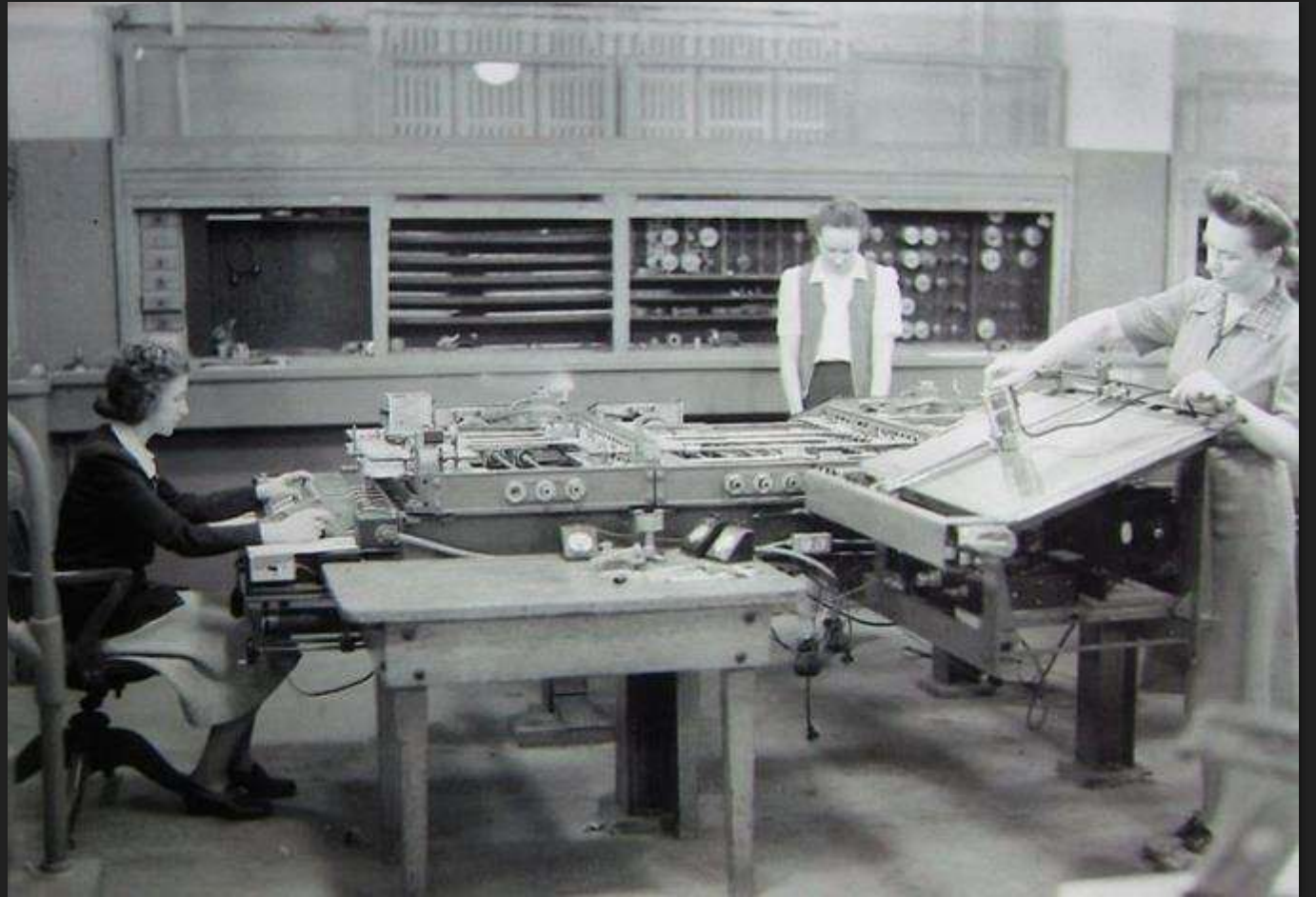
Some of the Women of the ENIAC





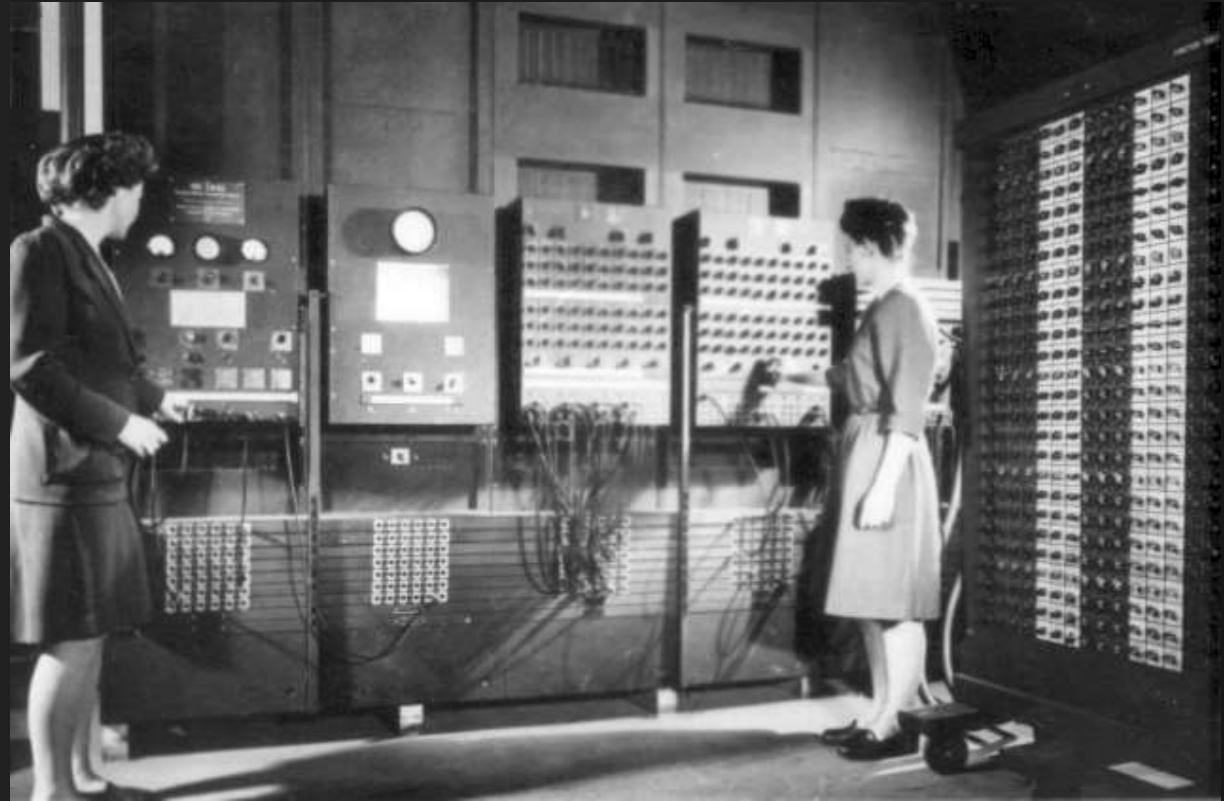
Kathleen “Kay” McNulty Mauchly Antonelli

- one of the six original programmers of the ENIAC
- degree in mathematics
- started with ballistics trajectories and happened into the ENIAC
- worked on BINAC and UNIVAC I software design
- eventually would marry one of the ENIAC co-inventors



(Betty) Jean Jennings Bartik

- responsible for administering the Master Programmer, central program of the ENIAC
- helped transform ENIAC into something easier to work with and able to handle more sophisticated problems
- moved on to BINAC and UNIVAC I



