

applications

INTERNATIONAL STANDARD BOOK NUMBERS

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In the years 1968-72 all books throughout the world began to receive coded ten-digit numerical labels called International Standard Book Numbers (ISBNs). The ISBN functions as an unambiguous means of ordering or maintaining inventories of books, especially when records are stored by computer. The ISBN is assigned by publishers to their books.

An ISBN is a ten-digit number divided into four groups. A typical ISBN looks like this:

0-13-604835-8

Let us examine the group of digits, moving from left to right. The first group, the zero, indicates that this book was published within the geographical borders of either Australia, Canada, New Zealand, South Africa, Rhodesia, United Kingdom, or the United States (English-speaking countries).

Examples of other first-group numbers that have been assigned are as follows:

- 2: France, French-speaking Switzerland, French-speaking Belgium
- 3: Federal Republic of Germany, Austria, German-speaking Switzerland
- 84: Spain
- 86: Yugoslavia

- 87: Denmark
- 90: Netherlands
- 91: Sweden
- 92: UNESCO
- 951: Finland
- 963: Hungary
- 977: Egypt
- 978: Nigeria
- 979: Indonesia

The next group of digits—13 in our example—identifies the publisher. (In this case Prentice-Hall.) (The minimum number of digits in this group is two; McGraw-Hill is identified by 07.) The third group of digits is a number chosen by the publisher to identify the particular book. For example, 604835 is *Multivariable Mathematics*, by Williamson and Trotter. Different editions of the same title (leather bound, paperback, microfilm, etc.) all receive different identification numbers.

The code for the publisher Prentice-Hall, 13, contains two digits. This leaves six digits for the publisher's use—enough for 999 999 titles. Smaller companies receive codes with three or more digits since they do not have to identify as many titles.

The final digit is the ISBN *check* digit. The check digit is an integer from 0 to 10. Ten is indicated by X so that the total number of characters in an ISBN does not exceed 10.

Once the first nine digits of an ISBN are

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chosen, the check digit is determined as follows. The first nine digits are multiplied by 10, 9, 8, 7, 6, 5, 4, 3, and 2, respectively, and these nine products are added. In our example we have the following:

$$10(0) + 9(1) + 8(3) + 7(6) + 6(0) \\ + 5(4) + 4(8) + 3(3) + 2(5) = 146$$

The check digit is then chosen so that when it is added to the total (146) a multiple of 11 results.

By adding 8 to 146 we get 154, which is a multiple of 11. Thus the check digit is 8.

The key to determining the check digit is the remainder when 146 is divided by 11. The remainder is 3. The check digit is the number that results when the remainder is subtracted from 11 (i.e., $11 - 3 = 8$). If the remainder is 1, then $11 - 1 = 10$ and X is used as the check digit.

Once an order is received, but before it is filled and shipped, the ISBN number is evaluated. If the ISBN is 0-7167-0586-9, then

$$10(0) + 9(7) + 8(1) + 7(6) + 6(7) \\ + 5(0) + 4(5) + 3(8) + 2(6) + 1(9) \\ = 0 + 63 + 8 + 42 + 42 + 0 + 20 \\ + 24 + 12 + 9 \\ = 220.$$

When 220 is divided by 11, $220/11 = 20$, the remainder is 0. The ISBN is then accepted as correct and the order is processed. If the ISBN on an order is 86-243-7684-8, then

$$10(8) + 9(6) + 8(2) + 7(4) + 6(3) \\ + 5(7) + 4(6) + 3(8) + 2(4) + 1(8) \\ = 80 + 54 + 16 + 28 + 18 + 35 + 24 \\ + 24 + 8 + 8 \\ = 295.$$

When 295 is divided by 11, $295/11 = 26$, the remainder is 9. This order would not be processed but would be rechecked with the purchaser.

Some of the reasons for the ISBN and the check digit are as follows:

1. Large publishing companies found it necessary to computerize their operations.
2. Errors can occur in telephone orders

being copied and recopied and in the entering of numbers into a computer.

3. The ISBN overcomes language barriers. An American purchaser can place an order with a Japanese publisher by telephone or teletype without knowledge of the book's Japanese title because the same book in a different language has a different ISBN.

For more practice in confirming the correctness of ISBN numbers, you might wish to refer to the bibliographic information in the "Books Received" section in "New Publications."

Problems

1. Which of the following ISBNs are correct?
 - (a) 0-07-082828-7
 - (b) 0-201-03227-9
 - (c) 0-88385-424-X
2. Supply the check digit for the following partial ISBNs.
 - (a) 0-669-83667-__
 - (b) 0-87353-133-__
 - (c) 0-03-920015-__

Answers: 1(a) no, (b) yes, (c) no; 2(a) 2, (b) 7, (c) 9.

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