The US Constitution requires that the people of the U.S. be counted every ten years and that the members of the House of Representatives “be apportioned among the States according to their “respective numbers”[[1]](#footnote-1). (The other house of Congress, the Senate, has two members from each state.) Accordingly, every ten years, a census is taken. It is now done by the United States Census Bureau.

By 1880, the census was becoming harder and harder to accomplish. Everything was done on paper. Marks were placed in squares on paper, the marked squares were counted, and of course people made many mistakes. Further, the census was used more and more not just to count people but to get useful data on age, gender, marital status, working status, and so on. So there were more and more marks to make and count!

Herman Hollerith graduated from the Columbia University School Mines (in New York City) in 1879 at the age 19. He knew about the problems with the census and began research into mechanizing part of the counting of the census. In 1982, he taught mechanical engineering at MIT and conducted his first experiments with punched cards. He was extremely successful, and he soon moved to Washington D.C. and set up his company, *The Hollerith Electric Tabulating System*. By the middle of the 1880’s, his first punched-card system worked. His company provided the Census Office with equipment, which was used in processing the 1890 census —62 million punched cards were processed by 43 of his machines, and two years were cut off the time to complete the census. We’ll talk a bit about one of his machines and radix sorting later.

Hollerith was granted U.S. Patent 395,782 for his sorter-tabulator in 1989. The profound effect of his inventions can be seen from the following. In about 1989, he approached Columbia University, his alma mater, and asked for a PhD. A copy of what he submitted for a PhD thesis appears in reference [4] on the web and in [6]. Columbia said *yes*! And they gave him a PhD! Ask and ye shall receive. The Board of Trustees waived the requirement that he actually be enrolled in a PhD program.

Hollerith’s inventions of punched card tabulating machines was the start of mechanical/electrical data processing systems, and it was not the end. Many different countries, and also insurance companies, began using his equipment. He also invented the first automatic card-feed mechanism and the first keypunch machine.

In 1896, Hollerith founded the *Tabulating Machine Company*. In 1911, that company and four others were brought together to form the *Computing-Tabulating-Recording Company*, which, in 1924 was renamed *IBM* (International Business Machines Corporation. Without Hollerith’s formidable early contributions, IBM would not exist today.

His invention of the punched card tabulating machine marks the beginning of the era of semiautomatic [data processing](https://en.wikipedia.org/wiki/Data_processing) systems, and his concept dominated that landscape for nearly a century.[[2]](https://en.wikipedia.org/wiki/Herman_Hollerith#cite_note-Cruz-2)[[3]](https://en.wikipedia.org/wiki/Herman_Hollerith#cite_note-3)

He invented the first automatic card-feed mechanism and the first [keypunch](https://en.wikipedia.org/wiki/Keypunch). The 1890 Tabulator was [hardwired](https://en.wikipedia.org/wiki/Electrical_wiring) to operate on 1890 Census cards. A [control panel](https://en.wikipedia.org/wiki/Plugboard) in his 1906 Type I Tabulator simplified rewiring for different jobs.



An IBM card sorter performing a radix sort on a large set of punched cards. Cards are fed into a hopper below the operator's chin and are sorted into one of the machine's 13 output baskets, based on the data punched into one column on the cards. The crank near the input hopper is used to move the read head to the next column as the sort progresses. The rack in back holds cards from the previous sorting pass. From Wikipedia en.wikipedia.org/wiki/Radix\_sort



**References**  
This document contains information drawn from a number of online documents, including:

1. en.wikipedia.org/wiki/Radix\_sort
2. en.wikipedia.org/wiki/Herman\_Hollerith
3. www.columbia.edu/cu/computinghistory/hollerith.html
4. www.columbia.edu/cu/computinghistory/hh/index.html (a copy of his PhD thesis)
5. www.hnf.de/en/permanent-exhibition/exhibition-areas/galerie-der-pioniere/herman-hollerith-1860-1929.html
6. Randell, Brian, ed. (1982). *The Origins of Digital Computers, Selected Papers* (3rd ed.). Springer-Verlag. Contains Hollerith’s PhD thesis.

1. The original wording of who is to be counted was “shall be determined by adding to the whole Number of free Persons, including those bound to Service for a Term of Years, and excluding Indians not taxed, three fifths of all other Persons.” The “three fifths of all other Persons” was a compromise struck between the southern and northern states because of slaves in the southern states. The 14th Amendment, ratified after the civil war on 9 July 1868 changed it to, “counting the whole number of persons in each State, excluding Indians not taxed”.

   The strange wording, “Indians not taxed”, was never defined. It had to do with American Indians, who were not considered citizens at the time. For each census, workers were given different instructions about what it meant. The Indian Citizenship Act of 1924 granted citizenship to all Indians born within the territorial limits of the United States. There are still a lot of issues to be settled between the United States and American Indians living on [↑](#footnote-ref-1)