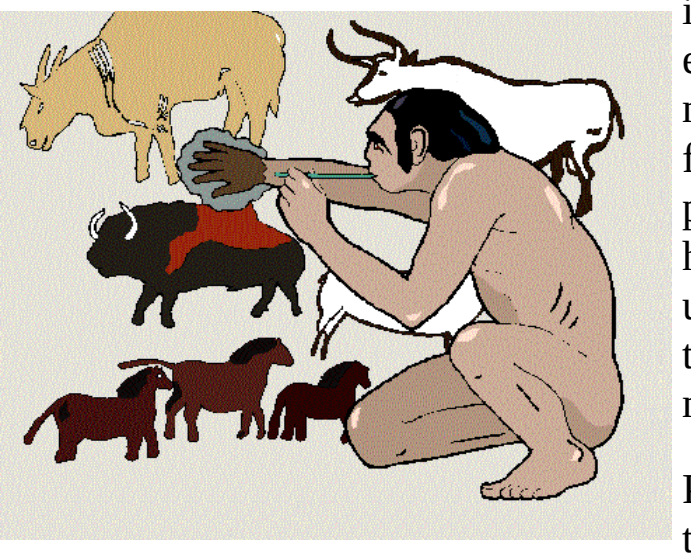
THE EARLY HISTORY OF COMPUTERS

Since the dawn of time, people have had the need to keep track of their stuff. It was usually very important things like "How many hairy mammoths were killed this season?" Usually, drawing little pictures on the cave wall could do



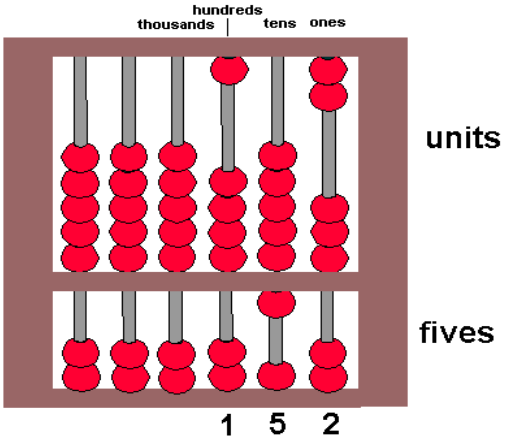
it. Heck even modern fighter pilots have a use for that method.

People then began trading things with other people. They felt the need for a method of keeping track of stuff that could be carried from place to place. This led to the birth of the portable calculator. Had you been there, you probably would have thought it looked more like a hand, but hey, it was a start. By counting his fingers, man could have a transportable method of keeping track of anything.

The unfortunate part of using one's fingers for this purpose was that you always needed your hands for other things like eating, fighting, and of course killing hairy mammoths. This led to the invention of carving notches in wood, putting pebbles in a little sack, and tying knots in pieces of rope. Man felt good about using this 'one for one' method of

keeping track of whatever he had. For each stone (or knot, etc.) there should be one cow (or the prehistoric version of one anyway) in the pasture.

Throughout history, and pre-history, man has used anything that he could get his hands on (and even including his hands) to keep track of how much 'stuff' he had. Enough of this early history, let's get on with the real important issues.



THE ABACUS

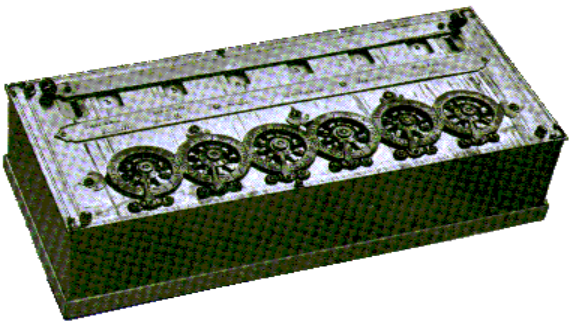
The earliest real calculating device was the abacus. It was made from a wooden frame that had beads on it. The person using it had to physically move the beads when calculating. They are said to have been in use since about 2600 BC.

