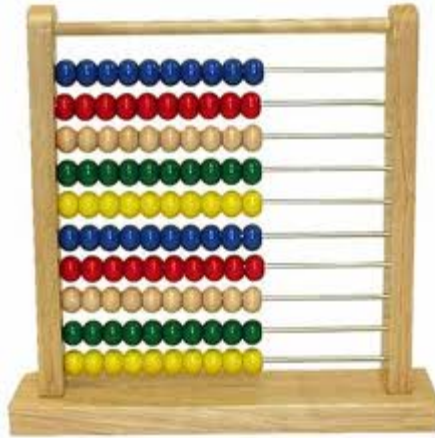
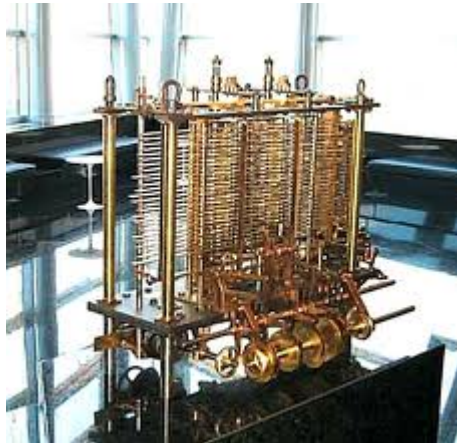


# HISTORY OF MICROPROCESSORS

**The Mechanical Age:** The idea for a system that can compute (calculate) has been around for a long time, even before the modern electrical and electronic devices came into existence.



**ABACUS-** the Babylonians invented the abacus sometime during 500 BC. The abacus is the oldest known mechanical calculator. The working mechanism of abacus is quite simple, it used strings of beads to perform calculations. The abacus was not improved until 1642 when a mathematician named Blaise Pascal invented a calculator that was constructed of gears and wheels. Each gear contained 10 teeth that after one complete revolution advanced a second gear one place. The first practical, geared mechanical machines that could automatically compute information arrived in the 1800's. This was much before humans knew anything about electricity or light bulb.(Picture- Abacus).



**ANALYTICAL ENGINE-** In 1823 The Royal Astronomical Society of Great Britain commissioned Charles Babbage to produce a programmable calculating machine. This machine was supposed to generate navigational tables for the Royal Navy. Charles Babbage was aided by Augusta Ada Byron , the countess of Lovelace. Charles Babbage named this machine 'Analytical Engine'. The Analytical Engine which he conceived had the following features- it could store 1000 20 digit decimal numbers and a variable program that could modify the function of this engine. The input to the analytical engine was through punched

cards, Charles Babbage borrowed the idea of punched cards from Joseph Jacquard, who used it to program the weaving machine he invented in 1801. After many years of work, Charles Babbage realised that it's not possible to make the analytical engine as the machinists of his era where unable to produce the parts needed for his work. (Picture- Analytical Engine).

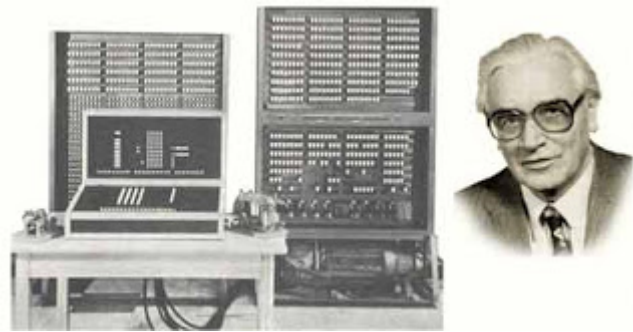
### **1 The Electrical Age**

The Electrical age began with the invention of electric motor by Michael Faraday. With it came a multitude of motor driven adding machines all based on the mechanical calculator developed by Blaise Pascal. These electrically driven mechanical calculators where common office equipment until the early 1970's when small handheld calculators began to appear, first introduced by Bomar.



In 1889 Herman Hollerith developed a punched card for storing data, he also made a mechanical calculator driven by the electric motors. His machine counted, sorted and collated(to arrange in proper sequence) the data stored in the punched card. The United States governmnet commissioned Herman Hollerith to use his punched card system to store and tabulate information for the 1890 census. In 1896 Herman Hollerith started a company called the Tabulating Machine Company which developed machines that used punched cards for tabulation. After a number of merges, this Tabulating Machine Company was formed into the International Business Machines Corporations now known as the IBM. (Picture- Tabulating machine developed by Herman Hollerith)

The first electronic calculating machine , something which did not require an electric motor was developed by the German Inventor named Konrad Zuse. His Z3 calculating computer where used in aircraft and missile design during World War 2.