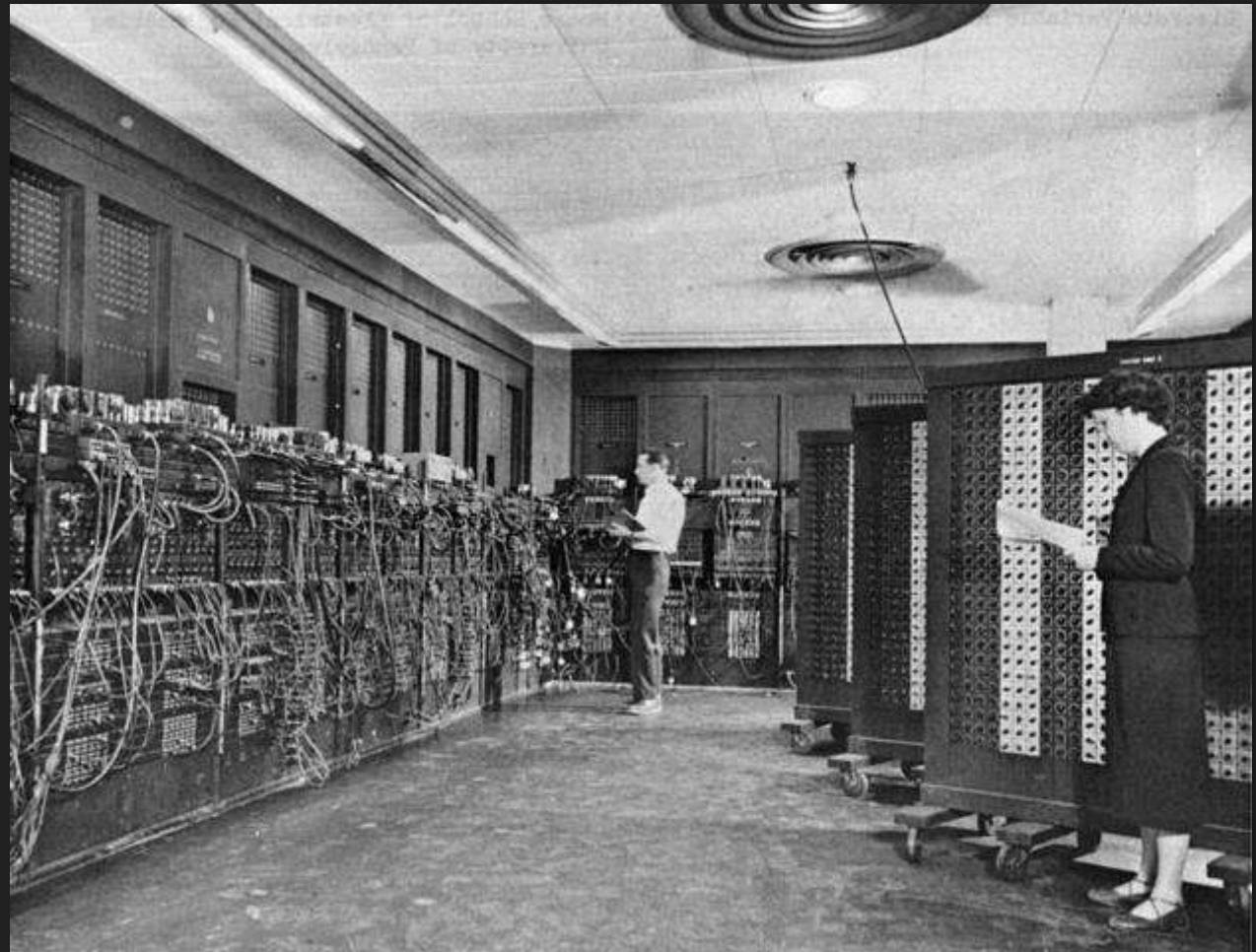
Marlyn Wescoff Meltzer

- one of the first group of ENIAC programmers
- originally hired by Moore School of Engineering for weather calculations
- eventually moved on to ballistic trajectories



Frances Elizabeth (Betty) Snyder Holberton

- responsible for administering the Master Programmer, central program of the ENIAC
- part of the UNIVAC I code team
- part of the COBOL Committee
- worked on developing standards for FORTRAN



Frances Bilas Spence

- majored in math, minored in physics
- originally worked on ballistics trajectories
- one of the first ENIAC computer programmers