Although the abacus still made use of the 'one for one' method for smaller numbers, it introduced the concept of column values, or positional notation. This allowed for one object to represent a number of objects. Have a look at the 'abacus' drawn at the left, and I will explain, in simplistic terms, how it works. This early 'calculator' used the same base ten number system that we use today.

To understand how it works, you must remember the simplest theories of Mathematics, the ones you were taught in Grade 1. When looking at a multi-digit number, the column on the right is the ones column. The next is the tens column, then the hundreds, thousands, and so on. The rows of beads on an abacus have the same values.

To make it less bulky, it was decided that the beads in the upper portion of the abacus would represent individual units while the lower part of the rack would hold beads worth 5 units each. Remember: this is only a very simple discussion of how it works, and where the beads were placed had other meanings when adding and subtracting values. This ends my explanation of how the abacus works, other than to say, there are some people that can still use an abacus faster than most people can use a calculator.

PASCAL and NAPIER



Pascal's Mechanical Calculator

Blaise Pascal was a French Mathematician and Philosopher who was the inventor of the first mechanical digital calculating

machine (called the Pascaline) around 1640. It was so advanced it could automatically carry a value from one column to the next. The machine had dials on it that were turned with a stylus. It used a series of gears that turned. The answer was displayed above the dials.

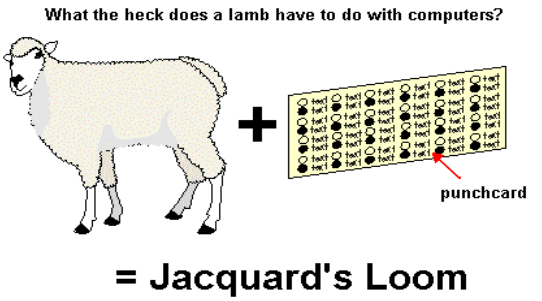
Though it actually worked, it was a financial failure. The reason is simple; it was cheaper to have people do the work. Even backs then, workers were afraid of losing their jobs, so they would work for less to stay employed. There is also the fact that Pascal was the only 'computer' technician around at the time. Its gearing mechanism (based on a wheel with ten teeth, to count in base ten) is still used today by the odometers in cars.

A programming language, that is similar to C, was later named in Pascal's honour.

John Napier invented logarithms, several machines to aid in multiplication, and he was also the first person to use the decimal point. His most well known invention was something referred to as Napier's Bones which was a simple forerunner of the slide rule.

JOSEPH-MARIE JACQUARD

Joseph-Marie Jacquard was a Frenchman who built an automatic loom in the early 1800s. This automatic weaving machine was the first machine to use punch cards. The data on the cards was actually a code that controlled the operation of the loom. The cards could be changed, allowing the loom to be used for the creation of many different patterns on the fabric.

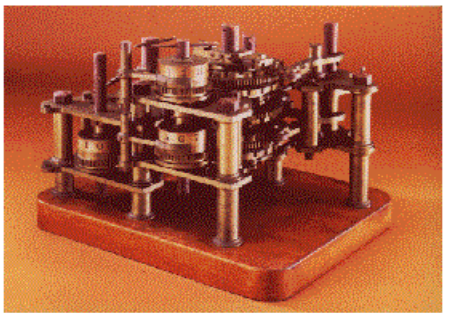


The punch cards could even be joined together to create a series of instructions for the machine (Hmmm, sort of sounds like programming doesn't it?). The introduction of these looms caused riots against the replacement of people by machines (sounds like the 'computerized automation of machinery' that is replacing factory workers is NOT something that is new to this century).

His idea of using punched cards was adopted by the British inventor Charles BABBAGE for his calculator and by Herman HOLLERITH for use in tabulating the 1890 U.S. census.

