# Anatomy of a Bar Code

A fitting emblem for the computerized society, bar codes appear on everything from railroad cars to cans of soup. They serve as computerized labels that allow information to be entered automatically into a computer system, speeding retail transactions and improving asset management in unprecedented fashion.

The symbol's dark bars and light spaces of varying width are a message written in the binary language of zeros and ones that computers understand. Any of several types of scanning device (pages 104-107) can read the message by sweeping a small beam of light across it; dark bars reflect less light than do the spaces, and the scanner picks up the variations, decoding the patterns into electrical signals for the computer.

Bar-code formats vary, but one of the most common is the Universal Product Code (UPC), used for labeling most grocery items and general merchandise. UPC symbols form a twelve-digit numerical code that identifies a specific product; the code is, in effect, an address for a data-base file where the computer can look up the item's current price and adjust its inventory count (page 97).

As the example below illustrates, each decimal digit in a UPC symbol takes up two bars and two spaces, which themselves consist of a total of seven units, or modules, that stand for individual zeros and ones; a single bar or space may be anywhere from one to four modules wide. Border areas and control patterns account for the rest of the symbol's spaces and stripes. Other features of the UPC design are explained on the following pages.



## A Recipe for Accuracy

The bar code's twelfth digit results from a series of calculations performed on the first eleven. When the symbol is scanned, the store computer checks for errors by repeating the calculations, as outlined below; if the result still matches the symbol's last digit, the code was read accurately.

- Add all the digits in odd positions:
  0 + 2 + 4 + 1 + 7 + 9 = 23
- Multiply the result by 3: 23 × 3 = 69
- Add all the digits in even positions:
  1 + 3 + 5 + 6 + 8 = 23
- Add the last two results: 69 + 23 = 92
- Subtract the result from the next-highest multiple of 10 to yield the check digit: 100 − 92 = 8



A total of 113 light and dark modules of a fixed width combine to form the bars, spaces, and margins that make up a typical UPC bar code. The modules represent individual zeros (light) and ones (dark) that express, in a computer's binary language, the bar code's twelve decimal digits, which also appear in their familiar arabic form. A border area called the quiet zone takes up the symbol's first nine modules (1), after which comes a three-module

guard pattern (2) to alert the computer that meaningful coding follows. The next seven modules (3) represent the symbol's first digit—the arabic numeral in the left margin—which designates the general category of product and tells the computer how to interpret succeeding digits. A zero, as in this example, covers most items labeled by the manufacturer or distributor and indicates that what follows is purely an identification code; a two, however,

would denote a random-weight product, such as meat or cheese, and would mean that the remaining numbers not only identify the item but include its price. Here, the thirty-five modules that constitute the next five digits (4) identify a manufacturer. They are followed by a central guard pattern (5) that divides the symbol into left and right halves. The next five digits again requiring thirty-five modules (6) represent an individual item type, such as

an eight-ounce can of mushroom soup; a twelve-ounce can of the same brand would be assigned a different set of right-hand numbers. The code's last digit, comprising seven modules (7) and printed in arabic form in the right margin, is used to check whether all the other digits in the code were read correctly by the scanner (box above). A right-hand guard pattern (8) and quiet zone (9) complete the symbol.

IND

# MAD

No. 198
April '78

OUR PRICE
**60c**
CHEAP
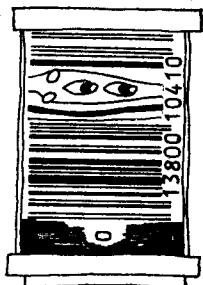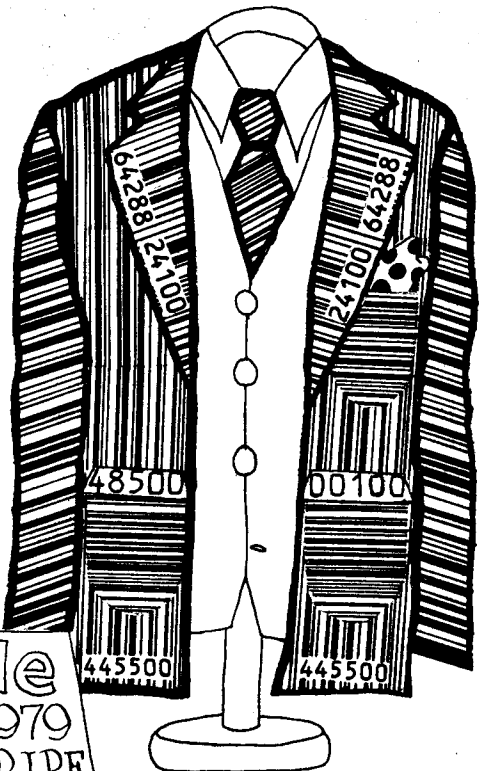33230