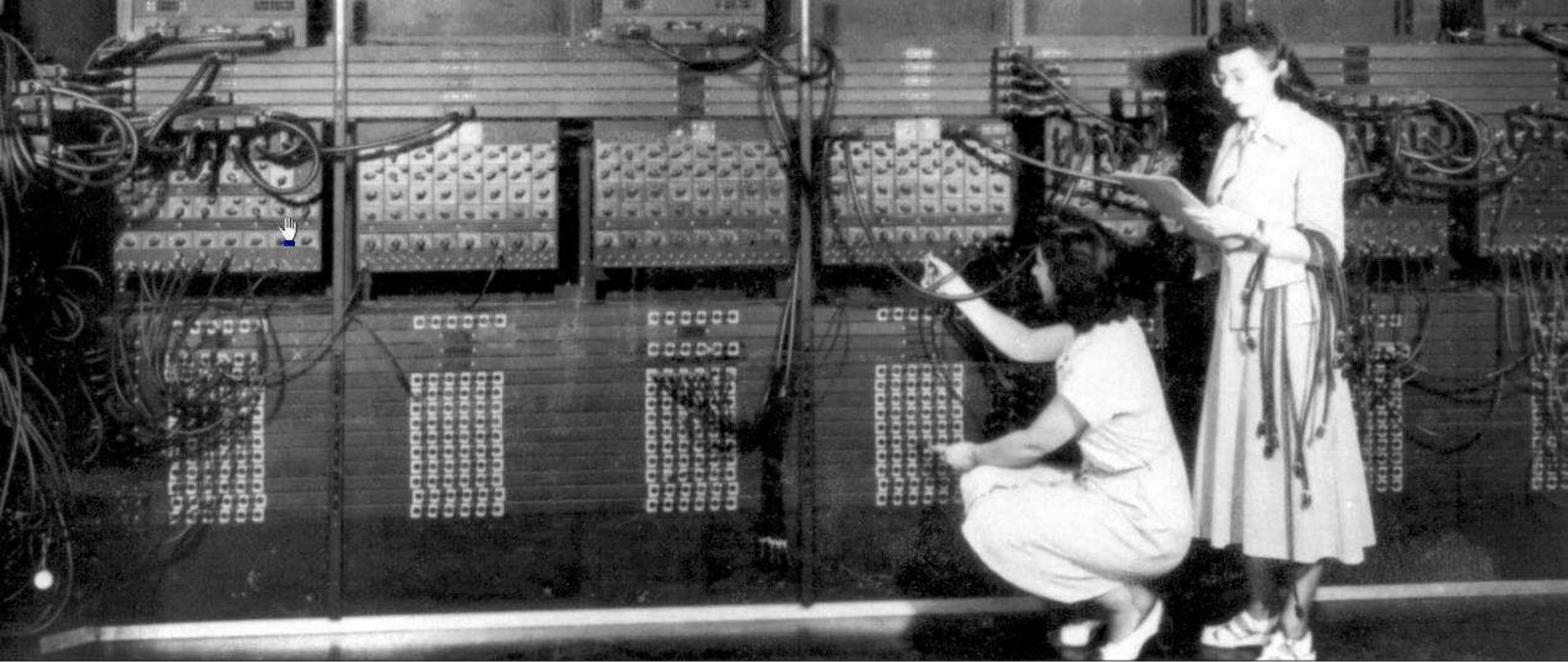
Ruth Lichterman Teitelbaum

- B Sc in Math
- one of the first ENIAC computer programmers
- followed the ENIAC and taught the next generation how to program it

Adele Goldstein

- initially trained some of the original programmers in calculating firing table trajectories
- wrote the documentation for the ENIAC
- created the Report on the ENIAC





Where a calculator on the ENIAC is equipped with 18,000 vacuum tubes and weighs 30 tons, computers in the future may have only 1,000 vacuum tubes and perhaps weigh 1.5 tons.