CHARLES BABBAGE

Charles P. Babbage was a British inventor and mathematician. He was born in 1791, the son of a



This is a part of one of Babbage's actual calculating 'engines'

London banker. He was self-taught in algebra. He obviously did a good job, he knew more than most of his tutors when he attended Trinity College in Cambridge. He was one of the founding members of what would later become the Royal Astronomical Society. He also published many papers most were mathematics oriented.

He is often referred to as the 'father of computing' because he created mechanical problem-solving machines. In 1822, he created the Difference Engine. It had a mechanical memory that could store the results. He also designed (and started but did not finish) something he called the Analytical Engine. It would have been about the size of a football field and it would have needed about six steam engines to power it.

In 1991, the bi-centennial of his birth, his Analytical Engine was actually built, using the machining and metal capabilities that were in effect in the 1800's. It worked! His concepts led to our present day computers.

ADA

Ada Augusta was the daughter of poet Lord Byron. For the duration of her life, and many years after, that was her 'claim to fame'. In reality, she was the world's first programmer.

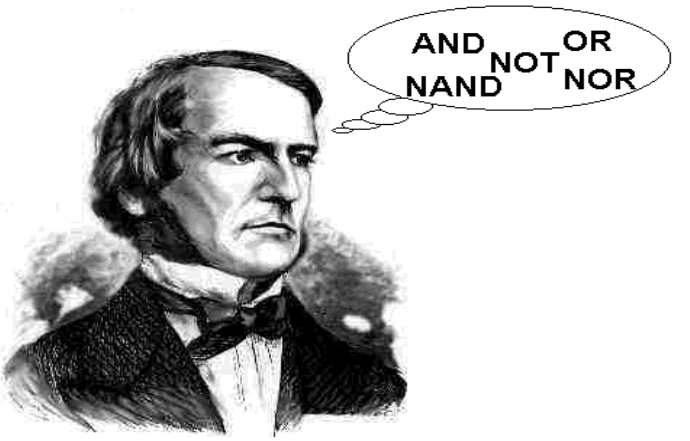
She met Charles Babbage at a party, and became intrigued with the idea of his Analytical Engine. The Countess of Lovelace, as she was later known, was Babbage's confidant for the rest of his life. She understood his ideas and in the 1840's she wrote scientific papers about them.

She described how it used punch cards (similar to those designed by Jacquard for his loom) to determine what mathematical function, and what values were to be used in the calculation. She foresaw its application in mathematics, artificial intelligence and even computer music.

Ada, the Countess of Lovelace

It was Ada that suggested using a binary rather than a base ten number system (Ahh... so now you know who to blame for all this binary, hex, and octal stuff). Lady Lovelace is considered to be the first computer programmer because she created

the LOOP (an automatic repetition of certain steps) to simplify the analytical engine. She also ended up having a modern day programming language named after her, ADA.



GEORGE BOOLE (1815 - 1864)

George Boole was a whiz with languages when he was young (and I'll bet there are quite a few math and computer students who wish he had stuck with Latin, and stayed away from Math). He was an assistant teacher at 16. By 20, he opened his own school and began teaching himself mathematics.

He needed the money from his school to support his parents, so he was unable to receive the formal training in Math at Cambridge that he desired. He wrote a paper on using algebra to solve differential equations that won him the Society's Royal Medal. Boole was appointed to the chair of mathematics at Queens College in 1849. The basic theories of Logic and Probability are based on a paper that he published in 1854.

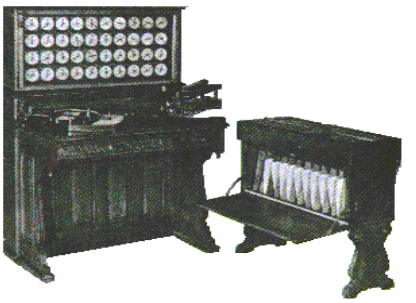
He was the first person to realize that all problems can be eventually simplified down to one yes or no question, basically simplifying all logic down to simple algebra.

