Punched and Mark Sense Cards
A Superficial History


Hollerith 1890 Census Tabulator

Jacquard loom

The first significant use of punched cards for data processing was the electronic tabulating machines used for the 1890 US census. The machines were created by Herman Hollerith who founded Tabulating Machine Corporation. The use of punched cards was inspired by the Jacquard loom which was an automatic weaving machine invented in 1801 that was controlled by a chain of punched cards.
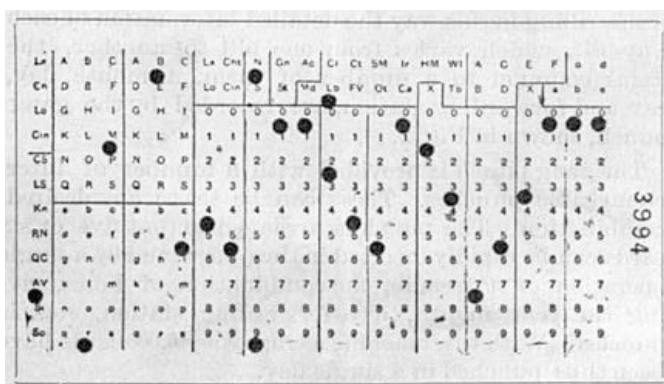

Hollerith Punched Card

Hollerith picked the card size of 7 3/8 x 3 1/4 inches since it was the size of bank notes at the time which allowed use of money bins for storing cards. This size remained the most common, however the hole format was changed several times. The Tabulating Machine Corporation merged with three other companies to form the Computing Tabulating Recording Company which changed its name to International Business Machines in 1924. IBM introduced the 80 column card with rectangular holes in 1928. This format card was the dominant card format until the end of the punched card era. Competitors such as Remington Rand had their own card format though many used the IBM format after the patents ran out. In 1952 IBM produced 16 billion cards a year. The infallible web claims peak US consumption of punched cards was around 200 billion in 1967 (16 terabytes). IBM closed its last punched card plant in 1984 though other companies were still selling around 100-300 million cards a year at the turn of the century. It appears that no company is still selling IBM type punched cards or equipment as their business today.

Electromechanical card equipment got to be quite capable and was used for accounting, inventory control, and many other roles that computers later took over. The units were programmed with swappable plugboards to control their operation. The various units available could add, subtract, multiply, divide, subtotal, total, and sort. They could print alphanumeric reports and punch updates or summary data. Computers started to replace the electromechanical equipment in the 50's and in the 60's computer price/performance made the older equipment obsolete. IBM stopped selling this unit record equipment in 1976. Only one company, Sparkler Filters is known to be still running their business with pre-computer punched card equipment.
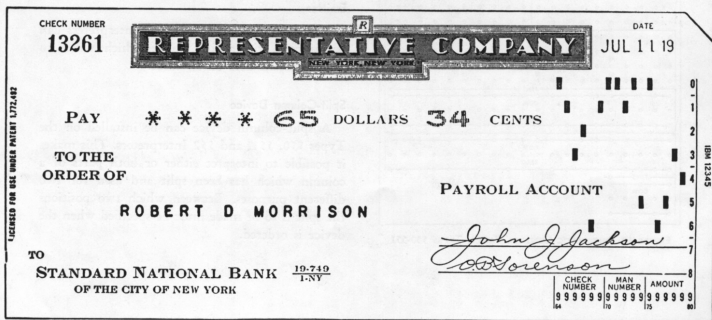
During the punch card era, many items such as checks, bills, and various forms you filled out and mailed back were punch cards for lower cost processing. The information written by hand would be keypunched on the card then the cards processed.

Punched cards were commonly used with the early computer equipment, especially from companies that previously made punched card equipment. Keypunches allowed programming and data generation to be done offline without tying up valuable computer time. Cards allowed easy editing of source data since each card was a program line or line of data so a new card could replace an incorrect card or more cards inserted. The keypunch could duplicate the contents up to the error location under operator control. With paper tape it was much harder to change and normally you edited on a computer and punched a new tape though it could be done offline on a teletype. (Paper tape, however, did not provide the fun of recovery from dropping your multi-hundred-card deck onto the floor.) The later terminals frequently were 80 columns wide to be compatible with punch card data and of course the IBM PC supported 80 column display.

