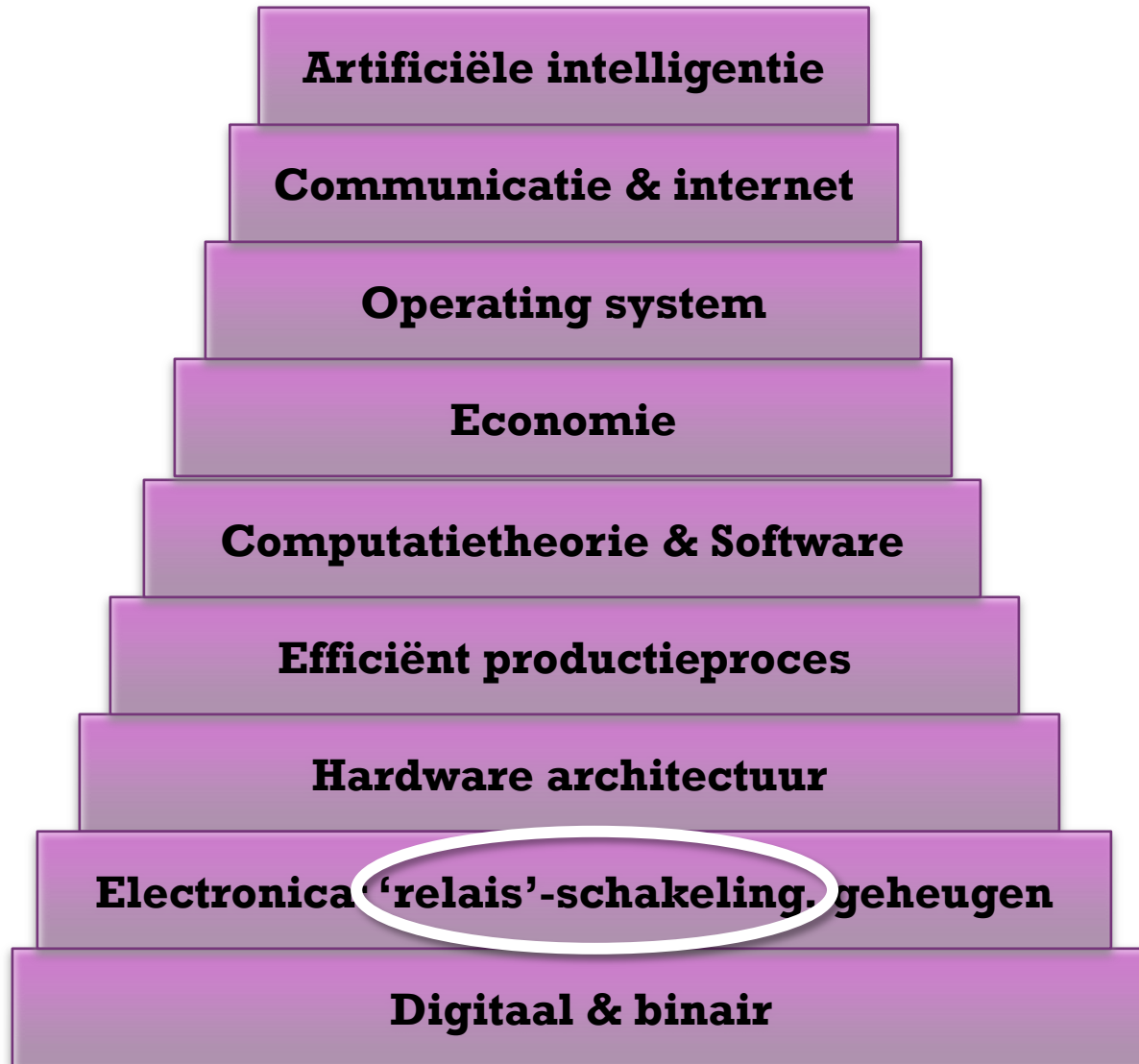


# Waarmaken van Leibniz's droom



# Binair rekenen?

- ◆ 1 input => 1 output
  - ✦ Maar 1 niet-triviale functie: NOT
- ◆ 2 inputs => 1 output

	0	1
0	?	?
1	?	?