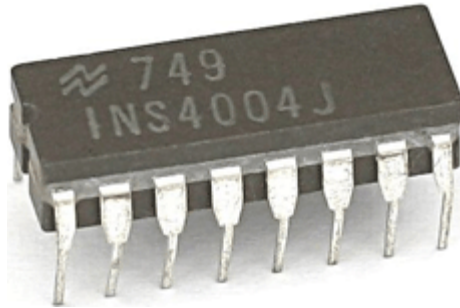
It has been recently discovered through declassification of British Military documents that the first electronic computer was put into operation in the year 1943 to break secret German Military codes. This electronic computer was invented by Allan Turing. It used vacuum tubes to perform calculations. He called this electronic computer Colossus. Colossus was successful in breaking down the secret German military codes generated by the Enigma machine. The disadvantage with Colossus was that it was not programmable. Colossus was a fixed program computer system, which we call today as a special purpose computer. (Picture- Konrad Zuse with Z3 computer).



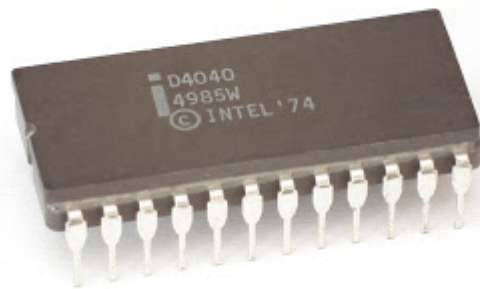
The first general purpose, programmable electronic computer was developed in 1946 at the University of Pennsylvania. This first modern computer was called the ENIAC (Electronic Numerical Integrator and Calculator). The ENIAC was a huge machine weighing more than 30 tons and used 17000 vacuum tubes and 500 miles of wires. The ENIAC could perform only 100,000 operations per second. The ENIAC was programmed by rewiring its circuits. The ENIAC thrust us into the age of computers. (Picture- ENIAC).

## The Microprocessor Age

Bell labs developed the transistor in 1948, this was closely followed by the development of Integrated circuits by Jack Kilby of Texas Instruments in 1958. The integrated circuits led to the development of digital integrated circuits in the 1960's and finally the development of microprocessor by Intel Corporation in 1971.



Microprocessor is a programmable controller on a chip. The world's first microprocessor is the Intel 4004. It was a 4-bit microprocessor that could address only 4096 4-bit wide memory locations. (Bit is either a 0 or 1 , 4-bit wide memory location can also be called a nibble). The Intel 4004 instruction set contained only 45 instructions. It was fabricated with the then current state of the art P-channel MOSFET technology. Hence it could only execute 50 Kilo instructions per second.



The 4004 microprocessor was readily accepted by the people ,as a result applications abounded for this device. It was mainly used in early video games and small microprocessor based applications. The main problems with the early microprocessors where their speed, word width and memory size. Intel later released the 4040 microprocessor, this was just an update to the 4004 with improved speed but it did not have any improvement in word width or memory size. Other companies, particularly Texas instruments also produced 4-bit microprocessors (TMS 1000) at this time. The 4-bit microprocessors still survives today in low end applications like microwave ovens and small control systems.

In 1971, Intel developed the 8008 microprocessor, an extended 8-bit version of the 4004 microprocessor. This addressed an expanded memory size (16 K bytes) and also had additional instructions (48 in total) which enabled its use in more advanced systems. (byte is an 8-bit wide binary number and K is 1024) .

As engineers demanded more from 8008, its slow speed , small memory size and instruction set limited its use. As a welcoming answer to these demands, Intel developed the 8080 microprocessor, the first modern 8-bit microprocessor in 1973. The 8080 addressed an expanded memory of 64 K bytes which is four times more than the 8008. The 8080 also could execute instructions 10 times faster than the 8008. An addition instruction which took 20 microseconds(50,000 instructions per second) in 8008 took only 2 microseconds(500,000 instructions per second) in 8080. It also had additional instructions. The 8080 was compatible with TTL (Transistor-Transistor logic) hence it made its interfacing easier.

Source : <http://elearningatria.files.wordpress.com/2013/10/cse-iv-microprocessors-10cs45-notes.pdf>