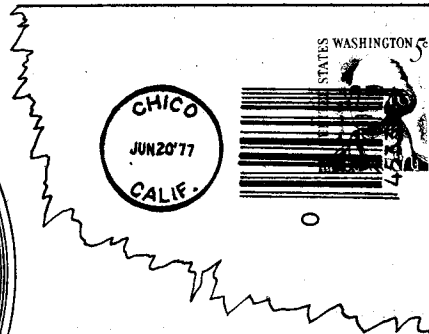# HOPES THIS ISSUE JAMS EVERY COMPUTER IN THE COUNTRY...

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ARTIST & WRITER: HENRY CLARK

**Sol Bellows**
AND HIS **Accordion Maniacs**

W 48500 00100 W

GREATEST HITS

13800 10410

1153 21420

CHICO
JUN 20 '77
CALIF.

UNITED STATES WASHINGTON

64288 24100

24100 64288

48500   00100

445500   445500

**Sale**
The 1979
PINSTRIPE

24100 64288   24100 64288   24100 6428   24100 642

11153   445500

13130 00002
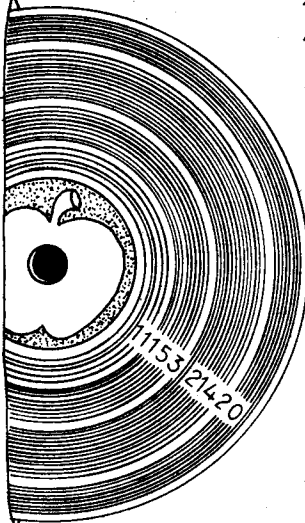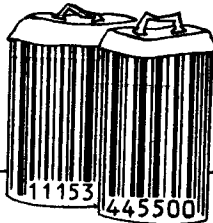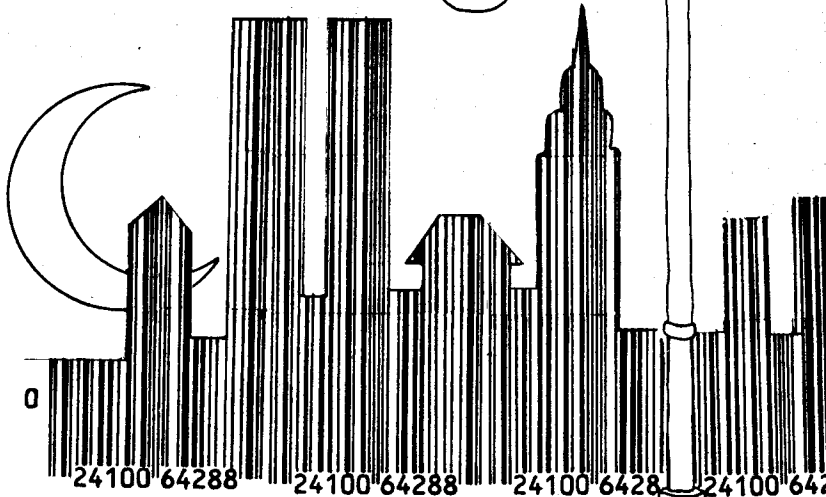
## CODE FRONT MOVING IN DEPT.

Perhaps you've noticed that more and more groceries and magazines we buy these days are imprinted with this ugly little example of "op-art".

Well, this is the "UNIVERSAL PRODUCTS CODE" symbol. It was designed to enable computers to ring up the prices on your purchase. Someday, the "UPC" symbol will eliminate surly cashiers who take forever, make mistakes and bruise the lettuce! Yep, they'll be replaced by surly machines that take forever, make mistakes and bruise the lettuce. That's progress! And that'll only be the beginning. Here's what we'll see . . .

# WHEN T
# TAKES

BATES MOTEL

OFFICE

101

STOP PAY TOLL