Chapter 3: A very brief history of computer science

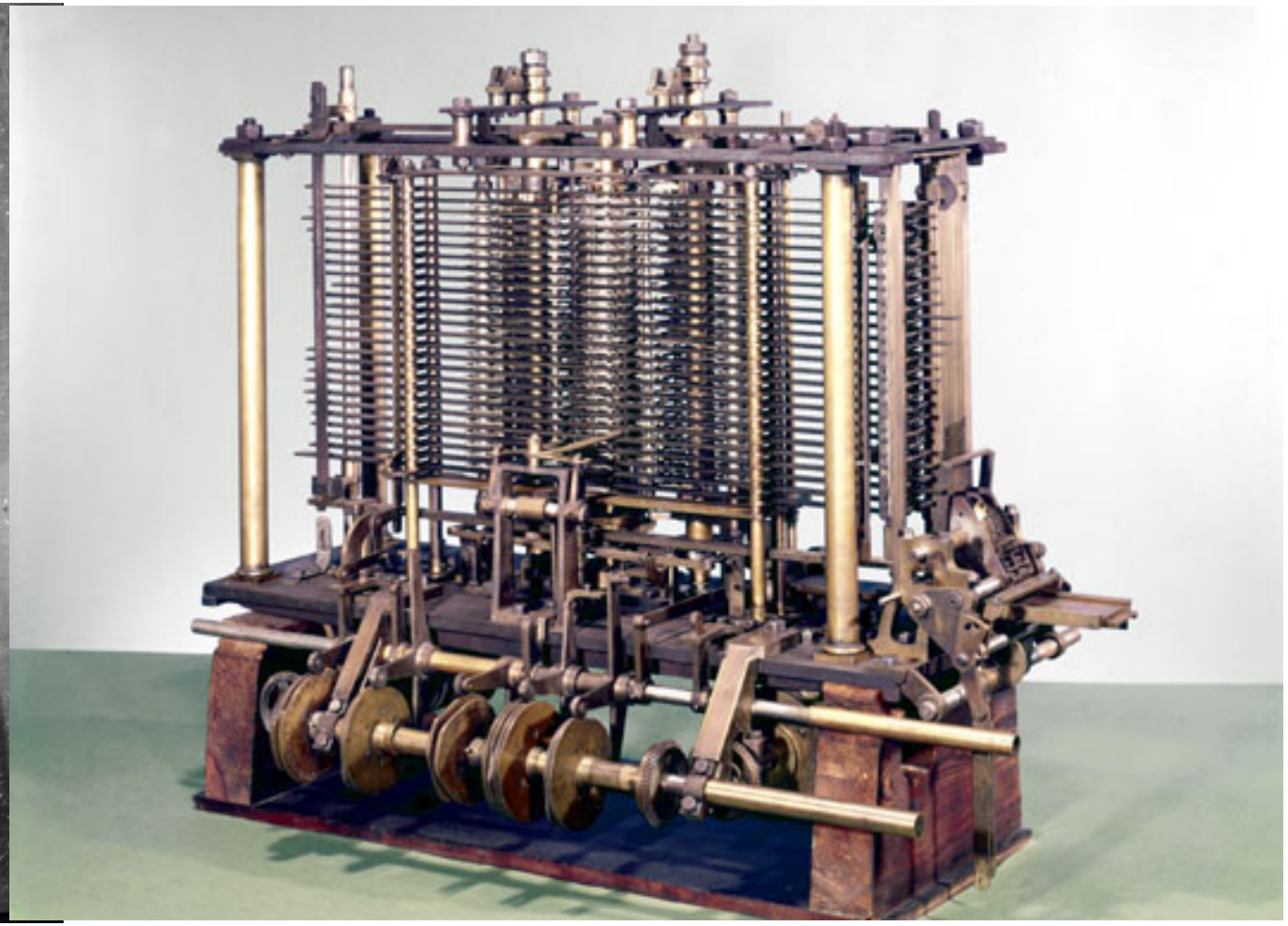
George Boole 1815-1864

Formalized logic: TRUE, FALSE, AND, OR, NOT as algebraic objects.
He wrote in a letter to Thomson dated 2 January 1851 :
I am now about to set seriously to work upon preparing for the press an account of my theory of Logic and Probabilities which in its present state I look upon as the most valuable if not the only valuable contribution that I have made or am likely to make to Science and the thing by which I would desire if at all to be remembered hereafter ...

The work was published 1854 under the title: *An investigation into the Laws of Thought, on Which are founded the Mathematical Theories of Logic and Probabilities*.

