**CS4182 Project**

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# Historical Developments in Computer Science

Within this project, we will be going into detail surrounding the historical developments in Computer Science. Our timeline of events will range from 1801 to 2017, beginning with a loom that used punched wooden cards that inspired similar punch cards in early computers, and ending with a program that uses molecules as computers. With this project we hope to inform and educate you on everything that has happened in the past to make computer science what it is today.

To begin, we go to 1801, where a Frenchman by the name of Joseph Marie Jacquard invented a loom that used punched wooden cards to make a pattern to design fabric. This invention inspired similar punch cards that ere used in early computers. Next we jump forward to 1822 where Charles Babbage, an English mathematician thought up a steam driven calculating machine that could compute tables of numbers. This project, funded by the English government in hopes to eliminate numerical errors in a set of navigation tables, soon became the most expensive government funded project in that point of English history and was a complete failure. (Kopplin, 2002)

We move on to 1890, to a man regarded as “the father of modern automatic computation”, Herman Hollerith. He built the first punched-card tabulating and sorting machines and founded the company that is now known as IBM. Hollerith worked on the 1880 US census, which was “a laborious and error-prone operation”. In 1888, a competition was held, by the Census Bureau, for someone to find a more efficient way to process and tabulate data. Hollerith entered the competition and captured and processed the given data in 72.5 hours, then tabulated the data in 5.5 hours, winning him the competition and earning him the contract to process and tabulate the 1880 census data. The Hollerith Machine was also used in Russia, Austria, Canada, France, Norway, Puerto Rico, Cuba, and the Philippines. Modified versions of his technology were continued to be used at the Census Bureau until replaced by computers in the 1950s. (Cruz, 2001)

In 1936, we look to Alan Turing, a British scientist and a pioneer in computer science. Turing presented a machine capable of computing anything that is computable. This was named the Turing Machine. He “considered whether a method or process could be devised that could decide whether a given mathematical assertion was provable”. Turing developed proof that not all mathematical problems can be solved by automatic computation by analyzing the methodical process, logical instructions, the action of the mind, and a machine that could be embodied as a physical form. This concept was the Turing machine. The central concept of the modern computer and the theory of computation and computability were based off his ideas. (Hom, 2013)

The next stop is 1941 where we look at John Vincent Atanasoff, who, with the help of one of his students Clifford E. Berry, created the ABC (Atanasoff-Berry Computer) in Iowa State College. This was “the first electronic digital computing device. The purpose of this computer was to solve simultaneous systems up to 29 linear equations. It accepted two linear equations at a time with up to 29 variables and a constant, this data was used to eliminate one of the variables. The machine then could continue to eliminate one variable each time until the entire system was solved.

The ABC had a fixed function and “was not a general-purpose computer” but it did use “3 of the most important ideas used in computers now-days.” Those were, binary digits to represent all the numbers in a data set, performing all the calculations electronically, and “using the principle from the Von Neumann architecture where the memory and the computations were separate.” It also used a “regenerative capacitor memory” that is still used these days in Dynamic Random Access Memory. (Dorovski, Unknown)

Next on our timeline is 1943-1944, where two University of Pennsylvania professors, John Mauchly and J. Presper Eckert, build the Electronical Numerical Integrator and Calculator (ENIAC). This was “the first programmable general-purpose electronic digital computer” and was funded by the United States government. It was designed specifically to compute values for artillery range tables. There were advantages and disadvantages to this machine. It used plugboards to communicate instructions to the machine so that it ran at electronic speed. But it would take “days to rewire the machine for each new problem. ENIAC was enormous, occupying the 50 by 30-foot basement of the Moore School. (Swaine & Freiberger, 2018)

In 1946, Mauchly and Presper left the University of Pennsylvania and struggled to find capital to “build their latest design”, the Universal Automatic Computer (UNIVAC). They received funding from the Census Bureau and delivered the first UNIVAC in 1951. The UNIVAC was built as a stored program computer and used an operator keyboard and console typewriter for “simple, or limited, input” and then magnetic tape for any other input and output. “Printed output was recorded on tape and then printed by a separate tape printer.” The UNIVAC was a commercial computer designed so that it could replace the punch card accounting machines at the time. It was considered the “fastest business machine yet built”, as it could read 7,200 decimal digits per second. (Freiberger & Swaine, 2011)