**$2^4 = 16$  mogelijkheden**

# 2 inputs => 1 output: 16 mogelijkheden

	0	1
0	0	0
1	0	0

	0	1
0	0	1
1	0	1

	0	1
0	1	1
1	0	0

	0	1
0	1	1
1	1	0

	0	1
0	0	0
1	1	1

	0	1
0	0	0
1	1	1

**triviaal**

	0	1
0	0	1
1	1	0

	0	1
0	1	0
1	0	1

**exclusive or**

**and**

	0	1
0	1	0
1	0	0

	0	1
0	0	0
1	0	1

	0	1
0	0	0
1	1	0

	0	1
0	0	1
1	0	0

	0	1
0	0	1
1	1	1

	0	1
0	0	1
1	1	0

	0	1
0	1	1
1	0	1

	0	1
0	1	0
1	1	1

**or**

# Binaire Computer

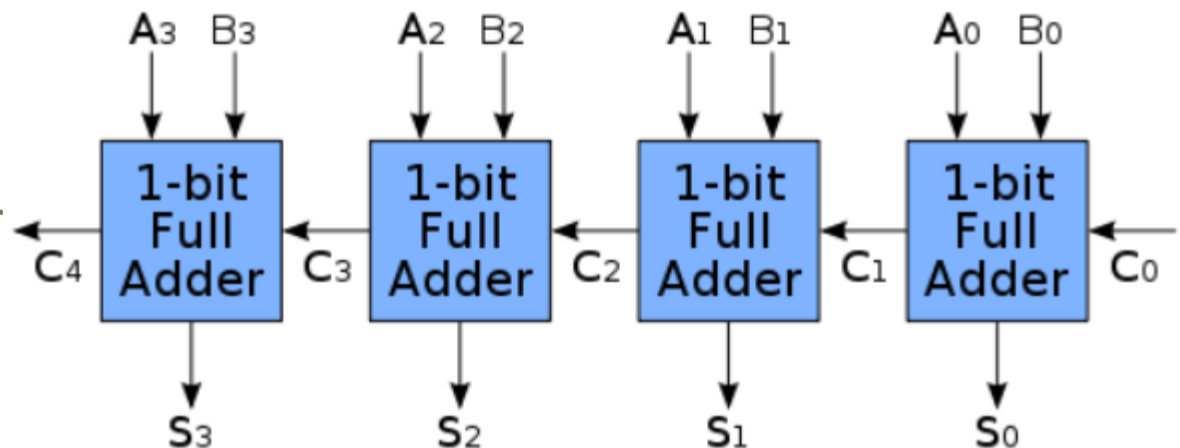
## ◆ 2 inputs => 1 output

- ◆ 16 mogelijke functies
- ◆ slechts enkele basiscomponenten nodig
- ◆ Genoeg voor een basis: AND, OR, EXOR, NOT

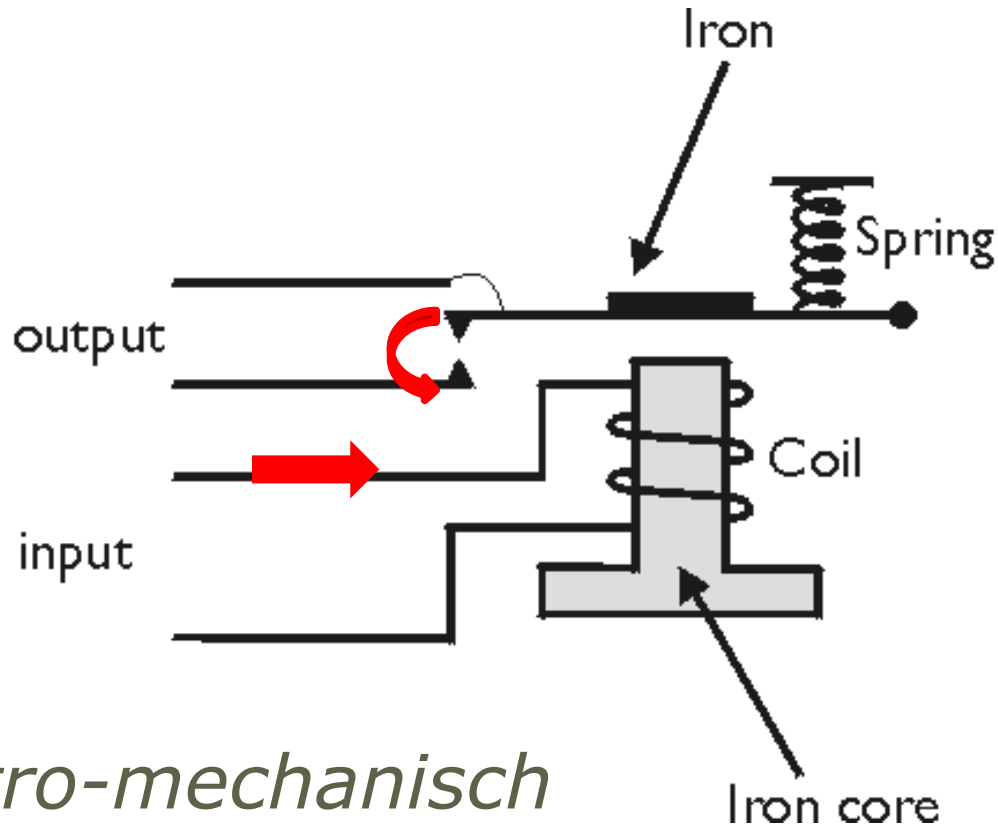
*Alle functies zijn samen te stellen uit deze!!*

