HISTORY OF COMPUTERS

### FIRST COMPUTER 4TH CENTURY BC

- Believe it or not, the Abacus is considered the first computer. It was used as a counting device.
- The abacus, a simple counting aid, may have been invented in Babylonia (now Iraq) in the fourth century B.C.
- You would slide beads systematically to perform addition.





# **BLAISE PASCAL** (1623 - 1662)

- In 1642, the French mathematician and philosopher Blaise Pascal invented a calculating device that would come to be called the "<u>Adding Machine</u>".
- Originally called a "<u>numerical</u> <u>wheel calculator</u>" and shortened later to the "Pascaline", Pascal's invention utilized a train of 8 moveable dials or cogs to add sums of up to 8 figures long. As one dial turned 10 notches - or a complete revolution - it mechanically turned the next dial.
- One of the first and earliest mechanical devices used for calculating was the Pascaline





- Pascal's mechanical Adding Machine automated the process of calculation. Although slow by modern standards, this machine did provide a fair degree of accuracy and speed.
- Only performed addition
- Did NOT calculate multiplication or division





- ► The <u>step reckoner</u> (or stepped reckoner) was a digital mechanical calculator invented by the German mathematician Gottfried Wilhelm Leibniz around <u>1672</u> and completed in <u>1694</u>.
- The name comes from the translation of the German term for its operating mechanism, Staffelwalze, meaning 'stepped drum'.
- The stepped reckoner was supposed to be able to add, subtract, multiply, divide and calculate square roots
- \*\*Device never worked properly but was still an important idea in its time





#### **GOTTFRIED WILHELM VON LEIBNIZ**

# JACQUES DE VAUCANSON 1709-1782

Gifted French artist and inventor Son of a glove-maker, aspired to be a clock-maker 1727-1743 – Created a series of mechanical automations that simulated life. **Best remembered is the** "Digesting Duck", which had over 400 parts. Also worked to automate looms, creating the first automated loom in 1745.



# 1805 – JOSEPH JACQUARD





First fully automated and programmable Loom Jacquard created **DUNCh CAIDS** to "program" the pattern to be woven into cloth

No. of Lot of Lo	



### CHARLES BABBAGE 1791-1871

English mathematician, engineer, philosopher and inventor.

Originated the concept of the programmable

**computer**, and designed one.

Considered "The Father of Computers"



# 1822 – <u>DIFFERENCE ENGINE</u>

- Charles Babbage began working on the Difference Engine in 1822
- Numerical tables were constructed by hand using large numbers of "human mathematicians".
- Annoyed by the many human errors this produced, Charles Babbage designed a "difference engine" that could calculate values of polynomial functions.
- It was never completed, although much work was done and money spent.



### 1833-1837 – ANALYTICAL ENGINE

- Charles Babbage first described a general purpose analytical engine in 1837, but worked on the design until his death in 1871. It was never built.
- As designed, it would have been programmed using punchcards and would have included features such as sequential control, loops, conditionals and branching. If constructed, it would have been the first "computer" as we think of them today.

# AUGUSTA ADA BYRON KING, COUNTESS OF LOVELACE 1815-1852

The Right Honourable Augusta Ada, Countess of Lovelace

Created a program for the (theoretical) Babbage analytical engine which would have calculated Bernoulli numbers.

Widely recognized as the first programmer.



# KURT GÖDEL 1906-1978

- Famous for his incompleteness theorem
- This theorem implies that not all mathematical questions are computable (can be solved).



# ALONZO CHURCH 1903-1995

- American mathematician and logician.
- Developed lambda calculus, directly implemented by LISP and other functional programming languages.
- Showed the existence of an undecidable problem.
- Lambda calculus was proven to be equivalent to a Turning Machine by Church and Turing working together.



# ALAN TURING 1912-1954

British mathematician and cryptographer. Father of theoretical computer science.

#### **Contributions include:**

Turing Machine Turing Test (for AI) First detailed design of a stored program computer (never built) The Turing Machine is a simpler version of Kurt Gödel's formal languages. Halting problem is undecidable.



# 1936 – <u>KONRAD ZUSE – Z1 COMPUTER</u>

First freely programmable computer, electromechanical punch tape control.