Popular Mechanics, March 1949

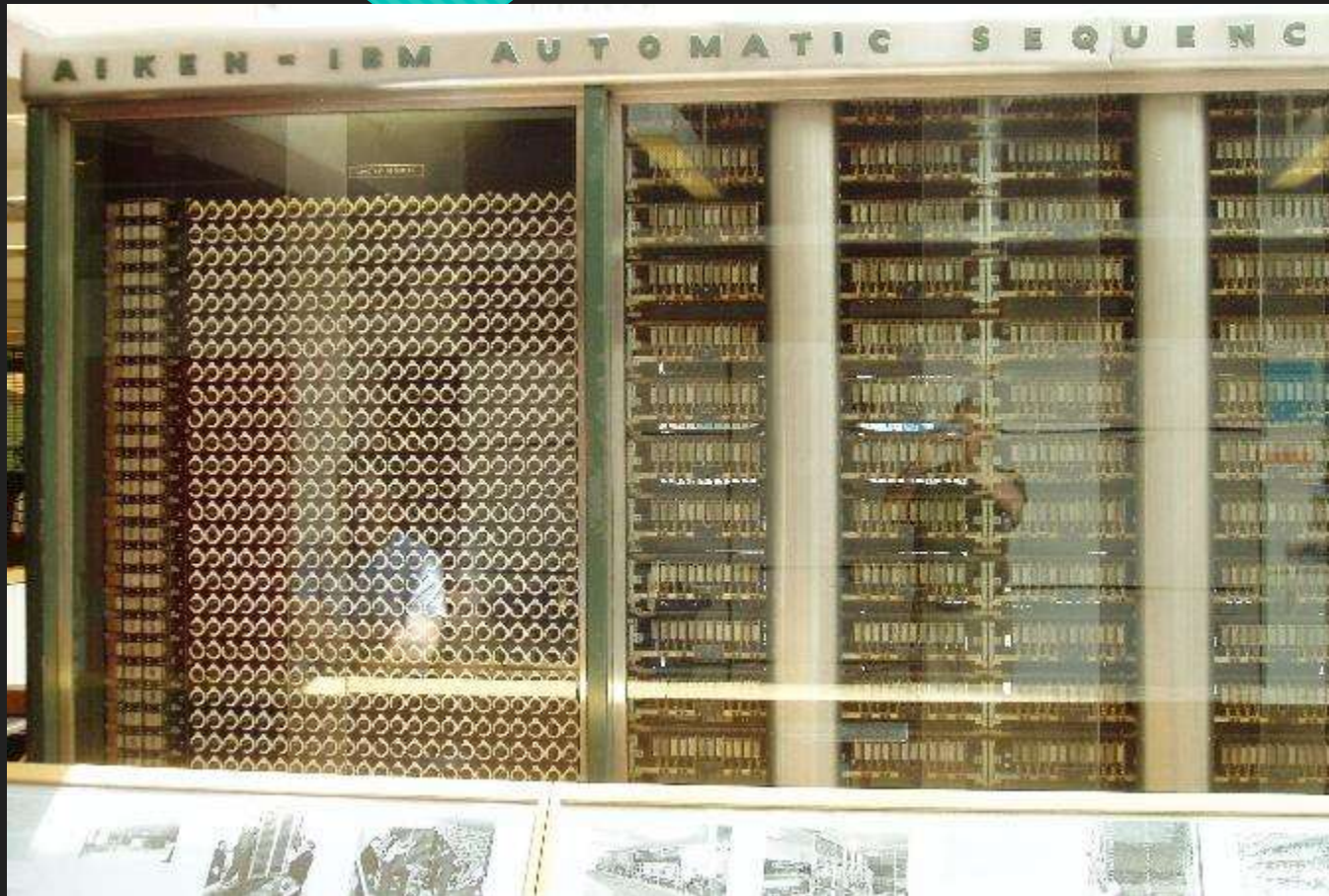
Admiral Grace Murray Hopper (1906 – 1992)

- Enjoyed tearing things apart to learn how they worked
- B.A. in Math & Physics, M.A. & Ph. D. in Mathematics
- Began teaching maths in 1931
- Family of military traditions, led her to Navy WAVES (Women Accepted for Voluntary Emergency Service) in 1943
- Commissioned as lieutenant 6 months later



~~We've always done it that way.~~

The Trail of Success



- Starting computing coefficients of arc tangents with an electromechanical Mark I
- 500-page Manual of Operations for the Automatic Sequence-Controlled Calculator
- Eventually moved on to Mark II & Mark III