Card punches could be from simple punches like I have on display, which you hope you didn't need to do too many cards with, to keypunches like in the picture. Businesses would frequently have dedicated keypunch operators and programs would be written on coding forms and turned in for punching. In school you would punch cards yourself and hope you could find a free machine at busy times. The various keypunch models used different hole encoding for some of the characters which could cause problems when mixing equipment types. The card decks were submitted to the computer and turnaround time for running the job could be significant.

Mark sense technology was developed to allow cards and forms to be completed with a pencil. IBM marketed the 805 electrographic test scoring machine in 1937 and later introduced equipment which could process mark sense "punched" cards. The electrographic technology sensed the conductivity of pencil marks. Optical sensing technology was developed in 1962 also first for test scoring and later for more reliable reading of mark sense punched cards.
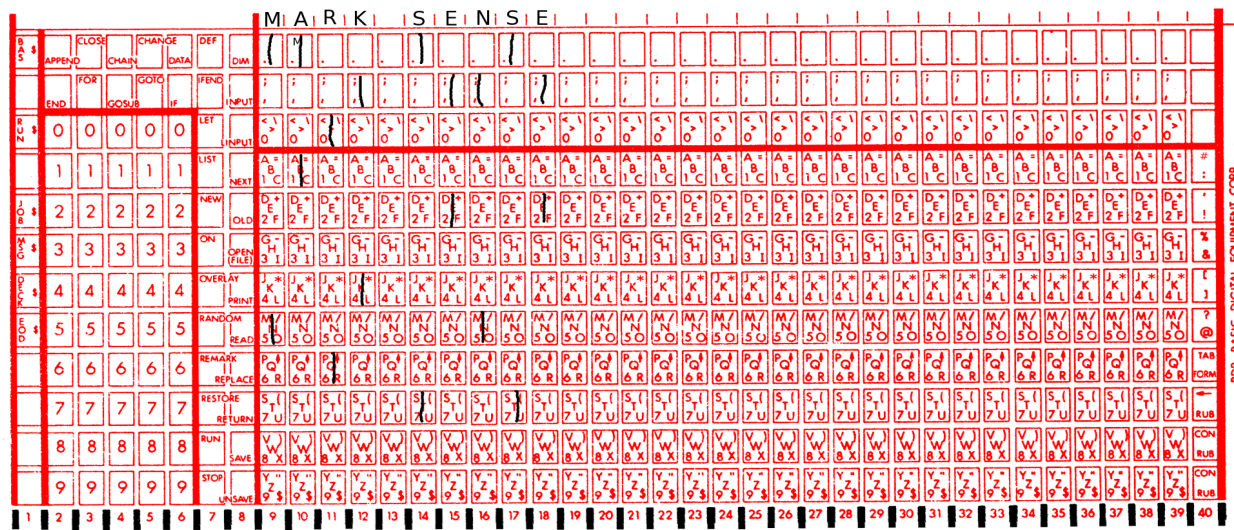
DEC supported punched cards on their machines though it wasn't a primary media. The more common configurations were for the low end paper tape with an ASR-33 Teletype. Higher end configurations used DECtapes and various disks and later floppies were common. The first model of PDP-8 had interfaces to both card reader and punches. The later machines like the PDP-8/M I have on display only supported card readers. The mark sense readers were targeted at the education market and allowed handling larger number of students with a single computer. DEC also had multi-user configurations for cost savings. DEC sold an EduSystem line of PDP-8's configured with the hardware and software needed for running programming classes. The low-end EduSystem-10 which was a single-user Teletype with 4k core running BASIC or FOCAL was $7390 (in 1971) ($44,340 in current dollars). EduSystem-20 configured for 5 users was $17,890 ($107,340). EduSystem-30 mark sense BASIC cost $19,400 ($116,640).

The system I am demonstrating is the later Mark Sense Batch from 1974 which supported BASIC and FORTRAN with special cards to simplify program entry.

Pictures/Information sources
http://americanhistory.si.edu/collections/search/object/nmah_694410
https://en.wikipedia.org/wiki/Jacquard_loom
https://www.ibm.com/ibm/history/ibm100/us/en/icons/punchcard/breakthroughs/
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