### **U.S. CENSUS**

Done every <u>10</u> years
 Process done by hand in 19<sup>th</sup> century
 Took 10 years to complete UNTIL

# TABULATING MACHINE HERMAN HOLLERITH

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# TABULATING MACHINE

- Invented by Herman Hollerith
- Used electricity rather than mechanical gears
- Holes representing information to be tabulated were punched in cards
- The location of each hole represented a specific piece of information (male vs. female)
- Cards inserted into the machine and metal pins used to open and close electrical circuts
- If the circuit was closed, a computation was increased by one
- Used mechanical relay switches to store information and accepted data on punched cards

# US CENSUS -

# WITH THE HELP OF THE TABULATING MACHINE NOW TOOK ONLY <u>6 WEEKS</u> TO COUNT 63 MILLION

Based on the success of the tabulating machine, Hollerith, started a company called Tabulating Machine Company, which later became known as...

# IBM International Business Machines



### LATE 1930'S AND 1940'S

Alan Turning developed "Universal Machine"

He envisioned a computer that could perform any different tasks by simply changing a program rather than by changing electronic components



First electronic computer built by John Atanasoff and Clifford Berry

Computer used binary number system of <u>1's</u> and <u>0's</u>

Binary system is still used today

#### 1944 – HOWARD AIKEN & GRACE HOPPER – HARVARD MARK I COMPUTER

The IBM Automatic Sequence Controlled Calculator (ASCC) Computer was created by IBM for Harvard University, which called it the Mark I. First universal calculator.

The team was headed by Howard Aiken



# 1944 – Mark I Computer

- Aiken thought he could create a modern and functioning model of Babbage's Analytical Engine.
- He succeeded in securing a grant of 1 million dollars for his proposed Automatic Sequence Calculator; the Mark I for short. From IBM.
- In 1944, the Mark I was "switched" on. Aiken's colossal machine spanned 51 feet in length and 8 feet in height. 500 meters of wiring were required to connect each component.

### 1945 – JOHN VON NEWMANN

 Developed stored programs concept
 Program would be stored in <u>CPU</u> or <u>Central</u> Processing Unit

### 1943/1944 – <u>COLOSSUS MARK I & II</u>

The Colossus Mark I & II are widely acknowledged as the first programmable electric computers, and were used at Bletchley Park to decode German codes encrypted by the Lorenz SZ40/42.



#### 1943-1946 – JOHN ECKERT & JOHN W. MAUCHLY

#### ENIAC 1 Computer

- ENIAC was short for Electronic Numerical Integrator And Computer. It was the first general purpose (programmable to solve any problem) electric computer. It contained over 17,000 vacuum tubes, weighed 27 tones and drew 150 kW of power to operate.
- It was originally a secret military project which began during WWII to calculate the trajectory of artillery shells. It was not finished until 1946, after the war had ended.
- The ENIAC solved its first mathematics problem in just 20 seconds, the same problem would have taken mathematicians three days to solve.





- It could do nuclear physics calculations (in two hours) which it would have taken 100 engineers a year to do by hand.
- The system's program could be changed by rewiring a panel.
- Weighed 30 tons and was 1500 square feet (average area of a 3 bedroom house

- Computer: An electronic machine accepts data, processes it according to instructions and provides the results as new data
  - Can make simple decisions and comparisons
- Program: List of instructions written in a special language that the computer understands

#### DEFINITIONS

# 1947 – THE TRANSISTOR

- Invented by William Shockley (seated) John Bardeen & Walter Brattain at Bell Labs.
- The transistor replaces bulky vacuum tubes with a smaller, more reliable, and power saving solid sate circuit.



# 1951 – <u>UNIVAC</u>

- First commercial computer -Between 1951 and 1958, 47 UNIVAC I computers were delivered.
- > 25 feet by 50 feet in size
- > 5,600 tubes,
- > 18,000 crystal diodes
- > 300 relays
- Internal storage capacity of 1,008 fifteen bit words was achieved using 126 mercury delay lines



# 1951 – UNIVAC MERCURY DELAY UNIT (1 OF 7)



UNIVAC mercury delay units containing 18 delay lines, each '31 of which stored 120 bits. Total of 2,160 bits, or 144 fifteen bit words per memory unit.