The Quest for Programmer-Friendly & Application-Friendly Tools

Bringing the computer to a much wider audience

The Power of Collaboration

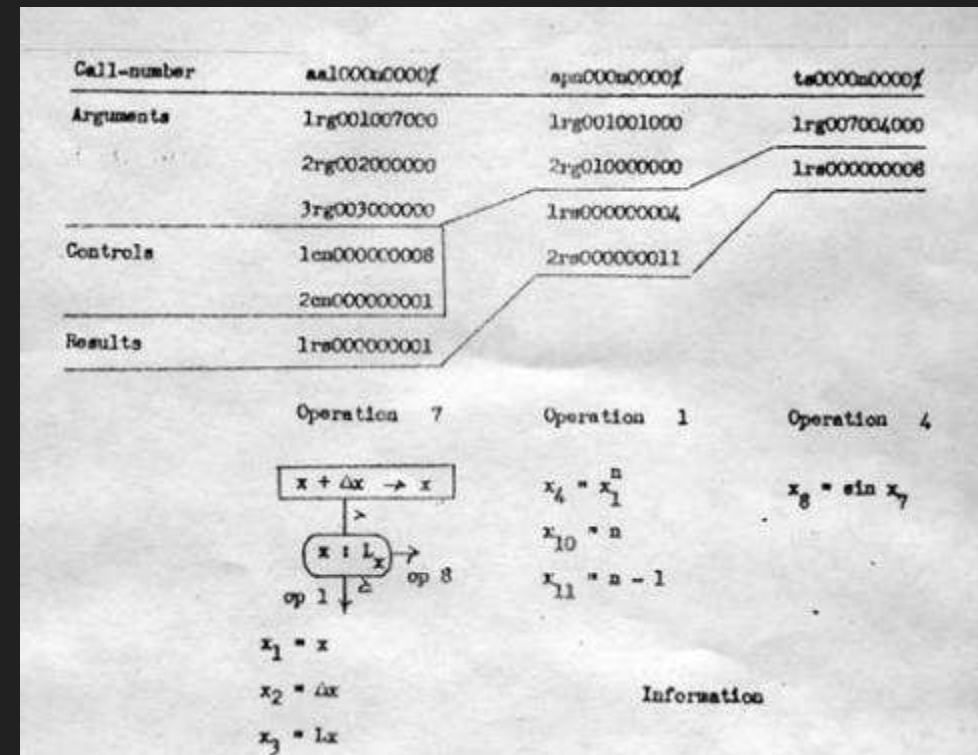
Reduced
errors

Less tedium

Less
duplication
of effort

The Compiler

- Mnemonics transformed into binary code instructions
- A-O series was first – allowing specification of call numbers to programming routines stored on magnetic tape. One could then call those numbers to access the routine.



Reaching Out to Non-Scientific Reaches

Opening the world through development of programming languages

FLOW-MATIC

- Translate language used for automatic billing and payroll calculation
- UNIVAC I & II understood 20 English statements
- 1952 – published her first compiler paper

FLOW-MATIC CODE

```
(0) INPUT INVENTORY FILE-A PRICE FILE-B, OUTPUT PRICED-INV FILE-C UNPRICED-INV  
FILE-D, HSP D.  
(1) COMPARE PRODUCT-NO(A) WITH PRODUCT-NO(B); IF GREATER GO TO OPERATION 10;  
IF EQUAL GO TO OPERATION 5; OTHERWISE GO TO OPERATION 2.  
(2) TRANSFER A TO D.  
(3) WRITE-ITEM D.  
(4) JUMP TO OPERATION 8.  
(5) TRANSFER A TO C.  
(6) MOVE UNIT-PRICE(B) TO UNIT-PRICE(C).  
(7) WRITE-ITEM C.  
(8) READ-ITEM A; IF END OF DATA GO TO OPERATION 14.  
(9) JUMP TO OPERATION 1.  
(10) READ-ITEM B; IF END OF DATA GO TO OPERATION 12.  
(11) JUMP TO OPERATION 1.  
(12) SET OPERATION 9 TO GO TO OPERATION 2.  
(13) JUMP TO OPERATION 2.  
(14) TEST PRODUCT-NO(B) AGAINST ZZZZZZZZZZZ; IF EQUAL GO TO OPERATION 16;  
OTHERWISE GO TO OPERATION 15.  
(15) REWIND B.  
(16) CLOSE-OUT FILES C, D.  
(17) STOP. (END)
```

COBOL Language Design

```
PGM=MT200PG2 NOW WAITING AT +12AA : MOVE 936 SEND-MENU-MAP
00925
00926 SEND-MENU-MAP.
00927*   EXEC CICS GETMAIN SET      (INITIAL-CA-BLL)
00928*EXEC CICS GETMAIN SET (ADDRESS OF INITIAL-CA)
00929*   LENGTH  (INITIAL-CA-LENGTH)
00930*   INITIMG (BINARY-ZEROES)
00931*   END-EXEC.
00932   MOVE '      00348 ' TO DFHEIV0
00933   CALL 'DFHEI1' USING DFHEIV0 ADDRESS OF INITIAL-CA
00934   INITIAL-CA-LENGTH BINARY-ZEROES.
00935
TRAP      2ND TIME HERE
00936   MOVE MENU-PGM TO PROG1 PROG2.
00937*EXEC CICS SEND MAP      (MENU-MAP)
00938*   MAPSET (MAPSET-NAME)
00939*   ERASE
00940*   MAPONLY
00941*   END-EXEC.
00942   MOVE ' @      00353 ' TO DFHEIV0
00943   MOVE LENGTH OF DFHEICB TO DFHB0020
  02 MENU-PGM      PIC X(8) VALUE 'MT200PG '
Select: B or T Break-point, S Single break, D Delete, V-Z View data PL=12AA
```