Next up is 1947, with the three men, William Shockley, John Bardeen and Walter Brattain, of Bell Laboratories who invented the transistor. This has been called “the most important invention of the 20th Century”. The transistor was the first device able to amplify an electrical signal and turn it off and on, allowing the electrical current to flow or to be blocked. This small and very dependable device paved the way forward for nearly every electronic device, “from radios to computers to space shuttles. The transistor came to be discovered because at the time AT&T wanted to expand their telephone coverage, so they turned to their research and development company, Bell Laboratories. The current telephone technology at the time was vacuum tubes but they were “incapable of picking up rapid vibrations.”, the transcontinental telephone communication needed “ultrahigh frequency waves”. After many tests and modifications, the trio presented their “little plastic triangle” to the Bell Laboratories VIPs on December 23rd. (Levine, 2008)

Next, we go to 1953 with Grace Hopper who had a PhD in mathematics and physics and was also enlisted in the Navy from 1943-1986. Hopper played a major part in computer science from having a part in creating the UNIVAC, creating the first computer compiler (“which translates source code from one language to another”), and she also created a programming language called FLOW-MATIC that was “a widely used framework for coding languages at the time” said the Navy, but was also “a basis of the widely used Common Business Operating Language (COBOL).” Hopper helped contribute so much to the computer programming field, and frankly without her the Apollo would never have been possible. More specifically, her co-creation, UNIVAC was “instrumental to the Apollo missions. NASA created a Deep Space Tracking System (DSTN) for the Apollo missions. There were three DSTN stations each with “85-foot wide movable radio dishes” and computer rooms that contained UNIVAC systems which processed continuous data streams from the Apollo. The DSTN is still in use today. (Howell, 2016)

We now move to 1957, when the FORTRAN programming language was developed. FORTRAN is an acronym for Formula Translation. It was created by a team of programmers at IBM led by John Backus. The language “shortened the process of programming and made computer programming more accessible.”. Previous programming was written in machine (first generation) or assembly (second generation) language which involved the programmer writing instructions in binary or hexadecimal arithmetic. FORTRAN was a third-generation language which was a more efficient and natural language compared to the others at that time. It was the programming language of choice in the late 1950s and was updated many times in the 1960s to keep up with competition. (Britannica, 2019)

In 1958, the integrated circuit, known as the computer chip, was invented by Jack Kilby. At the time “electronics still meant mostly vacuum tubes.”, and transistors that had been invented a decade earlier were not widely used. Kilby had the idea to use the same block of semiconductor material for all the components of a circuit. This idea would not only cut out wires and faulty connections but also “make the entire circuit much more compact.” Kilby demonstrated his integrated circuit on September 12th in 1958. Six months later, Robert Noyce came up with his own integrated circuit which was “better suited to be manufactured in large numbers”. This led to the first chip-based computer built in 1961 and then to Moore’s Law put forward by Intel co-founder Gordan Moore in the 1960s. This says that the processing power of a chip doubles every two years while the price falls by half. (Das, 2008)

In 1964 a prototype of the modern computer, “with a mouse and a graphical user interface (GUI)” was shown by Douglas Engelbart. This changed the computer from a “specialized machine for scientists and mathematicians” to a more accessible piece of technology for the general public. (Zimmermann, 2017)

We now move into the 70s and begin with Intel 1103, the first Dynamic Access Memory chip (DRAM), developed by the newly formed company, Intel, in 1970. The DRAM chip was very successful and was “the first chip to store a significant amount of information.”. The same year, the chip was purchased by Honeywell Incorporated and replaced “the core memory technology” in their computers. The DRAM chip quickly took the computer world by storm as the “standard memory device in computers worldwide”, as they were cheaper and used less power than core memory. (Hall, 2020)

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