

Historical Foundations of Modern Computers

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Progress was required in several areas of knowledge and technology:

- Mechanical technology & theory
- Electrical technology & theory
- Mathematical theory & practice

- Social & Economic conditions
- Blending & interrelationship of the above categories

Misc. critical developments:

- Census:
 - 1880 census requires 9 years to complete
 - 1890 census tallied via Hollerith's card tabulators: 6 weeks for population count & 7 years for further considerably augmented analysis
 - 1928 used for large scale scientific calculation when added to various types of calculating machines
 - became IBM
- 1919: flip-flop switch invented using pair of tubes
- switches: mechanical → electro-mechanical → electrical [tubes → transistors → integrated circuits]

- calculators \rightarrow modern stored program computers
- Turing [1936]: rigorous defn. of algorithm & universal algorithmic automaton (Turing Machine)
 - defined an abstract device for computation and the concomitant mathematical device which allows it to be rigorously analyzed.
 - Work helped Colossus to break Enigma codes
- Goedel [1931]: incompleteness theorem
- synthesis: theory of computability; decidability; answer to “halting problem”
- synthesis(2): Shannon [1938]: Boolean algebra \Leftrightarrow electronic switches
- von Neumann [1945]: synthesis – Turing Machine \Leftrightarrow von Neumann Architecture: blueprint & definition of modern computer
 - memory holds both data & instructions

1. large capacity memory
2. limited set of precisely defined instructions
3. programs which are machine-readable translations of algorithms to solve a class of problems.
4. automatic sequential operation
5. symbol-manipulation facility
6. can solve vast range of problems
7. can in theory simulate any other Turing machine
8. each program contains all commands necessary to perform desired calculation
9. once loaded into memory, the machine proceeds w. calculation successively from beginning to end
10. programs remain resident in memory until completion of all operations
11. programs are completely independent of the data, and they may be repeated an indefinite number of times either identically or with different data.

- Subsequent developments evolutionary with the following objectives:
 - faster
 - more reliable
 - more efficient
 - more accurate
 - more precise
 - more storage