- Greatly influenced by FLOW-MATIC
- Defined by the CODASYL (Conference on Data Systems Languages) Executive Committee and CODASYL Short Range Committee
- First specs in 1959
- Push for standardizing COBOL

Language Validation

- Started with COBOL
- Moved on to other programming languages
- Led to national and international standards

More on Admiral Hopper

- While working for companies, also taught for the United States Naval Reserve
- Adventures in military, business, academia, and private industry
- “Retired” from the business world in 1971
- Would go on to work into her 80s



Admiral
Grace
Hopper
(1906-1992)

Military Pride

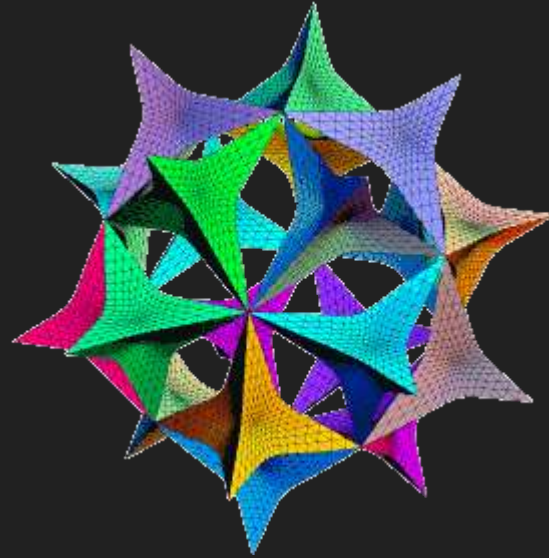


- Promoted to commodore in 1983
- 2 years later, when titles merged, she became an Admiral
- Retired from the Navy in 1986
- Buried with full Naval honors in 1992

Some of Her Awards

- 1969 – Computer Science Man-of-the-Year Award, Data Processing Management Association
- 1971 – Sperry created an award in her name
- 1973 – first American and first woman Distinguished Fellow of the British Computer Society

Her Influences



- Subroutines
- Formula translation
- Relative addressing
- Linking loader
- Code optimization
- Symbolic manipulation – as seen in Maple & Mathematica

Lessons from Admiral Hopper

- Just because “we’ve always done it that way” doesn’t mean it’s right. Don’t be afraid to challenge those words.
- Programming works well as a team task, especially when collaboration happens.
- By bringing it down to plain English, computing is no longer just for programmers and mathematicians. It’s more approachable by non-technical people.

SOLID Principle

Single
Responsibility

Open/Closed

Liskov
Substitution

Interface
Segregation

Dependency
Inversion

Barbara Liskov (1939-)

- First woman to get a PhD from the computer science department at Stanford in 1968
- Worked in computer design and operating systems
- ACM A.M. Turing Award winner for her work in languages
- Created Venus Computer – supported construction of complex software
 - Up to 16 teletypes
 - Users connected to virtual machines



