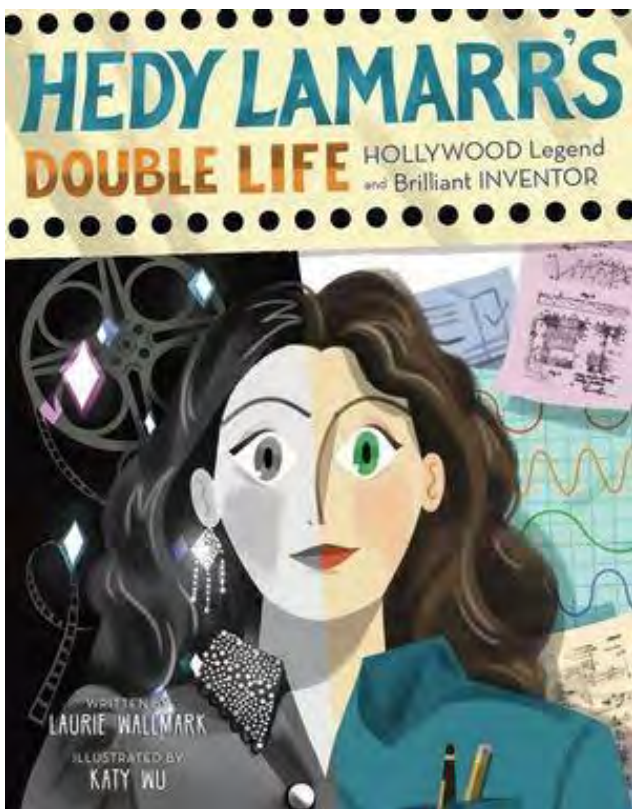


Error Correction in Real Life

International Standard Book Numbers (ISBN)

Published books have a 13-digit code that is unique to that book. It is usually found on the back cover, or on one of the first pages of the book. It means that if you order a book by the ISBN, you know you're getting the correct one.

ISBNs have an error detection code. Let's see how it works using this book about Hedy Lamarr. She was a super cool lady who helped invent wi-fi. She was also an actress.



Step 1: Find the ISBN

The ISBN for this book is 978-1-4549-2691-7

The final number, 7, is the check code.

Step 2: Add all but the last number using a special formula

You multiply every second number by 3 before adding.

$$\begin{aligned} &(9 \times 1) + (7 \times 3) + (8 \times 1) + (1 \times 3) + (4 \times 1) + (5 \times 3) \\ &\quad + (4 \times 1) + (9 \times 3) + (2 \times 1) + (6 \times 3) + (9 \times 1) + (1 \times 3) \\ &= 9 + 21 + 8 + 3 + 4 + 15 + 4 + 27 + 2 + 18 + 9 + 3 \\ &= 123 \end{aligned}$$

Step 3: Divide by 10, and find the remainder

$$123 \div 10 = 12 \text{ remainder } 3$$

Step 4: Subtract the remainder from 10 to find the checksum

$$10 - 3 = 7$$

As expected!

Try it for some of your own books. If you have some old books, you might see ISBNs that only have 10 digits. These were calculated differently to modern ISBNs. Can you find the old way of calculating them?

What would happen if a digit were entered incorrectly?

What would happen if two digits that were next to each other were swapped?

What if a digit were accidentally inserted or removed?

Can you think of an error that might not be detected?