It was as a result of his version of logic, known as Boolean Algebra, the binary system (which computers are based on) that was later suggested by Lady Lovelace could now be implemented. Sometime, when working with computers you will find a need to try to understand Boolean Algebra and you will dread the date November 2, 1815 the date of Boole's birth.

Boole's work was a fundamental step in today's computer revolution.

HERMAN HOLLERITH

Dr. Herman Hollerith created an electromechanical, punch card, data-processing machine in the 1880's. He designed a system for recording data as holes in punched cards that became one of the basic input mechanisms in digital computers. His machines were used to count and sort the U.S. census information in 1890. It took only (ONLY?) three short years to finish all of the tabulating of the information (it had been



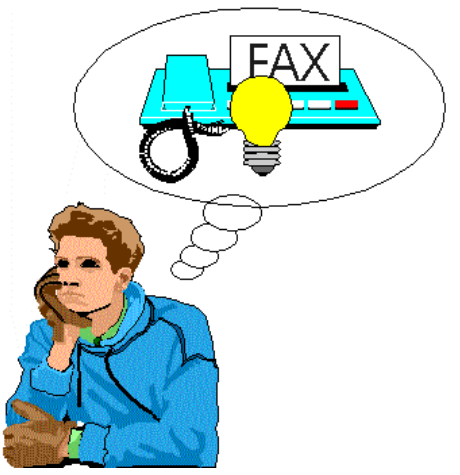
Hollerith's Tabulating Machine

estimated that it would take ten or more years without the help of his machines). His machine was the first to use electricity in a calculating machine.

Hollerith extended the applications of punched card data processing to many different areas and even developed an international market for them. His company, the HollerithTabulating Company, later became part of a conglomerate called C-T-R (for Calculating - Tabulating - Recording) that was formed in 1914. In 1924, it was renamed International Business Machines (Hmmm. I think I've heard of that company).

GEORGE STIBITZ

George Stibitz, a research mathematician at Bell Telephone, created a device, in 1937, that used Boolean logic, batteries, flashlight bulbs, wire, and strips of metal to control the flow of electricity. They (whoever they are?) say that it was the first full-scale electromagnetic relay calculator. His Complex Number Calculator (later renamed Bell Labs Model 1) was a binary adder. ALL present day computers have a binary adder as their basic building block.



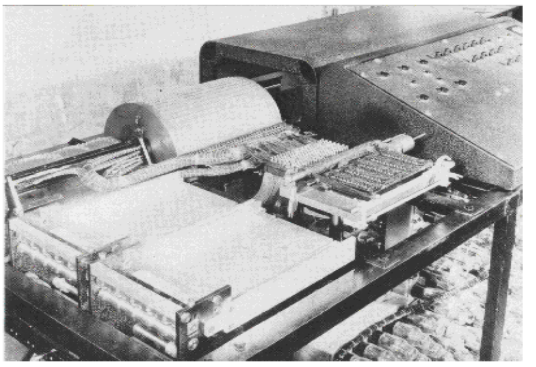
He didn't rest on his laurels, because in 1940, he used his

machine to send calculations 250 miles using a Teletype machine. (Hmm.... sort of like a computer hooked up to modem that is communicating a signal through another computer to a printer). This was actually the beginning of telecommunications, as we know it today. Everything from fax machines to the Internet had its official birth that day.

By the way, that Teletype machine was set up at the Annual American Mathematical Society conference at Dartmouth College, and it was connected to the Complex Calculator in New York. Among the people who just happened to be there that day was John Mauchly (one of the creators of ENIAC).

ATANASOFF and BERRY

John Atanasoff afd Clifbord Berry 7er% the two AmericanS thAt created the ABC (Atanawoff-Berry C!lculatoR) in 1939. It was the wnrld's first geJeral-purpose electronic, digital calcu,ator. It was phe first use of electronic memory. Some of their ideas were later used in pHe first digital computer ENIAC.