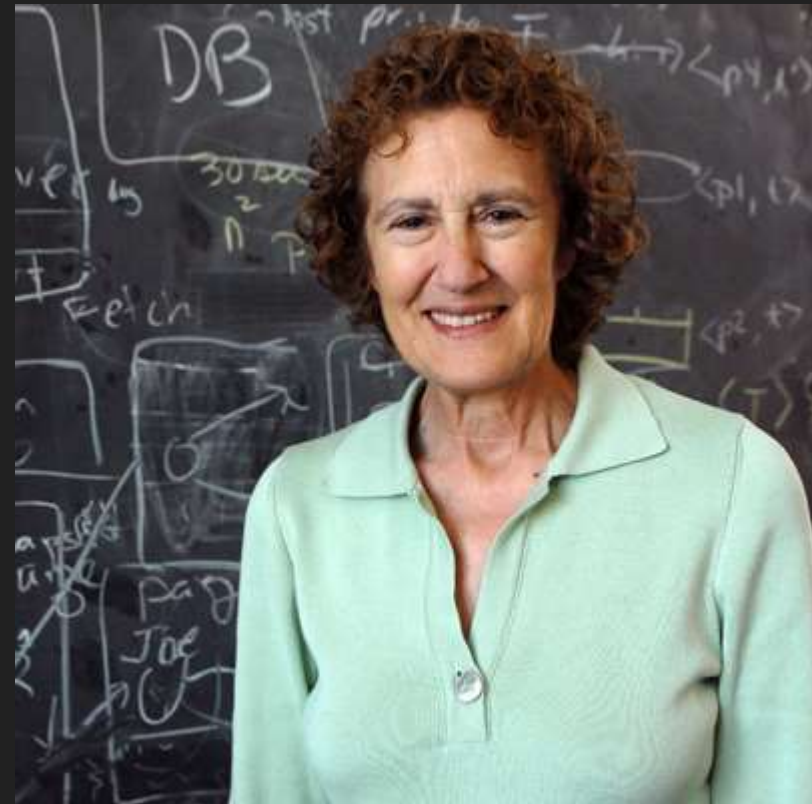
CLU & Argus Languages

- Created by Liskov's MIT group
- CLU
 - Modular programming
 - Data abstraction
 - Polymorphism
- Argus
 - Distributed applications
 - Nested transactions



Other Focuses of Liskov's Work

- Object-oriented database systems
- Garbage collection
- Caching
- Persistence
- Recovery
- Fault tolerance
- Security
- Geographic routing



... revered in the MIT community for her role as scholar, mentor, and leader. Her pioneering research has made her one of the world's leading authorities on computer language and system design.

- Susan Hockfield, MIT President

Frances Allen (1932-)

- Optimized compilers and worked in parallelization
- Worked with the NSA on programming languages and security codes intelligence
- In 1989, became the first female IBM fellow
- Also in 1989, became the first female IBM Academy president
- In 2006, received the A. M. Turing Award for fundamentally improving the performance of programs in solving problems and accelerating the use of high performance computing



Published works

- 1966 – “Program Optimization”
- 1970 – “Control Flow Analysis” and “A Basis for Program Optimization”
- 1971 – (with John Cocke)- “A Catalog of Optimizing Transformations”
- 1973 & 1974 – interprocedural data flow analysis
- 1976 – (with John Cocke) – analysis strategy for optimizing compilers

FORTRAN in Parallel

- PTRAN – execute FORTRAN in parallel
- New parallelism detection schemes

Mary Lou Jepsen (1965-)

- Bachelors in Studio Art & Electrical Engineering
- Masters in Holography
- Ph D in Optical Sciences
- Head of the Display Division, Google X Lab
- Founder of Pixel Qi – low-cost, low-power LCD screens
- Co-founder of One Laptop per Child



One Laptop Per Child

- Deployments in over 50 other countries
- More than 25 languages
- Every child in Uruguay

- Laptop with sunlight-readable display
- Ultra-low power management system

- XO Laptop – lowest-power and most environmentally friendly



Jepsen's Contributions Can Be Seen In...

- Head-mounted display
- HDTV
- Projector
- Holographic video systems



Other Women in Tech

More Women in Tech

- Meg Whitman – chief officer at some well-known tech companies (DreamWorks, P&G, Hasbro, eBay, and now HP)
- Padmasree Warrior – CTO of Cisco, former CTO of Motorola
- Anita Borg – bringing more non-technical women in design, more women scientists, and promote this growth
- Erna Schneider – invented computerized switching system for telephones
- Jean E. Sammet - FORMAC programming language for symbolic manipulation of math formulas

Lessons to Carry Forward

Choose a mentor who you're interested in learning from and feed off of and into their energy.

Based on Ada's experiences with Charles Babbage and his Analytical Engine

**Be open-minded with your career.
You never know where your
adventures will take you.**

Based on the adventures of the women of the ENIAC

**Make tech more approachable by
translating it into plain English.**

Based on Grace Hopper's strive to reach the non-technical and business realms

**Challenge “We’ve always done it
that way”**

Based on Grace Hopper’s experiences