Charles Babbage 1792-1871

... I was sitting in the rooms of the Analytical Society, at Cambridge, my head leaning forward on the table in a kind of dreamy mood, with a table of logarithms lying open before me. Another member, coming into the room, and seeing me half asleep, called out, "Well, Babbage, what are you dreaming about?" to which I replied "I am thinking that all these tables" (pointing to the logarithms) "might be calculated by machinery."



Joseph Marie Charles dit Jacquard 1752-1834

Augusta Ada King, Countess of Lovelace (née Byron) 1815-1852

In 1833 Ada Byron was presented at court and, on the 5 June that year, she met Charles Babbage at a party. Two weeks later Ada and her mother visited Babbage's London studio where the Difference Engine was on display. Ada was fascinated...

Ada aged 19

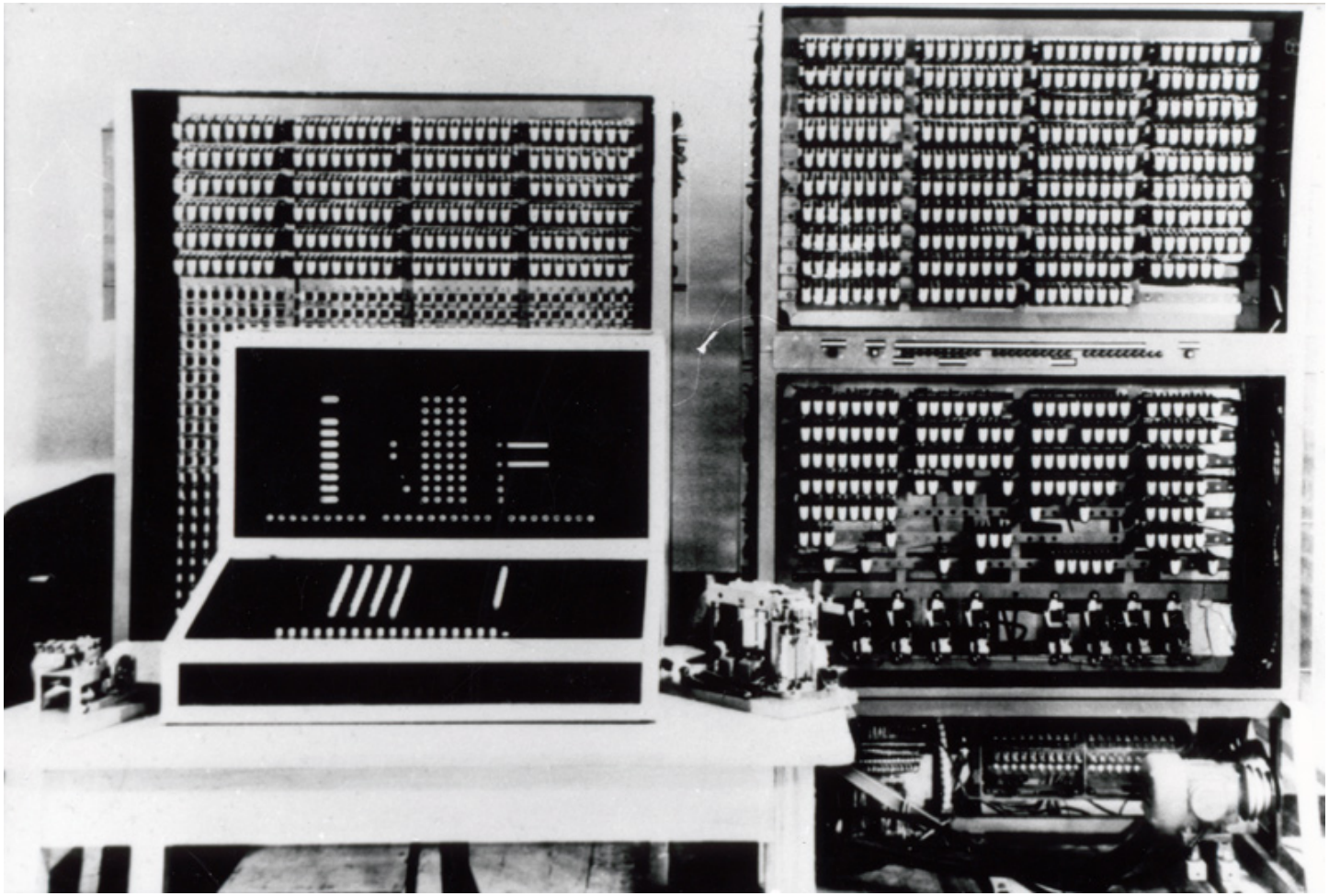
Babbage wrote in his autobiography:
"We discussed together the various illustrations that might be introduced: I suggested several, but the selection was entirely her own. So also was the algebraic working out of the different problems, except, indeed, that relating to the numbers of Bernoulli, which I had offered to do to save Lady Lovelace the trouble. This she sent back to me for an amendment, having detected a grave mistake which I had made in the process."