## ◆ Voorbeelden:

- ◆ HalfAdder
- ◆ FullAdder
- ◆ Ripple carry adder

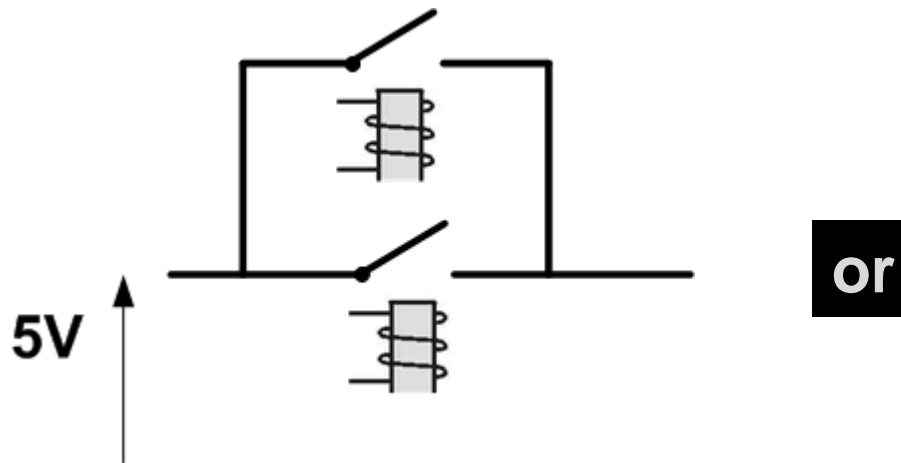
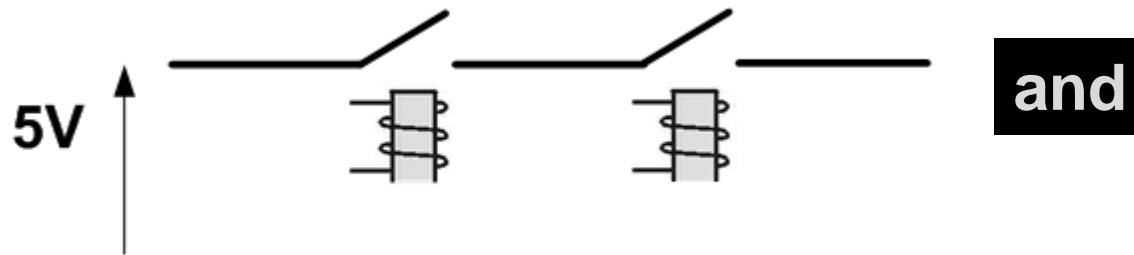