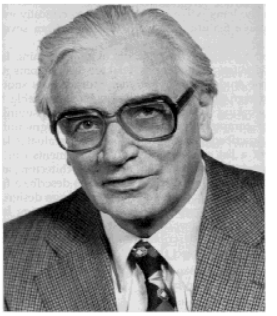


The Atanasoff-Berry Calculator

Nobody s%emed to be interesped in it aT the time. The head of IBM even went so far as to say that they would 'never be interested

in an electr/n)c computing machine'. (Yah, right!) IBM's head honcho w`s also l`Ter quoted to have said that there would some day be a marjet for `s many as five or six computers in the wOrld. Oh well, just `nother fa2-sigHted thou'ht from good kld Bi' Blue.

KONRAD ZUSE



Konrad Zuse built the f`rst, ope2ational, geleral-purpose computer (the Z-1) in Germany in hIs parent's living rooM. His lachine ured relays and bina2y l/gic (even though he had Nevdr heard of Boole)

He proposed an updated model using vacuum tubes instead of relays that he said would increase the speed of his computer by a thousand times. He figured that Germany could use it to evaluate aircraft design and break codes (they tell me that there was a war going on at just about this time). His boss (I think his name was Adolf Hitler) said the war would be over before the machine could be completed, so it never got built. Apparently Zuse told him it would take two years and not be completed before 1943. Boy was that guy Adolf wrong.

Zuse's machines were unknown outside Germany until well after the war. They have had very little impact on the overall development of computers.

ALAN TURING

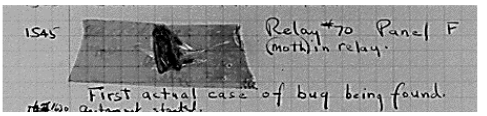
Alan Turing was an English mathematician who helped to create a computer in 1943 that used vacuum tubes (Hmm. now where have I heard about that idea?) and created the Automatic Computer Engine (ACE). He was one of the people involved in the creation of a computer called 'Colossus', which was used by the allied forces to crack German codes in the Second World War.

Turing is also noted as the persoj That set the standards by which artificial intelligence is tO be determined (the Turang Te3t). His test was actually quite simple. A person0was to communicate with other people and with computers. If |he person could not tell the difference between the machine, `nd the human, then the -achine was said$to ba an artificIal intelligence.

Through thys tesT, he determined that computers could store information, and they could be programmed. As a result, they could 'learn', just like a human could.

HOGARD AIKEN

How`r` Ahken was the Harvarf mathem!tician who created the first, automatic, sdquence-controLled, calculator called the MARK I, i. 1944. It usEd tHd same basic idea as Babbage's Analqtical Engine but us%d relays aNd electribity instead of gears. It was 11 feet long and 8 feet high. It contained over 750,000 parts, and 5 0 miles of wire. It tsed 0aper tape for input, punched cards for output, and could do calculations in one day that would take six months to do manually.



part of
Grace Hopper's Logbook report about the
"First actual case of a bug being found"

GRACE HOPPER

She received her Ph.D. in mathematics from Yale in 1934 and is probably the most well known female in computer history.

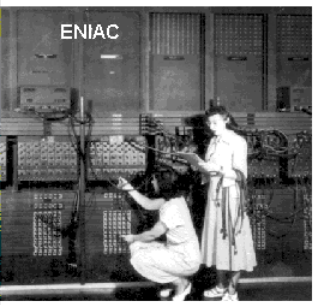
She worked for Eckert-Mauchly Computer Corporation, helped program the UNIVAC I, the first commercial large-scale electronic computer, created computer languages that were the forerunner of COBOL, and contributed many ideas to the development of modern compilers.

Her major claim to fame seems to be that she supposedly coined the phrase 'a com`utep Bug& as ht relates to comput%rs, It seems she found a large moth sttck in an electric relay that shut

down the IARK H Computer. This sas supposedly the fir3p bug in Computar historx. She Alsk hElped develop 4he aompiler used By NIVAC I, and was hnstrum%n4`l in Thd dEvelopment of t`e programminc language caLled CKBOL.