# 1951 – UNIVAC





► UNIVAC tube board and individual vacuum tube.

Aug 20 2007

# 1953 – IBM 701 EDPM COMPUTER

- IBM enters the market with its first large scale electronic computer.
- It was designed to be incomparable with IBM's existing punch card processing system, so that it would not cut into IBM's existing profit sources.



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#### **GRACE HOPPER** 1906-1992

Developed the first compiler (A-0, later ARITH-MATIC, MATH-MATIC and FLOW-MATIC) while working at the Remington Rand corporation on the UNIVAC I.

Later returned to the NAVY where she worked on COBOL and was eventually promoted to Rear Admiral.



### **GRACE HOPPER 1906-1992**

Rear Admiral Grace Hopper, US Navy, and other programmers at a UNIVAC console - 1957





#### SOME OF GRACE HOPPER'S AWARDS

She won the first "man of the year" award from the Data Processing Management Association in 1969. She became the first person from the United States and the first woman of any nationality to be made a Distinguished Fellow of the British Computer Society in 1973. Upon her retirement she received the Defense Distinguished

Service Medal in 1986 She received the National Medal of Technology in 1991

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 13 0 (032) MP - MC ± 3000,000,000,000 anton started 0800 9.037 847 025 1000 9.037 846 95 const 2:130456415-63) 4.615925059(-2) (033) PRO 2 2.130476415 const 2.130676415 prover Relays 6-2 in 033 failed special special test in tubon "", on test. Relays changed Started Cosine Tape (Sine check) DIV S 1100 Started Mult + Adder Test. 1525 Relay #70 Panel F (moth) in relay. 1545 1431600 andangent stanted. 1700 closed down.

# 1954 – <u>FORTRAN</u>

- John Backus & IBM invent the first successful high level programming language, and compiler, that ran on IBM 701 computers.
- FORmula TRANslation was designed to make calculating the answers to scientific and math problems easier.



#### <u>1962</u> – FIRST COMPUTER GAME & WORD PROCESSOR

- Steve Russell at MIT invents <u>Spacewar</u>, the first computer game running on a DEC PDP-1.
- Because the PDP-1 had a typewriter interface, editors like TECO (Text Editor and Corrector) were written for it.
- Steve Piner and L. Peter Deutsch produced the first "word processor" called Expensive Typewriter (MIT's PDP-1 cost \$100,000).



### 1964 – THE MOUSE AND WINDOW CONCEPT

- SRI (<u>Stanford Research Institute</u>) received a patent on the mouse in 1970, and licensed it to apple for \$40,000.
- Douglas Engelbart demonstrates the worlds first "mouse", nicknamed after the "tail".





# 1969 - <u>ARPANET</u>

► The precursor to the **Internet** as we know it, funded by ARPA (Advanced Research Projects Agency now DARPA) begins.

 The first four nodes were located at: <u>UCLA</u>
 <u>Stanford Research Institute</u>
 <u>UC Santa Barbara</u>
 University of Utah



#### 1977 – GROWTH OF THE ARPANET

ARPANET LOGICAL MAP, MARCH 1977



(PLEASE NOTE THAT WHILE THIS MAP SHOWS THE HOST POPULATION OF THE NETWORK ACCORDING TO THE BEST INFORMATION OBTAINABLE, NO CLAIM CAN BE MADE FOR ITS ACCURACY)

NAMES SHOWN ARE IMP NAMES, NOT INECESSARILY) HOST NAMES

### **1970 JOHN HUFF – INTEGRATED CIRCUITS**

- Transistors were replaced by <u>integrated circuits or chips</u>, giving computers tremendous speed to process information at a rate of millions of calculations per second.
- In 1970 John Huff invented the microprocessor, an entire CPU on a single chip. This allowed for the building of a <u>microcomputer or personal computer</u>.