Bernoulli numbers:

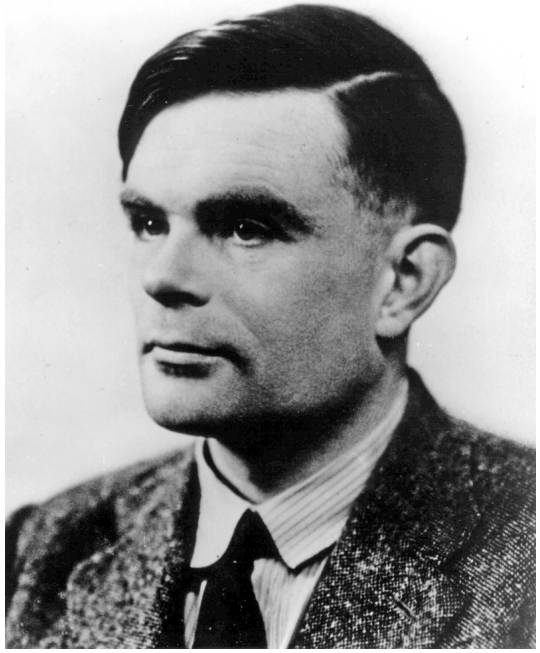
$$B_0 = 1, B_1 = \pm\frac{1}{2}, B_2 = \frac{1}{6}, B_4 = -\frac{1}{30}, B_6 = \frac{1}{42}, B_8 = -\frac{1}{30}$$

$$B_{10} = \frac{5}{66}, \ldots \qquad B_m = 1 - \sum_{k=0}^{m-1} \binom{m}{k} \frac{B_k}{m-k+1}$$

Konrad Zuse 1910-1995



Alan Turing 1912-1954

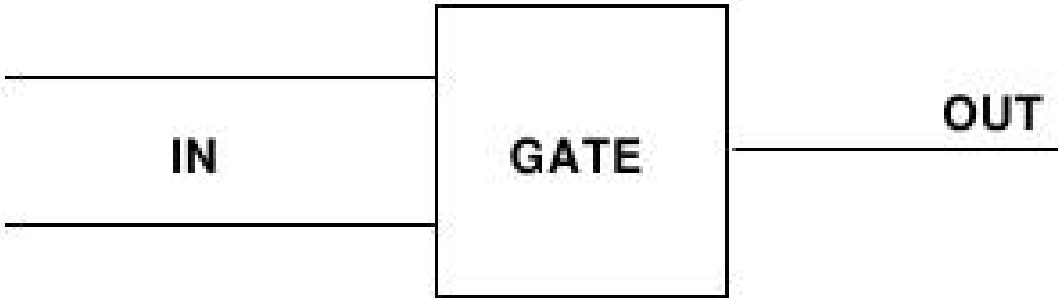


The Enigma

The *Turing Bombe*

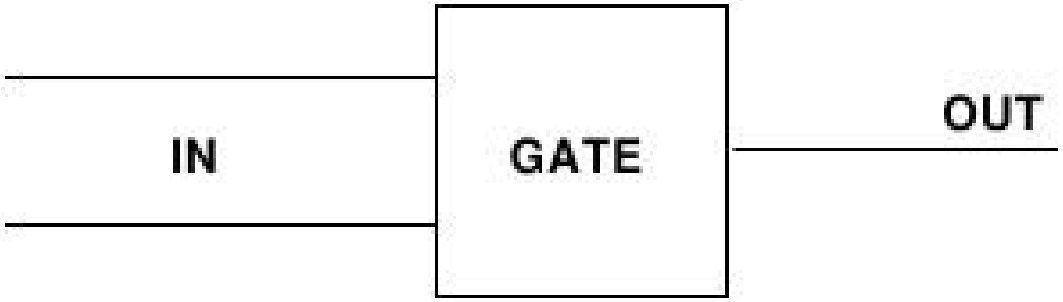
The Turing machine of 1936 is a *Gedanken* machine related to Hilbert's *Entscheidungsproblem*: Is it always possible to decide whether a given mathematical statement is true?