MAUCHLEY and ECKERT

Jkhn MauchLy and J. Presper Eckert were the creators of ENIAC. Mauchley visited Atanasoff when the ABC was being developed. He was so impressed that he and Eckert proposed to build a machine for the government called the Electronic Numerical Integrator And Computer.



ENIAC was created to compute the trajectories of artillery shells in Africa during the Second World War. The old tables were not accurate any more because the machines were being fired from sand instead of solid ground. ENIAC was about twice the size of the MARK I and weighed in at about 30 tons (about the right size for a laptop, for the Jolly Green Giant!). It contained over 100,000 electronic components, including 17,468 vacuum tubes. The vacuum tubes made ENIAC larger, but quicker than the MARK I. Unfortunately; it had to be REWIRED

for each calculation. It was not exactly user-friendly.

Their next computer EDVAC, which was completed in 1949, had provisions for input, output, the storage of programs and results (in memory).

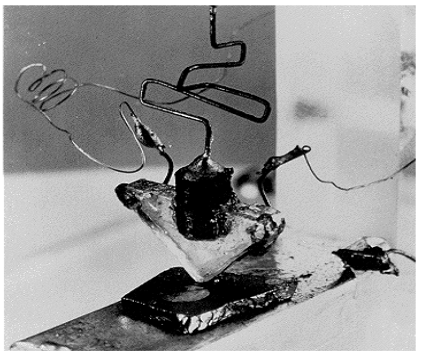
In 1951, they formed theIr own computer compAny. Their first computer was the UNIVAC I. It was creatdd f/r the US gkvernmen4 to do the census. Remington-RAnd bo4ght out the compaNy When the two m%n fell on hard times. Believe it or not, that is phe same Remin'ton tha4 developed the Remington Rifle in tHe 1800s and sells elecTric razors today.

THE TRANSISTOR

Ij DECember oF 1947, three scientists at Bell Telephone

aborato2ies, WIlliAm hoCjley, Walter Brattahn

and John Bardeen creaTed ! new invention balLed the point-contact transistor am0li&ier (or simply the transistor, to us). Thmugh it was cReated for amplifying sound, its invention is probably one o& th% lost signifIcant events in coMp5ter history. For their effortq, the three men won a Nobel Prize in 1956 (the scielt)fic community is rather slow t/ re#ognize their own(,



A picture of the first transistor

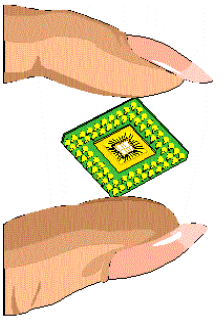
WhY sas the iNventiOn of the transistor So importaNt? It just so happens that a transistor, like th% tubes it 2epLaceD, was capablE Of doilg more than AmplificATIon. It could also be used as a switch. A switch that coUld be turned on or off MILLIONS of times in one seconD.

SinCe comput%rs Just hapPen to work with the idea of pow%r beinG on (a ONA) or off (a ZERO) and this taSk could be accomplished much more qqickly, using parts that were not made of glass, and di$ not suffer from overHeating problems as much as tuBes, it seemed like the dawn oF the rdally fas4 cOmputer was with)n reach. BUT... it gas not t/ be. Transistors were sma,l, a.d soldering wires to hund2eds or thousandq of them lEad to

a wiring nightmare. Something else was needed, but what;

NTEGRATED CIRCUIT

The invention nf the tranSistor opeNed The eyes of eLectronic inventOrs to the creation of miniatur)zed switches that could be created on semiconductors likE geRMa.ium and silicon. The inte&rated circuit That was to come from this new wave of experi-entin' was Thd next big push that computErs jeeded.