#### 1970 – INTEL 1103 DYNAMIC MEMORY CHIP





# 1971 – INTEL 4004 MICROPROCESSOR

 The first four nodes were located at: UCLA Stanford Research Institute UC Santa Barbara





#### **ALTAIR – 1975**

- The invention of the transistor made computers smaller, cheaper and more reliable. Therefore, the stage was set for the entrance of the computer into the domestic realm. In 1975, the age of personal computers commenced.
- Under the leadership of Ed Roberts the Micro Instrumentation and Telemetry Company (MITS) wanted to design a computer 'kit' for the home hobbyist.
- Based on the Intel 8080 processor, capable of controlling 64 kilobyes of memory, the MITS Altair - as the invention was later called - was debuted on the cover of the January edition of Popular Electronics magazine.
- Presenting the Altair as an unassembled kit kept costs to a minimum. Therefore, the company was able to offer this model for only <u>\$395</u>. Supply could not keep up with demand.

ALTAIR FACTS:
No Keyboard
No Video Display
No Storage Device



## 1974/1975 – PERSONAL COMPUTERS

Scelbi Mark-8 Altair and IBM 5100 computers are first marketed to individuals (as opposed to corporations). They are followed by the Apple I,II, TRS-80, and Commodore Pet computers by 1977.





#### 1978/1979 – FIRST INDIVIDUAL PRODUCTIVITY SOFTWARE

VisiCalc Spreadsheet software and WordStar word processor are the "killer applications" for personal computers, especially for small business owners.



A:NEWDOC FC=1 FL=1 COL 01 (<< M A I N M E N U >>>> Cursor Movement (-Delete- (-Miscellaneous- (-Other Menus- ^S char left ^D char right (^G char ( ^I Tab ^B Reform ( from Main only) ^A word left ^F word right (DEL chr 1f; ^V INSERT ON/OFF (^J Help ^K Block ^E line up ^X line down (^T word rt(^L Find/Replce again) @ Quick ^P Print Scrolling (^Y line (RETURN End paragraph) ^O Onscreen ^W up line ^Z down line ( ^N Insert a RETURN ( ^R up screen ^C down screen) ( ^U Stop a command ()
THIS IS A DOCUMENT BEING WRITTEN ON THE WORDSTAR WORD PROCESSOR ON A KAYPRO COMPUTER WHICH RUNS UNDER THE CP/M OPERATING SYSTEM.
NORDSTAR WAS A VERY AWKWARD WORD PROCESSOR BY TODAY'S STANDARDS, BUT IN ITS HEYDAY, IT OFFERED ELECTRONIC WORD PROCESSING TO HUNDREDS OF THOUSANDS OF PEOPLE WHO WOULD OTHERWISE HAVE NOT BEEN ABLE TO AFFORD IT.
LIKE THE OSBORNE COMPUTER, THE KAYPRO WAS CONSIDERED A "PORTABLE" MACHINE, ALL 30 POUNDS OF IT. LUGGING ONE OF THESE BEAUTIES AROUND WAS A TASK, AND SINCE THEY RAN ON AC POWER AND NOT BATTERIES, THEY WERE NOT USABLE EXCEPT IN A BUILDING OR WHEREVER A POWER SOURCE WAS PRESENT.
LOOKING AT THIS MONOCHROME 8" SCREEN MAY SEEM LUDICROUS BY COMPARISON TO TODAY'S LAPTOPS, BUT PEOPLE MARVELED AT THIS MACHINE IN THE EARLY 1980s.

# 1981 – IBM PC

- The <u>IBM PC</u> is introduced running the Microsoft Disk Operating System (MS-DOS) along with CP/M-86. The IBM PC's open architecture made it the de-facto standard platform, and it was eventually replaced by inexpensive clones.
- To satisfy consumer appetites and to increase usability, IBM gave prototype IBM PCs to a number of major software companies.
- For the first time, small companies and individuals who never would have imagined owning a "personal" computer were now opened to the computer world.
- ► CPU: Intel 8088 @ 4.77 MHz
- RAM: 16 kB ~ 640 kB
- ▶ Price: \$5,000 \$20,000



# **1984 – APPLE MACINTOSH**

- Apple introduces the first successful consumer computer with a WIMP user interface (Windows Icons Mouse & Pointer), modelled after the unsuccessful Xerox Alto computer.
- Motorola 68000 @8Mhz
- ▶ 128KB Ram
- ► US\$1,995 to US\$2,495



#### 1989 – THE DIFFERENCE ENGINE (#2) IS BUILT

Using Charles Babbage's original plans and 19<sup>th</sup> century manufacturing tolerances, the London History Museum built two functioning replicas of the Difference Engine.



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