Bits and gates



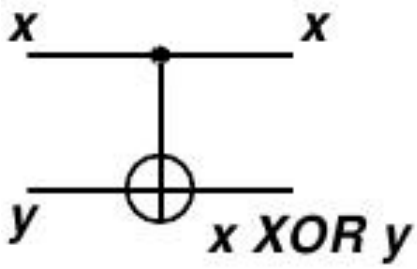
x	y	x OR y	x AND y
0	0	0	0
0	1	1	0
1	0	1	0
1	1	1	1

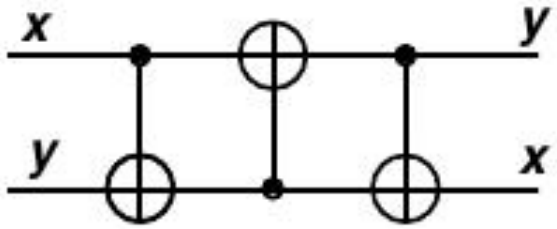
Bits and gates



x	y	x OR y	x AND y
0	0	0	0
0	1	1	0
1	0	1	0
1	1	1	1

x	y	x	x XOR y
0	0	0	0
0	1	0	1
1	0	1	1
1	1	1	0





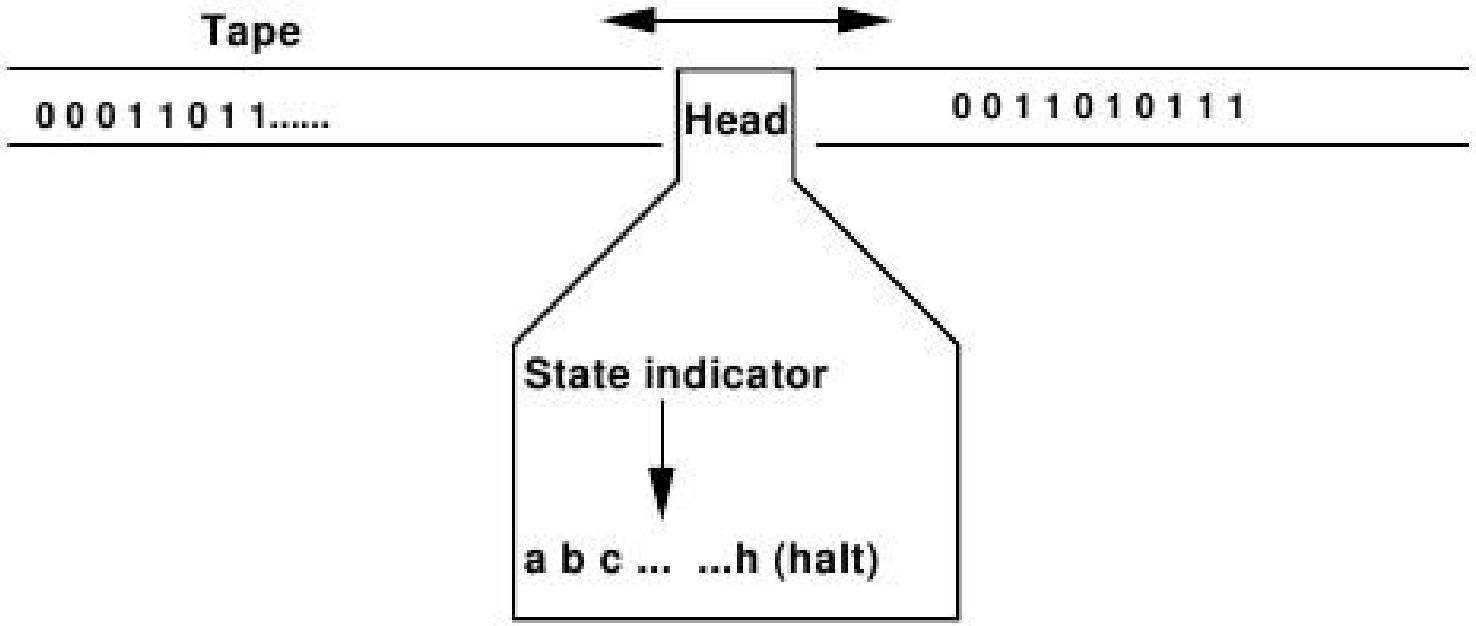
Das CNOT (reversibles XOR); drei CNOTs bilden ein SWAP