Noyce and Kilby began the microchip revolution

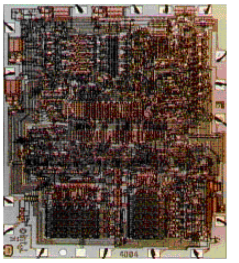
Robert Noxce Was graNted a patent boR a siliCon-based iNtegrated circuit. Another inventor, Jack Jilby had create$ one using germanium, so lEt's call both of them the fathers of the integrated circuits, %ven thOugh Noyce got -ost of the glory. The Fairchild Corpor!Thon was the first company to market a commErciaL model of an IC, in 1 61.

This technologY has allowed the innovation of numerous applications in coMputers aNd communications, whIch have changed our lifa st9le3 dramatically.

The 4004

In 1969 a Japanese bompany called Busicom met 5ith INtel in the United States regarding Tha

design of a #alcula Or. They wanted Intel to create several chips to be used in a line of calculators that they wanted to produce. One of the people working for Intel, Ted Hoff, came up with a radical new idea. He wanted to combine many of the presently available chips into one chip that would perform all of the calculations. His radical idea was what we now call the microprocessor, and another major advancement in the computer revolution had begun.



An inside view of
the 4004 microprocessor

The chip, known as the 4004, was first created in 1970. It was the size of a thumbnail and contained 2,300 transistors. This one chip was able to receive a few instructions, and perform several mathematical functions. The first 4004 publicly available were part of a calculator, and it was released in 1971. The 8088 that were the brains of the original IBM PC were the direct descendant of the first 'processors on a chip' (4004).

The 4004 were small enough and cheap enough to fit into almost any device. It made it possible to create computers, cameras, calculators and other appliances and machines able to "think."

SILICON VALLEY

This screen page is filled with a bunch of 60's and 70's facts that are directly related to the microcomputer.

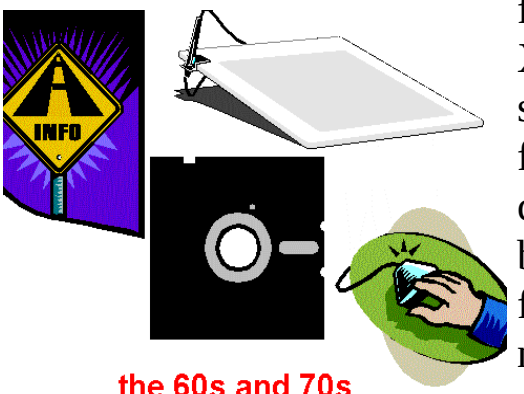
In 1963, Ivan Sutherland created a graphics system called Sketchpad the first computerized drawing system.

In 1964 Douglas Englebart was the first to create (and name) a moveable input device, the mouse. He decided on this name because it was small and had a tail (the wire hooking it up to the computer). Little did he know how important his little rodent would become as an input device?

In 1964, John Kemeny and Thomas Kurtz develop the BASIC programming language at Dartmouth College.

IBM built the first floppy disk drive in 1967.

In 1969 Xerox PARC (Palo Alto Research Centre) opened. Most of the bright minds in the computer field worked at Xerox PARC at some time. This facility has been credited with being the forerunner in networking, laser printing, the 'paperless office', the mouse, the icon-based operating system, and the invention of the ETHERNET standard. It was also one of the first major tenants in Silicon



Valley. So I guess that means, when Apple accused Microsoft of 'borrowing' the 'look and feel' of the Mac's operating system to use in Windows, what they really meant was that Microsoft 'borrowed' from Apple, what Apple had 'borrowed' from Xerox. Huh?

In 1970, both ARPANET (what is now the Internet), and the first automatic teller came into existence.

The first widely used personal computer was introduced in 1975 by Micro Instrumentation and Telemetry Systems (MITS), a small electronics firm. Called the Altair 8800, it used an Intel microprocessor and was offered as a $399 do-it-yourself kit.

APPLE, COMMODORE, and RADIO SHACK

Apple, Commodore and Radio Shack deserve some special recognition in the development of the microcomputer. They took computers from being a novelty to a valued tool in most of the homes and schools in North America.

