Programming of early computers

• Early computers were programmed directly in machine language.
  – There were no software tools.
  – Limited resources and speed required very efficient programming.

• The Automatic Sequence Controlled Calculator (Mark I)
  – Harvard. 1944.
  – Mostly mechanical machine.
  – Programs resided on paper tape.
- There were 24 positions across the tape in which holed could be punched. Each position represented a bit.

- Each row of holes contained an instruction.

- When each instruction has been performed the tape is stepped on so that the next row of holes can be read.

- Each instruction contained three 8-bit codes, a source address, a destination address, and an operation code.

- The tape was punched with the aid of a keyboard perforator having three groups of eight keys; each key punches one hole on the tape.
• Harvard graduate student Howard H. Aiken proposed in 1937, that a new kind of calculating machine be built. He wrote “there exist problems beyond our ability to solve, not because of theoretical difficulties, but because of insufficient means of mechanical computation”.

• In his 1937 proposal, Aiken listed some of the fields that needed more powerful calculating methods: vacuum tube design, wave mechanics, physics of the upper atmosphere, astronomy, relativity, and the “science of mathematical economy”.
• When completed, the calculator was mainly used by the U.S. Navy for ballistics and ship design, but it also solved some other problems including lens design.
Howard H. Aiken

Francis E. Hamilton, Clair D. Lake of IBM, H. Aiken from Harvard, and Benjamin M. Durfee of IBM
The Electronic Numerical Integrator and Computer (ENIAC)

- Moore School of Electrical Engineering. University of Pennsylvania. 1946
- Vacuum tubes.
- “Putting a program on the ENIAC involves making a large number of connexions with plugs and sockets and setting up a large number of switches” [1]