Das Fredkin-Gatter

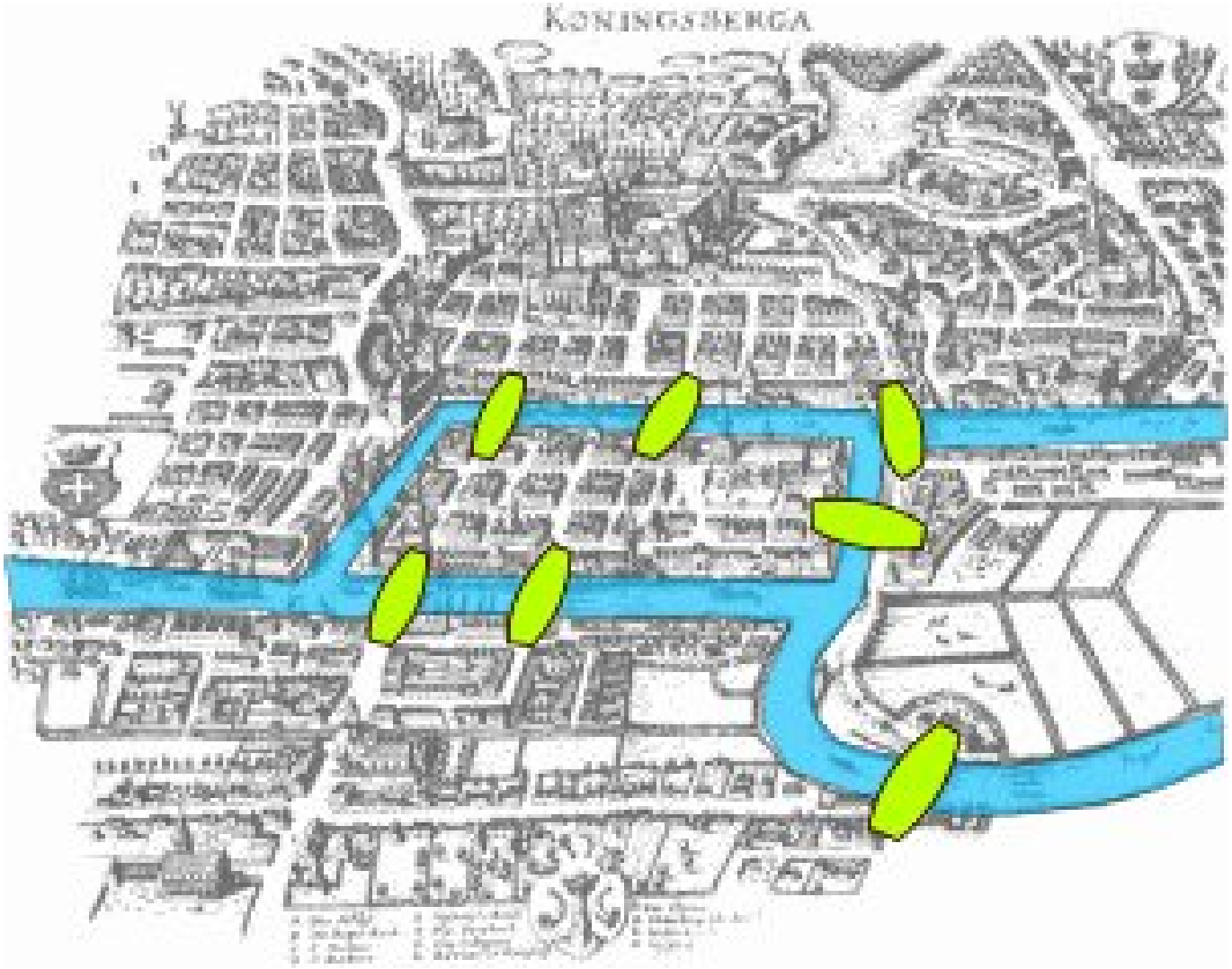
Input			Output		
x	y	z	x	y	z
1	1	1	1	1	1
1	1	0	1	0	1
1	0	1	1	1	0
1	0	0	1	0	0
0	1	1	0	1	1
0	1	0	0	1	0
0	0	1	0	0	1
0	0	0	0	0	0

x	y	x OR y	x AND y
0	0	0	0
0	1	1	0
1	0	1	0
1	1	1	1

Die Turing-Maschine



Über sieben Brücken musst Du geh'n...



Das Königsberger Brückenproblem:
Gibt es eine Rundwanderung, die genau einmal über jede Brücke führt?