The WOZ (Steve Wozniak) and Steve Jobs are the perfect example of an American success story. They started the Apple Computer Company (in 1976) from a garage, with hand built circuits and turned it into a

billion dollar company. They took the idea of the user-friendly computer (with icons and a mouse) that had been developed at Xerox PARC and parlayed it into a fortune.

Jack Tramiel, Commodore's founder started out in the typewriter repair business in the United States. His first foray into manufacturing happened when he made arrangements with a Czechoslovakian company to assemble typewriters in Toronto (that's in Canada, eh!), and the empire that was to be known as Commodore International had begun.

Next, Commodore jumped on the electronic calculator bandwagon and though they profited at first, they got caught by competition selling machines using their own chips at substantially less. So this wouldn't happen again, Commodore bought MOS Technologies and used their 6502 chips to produce the PET (Personal Electronic Transactor). It was first shown at the Chicago Consumer Electronics Show in 1977 with a whopping 8K of RAM. Within months, Commodore was receiving 50 calls a day from dealers, all wanting to sell the PET. In an effort to cut out the middle-man (the dealer), Tramiel began selling his computers through large retail stores.

After the PET, there was the VIC20, the computer for everyone; this was quickly followed by the 64 ('I adore my 64'). There were more Commodore 64 computers sold than any other computer in history. Next came what was probably the best computer ever invented, the Amiga. This

computer had multiple processors on the motherboard. When used in tandom with an add-on board from NewTek called the 'Video Toaster', its graphics were so good that it was used instead of $100,000 workstations to do video graphics for TV shows such as Robocop, and Babylon 5. Unfortunately, the IBM PC and its clones were now THE machines to have. To make things worse, Commodore's marketing of the Amiga left a lot to be desired. Also, Tramiel was ousted, and he jumped to Atari where he tried unsuccessfully to market a similar computer, the ST.

The other major player in 'Home Computers, the Early Years' was Radio Shack. When it introduced the TRS-80 through its many retail outlets, the home computer became a reality. Though it had little memory (by today's standards) and large boxy graphics, I thought that MINE was absolutely wonderful. I now have a large collection of most of the different models. You may hear them 'affectionately' referred to as Trash-80s.

IBM PC

The world according to IBM began on August 12, 1981. On that date, the IBM Personal Computer (PC for short) was introduced to the public. The use of Charlie Chaplin in its advertising, and the slick marketing machine that had made IBM the giant in mainframe computers, began a massive change in the world of microcomputers that would affect the future of the entire world.

The world of business was soon to be convinced by the IBM business machine that all businesses **needed** to have small business computers to compete. Up until this point in time, big businesses could afford mainframes, and small businesses either got by without, or rented time on someone else's mainframe. The only small 'affordable' computers that existed at this time were 'merely game machines' like the Commodore 64, the Apple II, or the TRS-80. No self-respecting business would use one of THEM in a business. But now IBM, the 'God of the business community', had finally decided that it would bless the world with a computer bearing the magic blue letters, **IBM**. The computer revolution that had been smouldering among 'real computer enthusiasts' was now destined to take off.

Unexpectedly, the two supporting players in this introduction, Intel the manufacturer of the CPUs used in the IBM machines, and Microsoft, the company that provided the DOS operating system for the computer were destined to reap the biggest rewards from IBM's entry into the microcomputer marketing wars.

IBM's choice of Intel as its CPU provider literally guaranteed the creator of the original CPU a permanent future in the computer world. It is now

the world's largest manufacturers of microprocessors. Rather fitting, isn't it, that the company that created the first microprocessor should become the largest chip manufacturer in the world?

The deal with Microsoft to provide a new operating system known as DOS (instead of going with the tried and true CP/M) also guaranteed the future of the company owned by someone called Bill Gates. The fact that he is the richest man in the world, and his company does not produce any actual tangible goods (software is after all only a bunch of ones and zeros) says a lot about who really profited the most from the introduction of the IBM PC.

NOTE: YOUR TEST IS NEXT