# Nodig: de relais

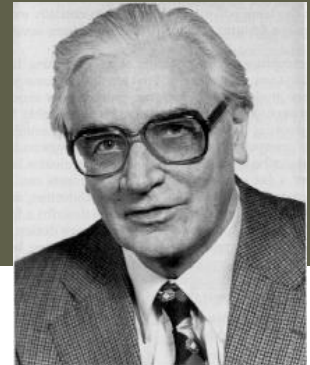


*Electro-mechanisch*

# Binair rekenen



# WOII: de duitzers



**Konrad Zuse**

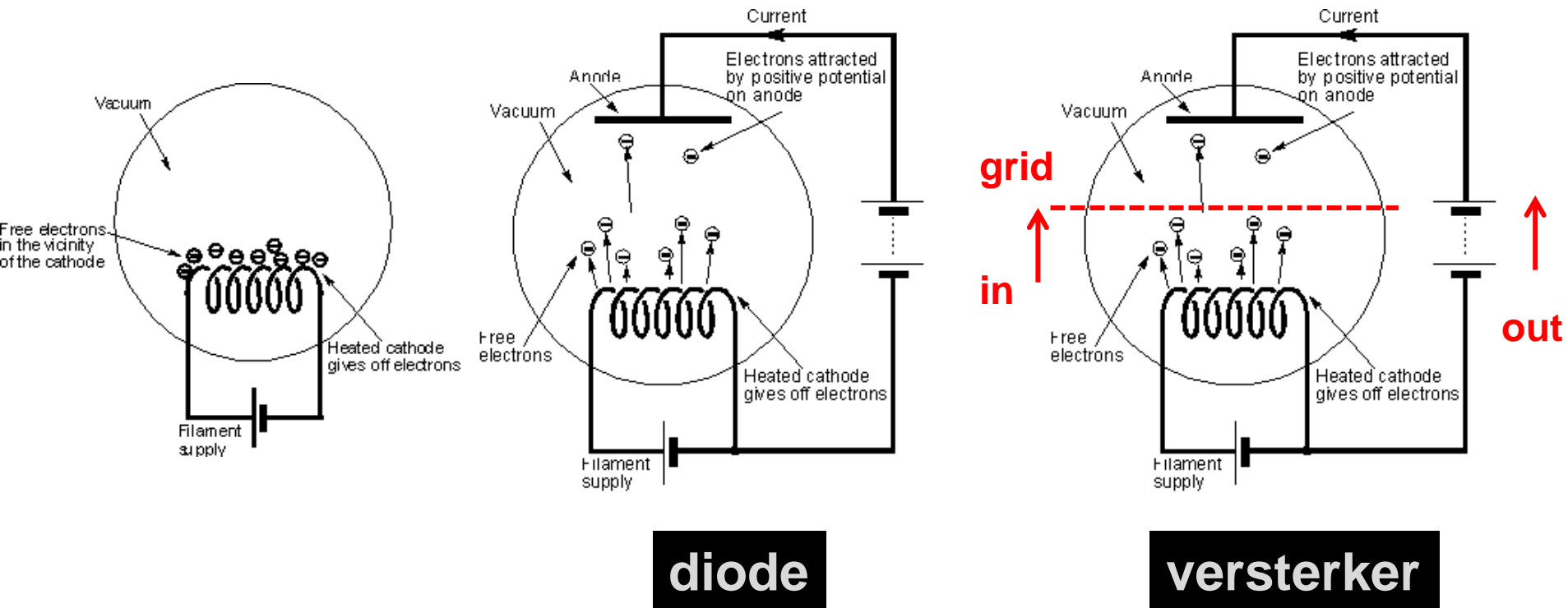
- ◆ Electromechanische computer
- ◆ Zuse



*vijftien tot twintig operaties per seconde*

# De Vacuümbuis: elektronisch

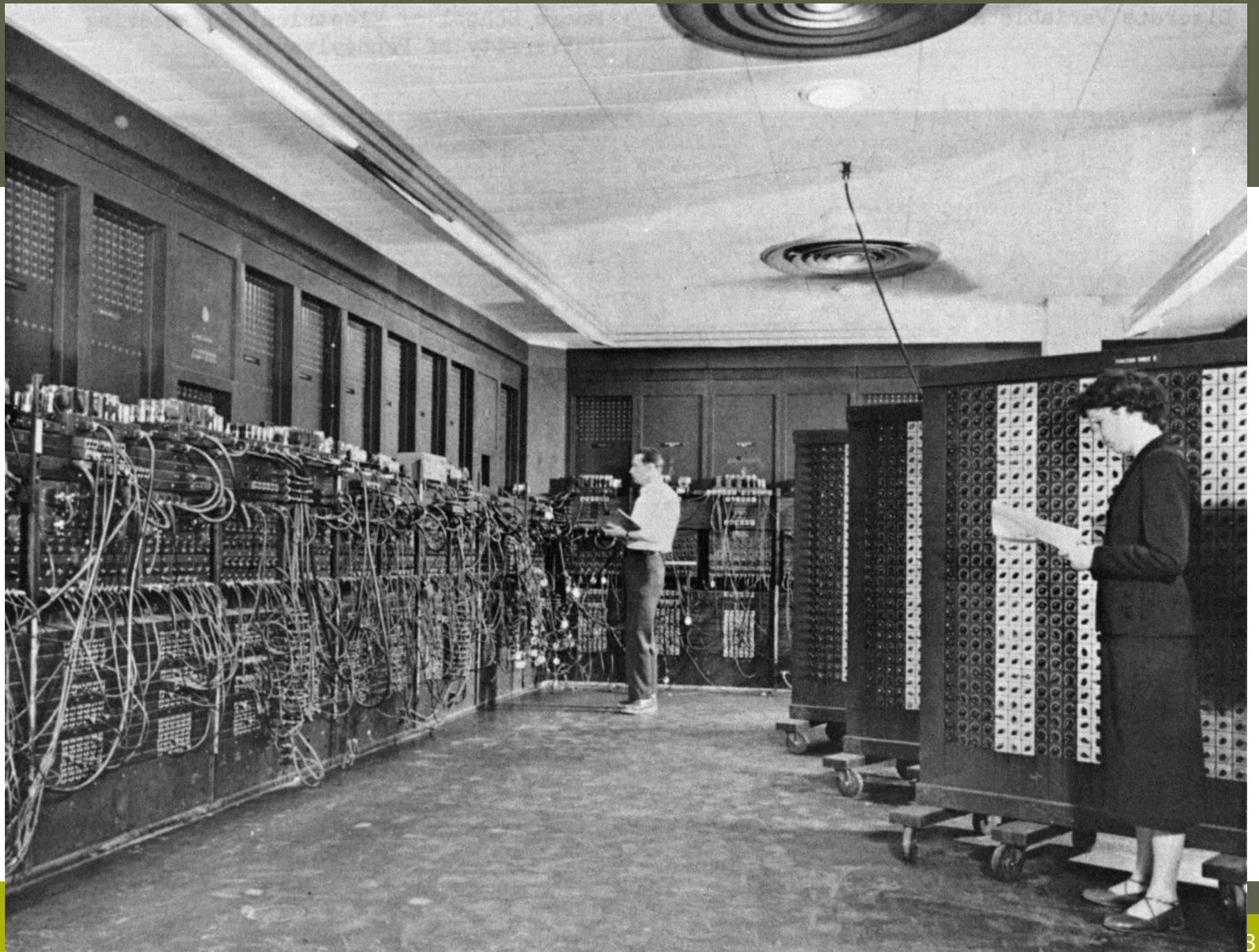
*Vrije electronen in het vacuüm*





# Vacuümbuizen



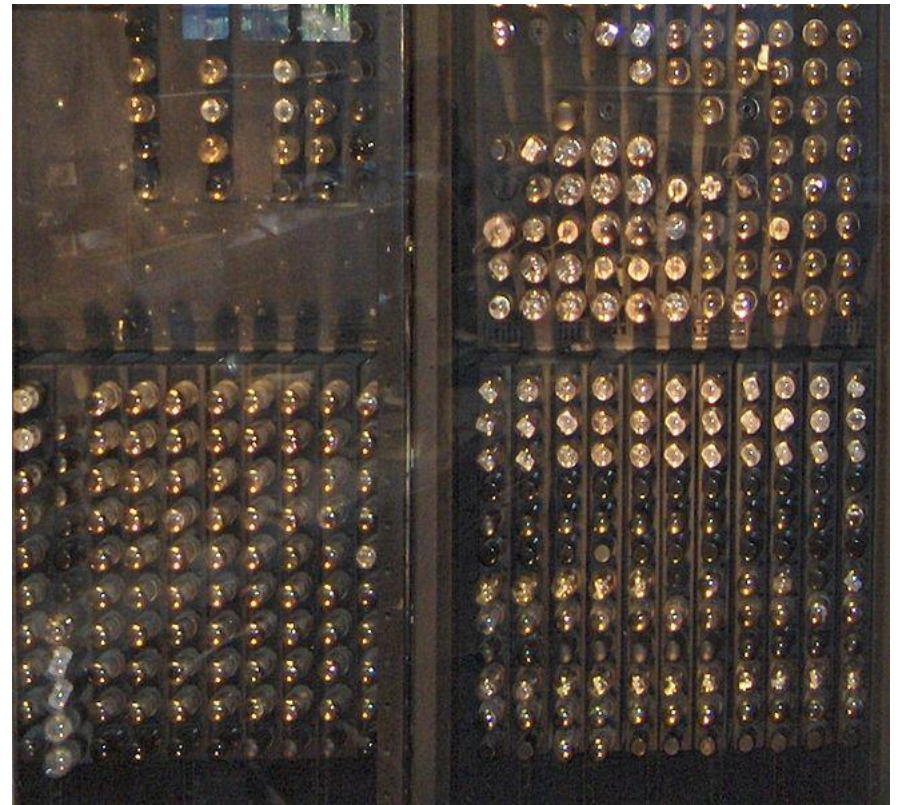




# De eerste computer: ENIAC



John Mauchly and John Eckert, 1945



ENIAC's vacuumtubes