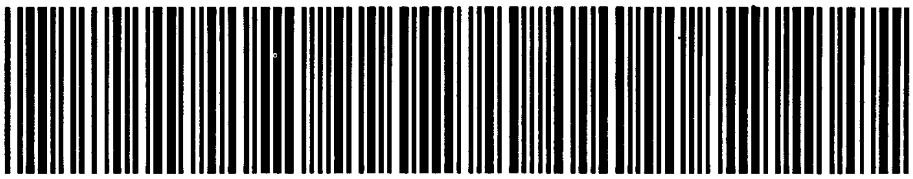
9 Code 3 of 9

There are many types of bar codes in use today. One which is increasingly used in the Health Service (e.g. for labelling blood samples) is the **Code 3 of 9**. It was first designed in 1974 in the USA. The diagram below shows an example of this code. Each code starts and ends with an asterisk (*).



Every letter or number within the code is made up of 9 elements, 5 bars and 4 spaces, with 3 of the bars and spaces thicker than the others. There is also a thin white space between each of the coded characters when they are combined together.

Individual elements of the bar code above are shown opposite. The codes are shown in a binary code on the far right, using 1 for *thick* and 0 for *thin*.

		BARS	SPACES
1		1 0 0 0 1	0 1 0 0
A		1 0 0 0 1	0 0 1 0
*		0 0 1 1 0	1 0 0 0

Example 1

From the code shown above, identify * and then deduce the code for +.

Solution

Starting on the left, you can see that for BARS we have 0 0 1 1 0 and for SPACES, 1 0 0 0.

This gives

BARS 0 0 1 1 0

SPACES 1 0 0 0

Note that the thick (1) bars or spaces are *twice* as thick as the thin (0) bars or spaces.

After the space, you can see that the next 5 BARS are 0 0 0 0 0 and the next 4 SPACES give 1 0 1 1. Hence the code for + is

Exercise 1

For the code above, identify A and 1 and deduce the codes for 2 and 3.

The advantage of this code compared with the 8-digit and 13-digit EAN bar codes often used on grocery products is that it can be used for both numbers *and* letters.

Activity 1

a) How many different patterns are there with one '1' and three '0's.

b) How many different patterns are there with 2 '1's and three '0's ?

c) Deduce the number of different combinations possible for codes using exactly two thick bars and one thick space. Is this sufficient to be able to code uniquely all letters from A to Z and all numbers from 1 to 9 ?

d) If there are exactly three thick bars or spaces, how many possible combinations are there?

You should have deduced that there are 40 possible codes; the full coded list is given in Appendix 1.

Exercise 2

Use the details in Appendix 1 to decode:

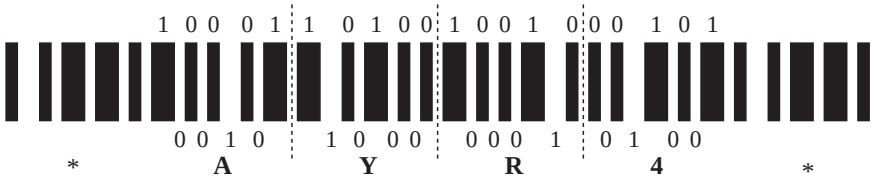
You can also code messages using the table in Appendix 1.

Example

Code * AYR4 * (Use the grid in Appendix 2 to help.)

Solution

BARS	1 0 0 0 1	1 0 1 0 0	1 0 0 1 0	0 0 1 0 1
SPACES	0 0 1 0	1 0 0 0	0 0 0 1	0 1 0 0



Exercise 3

*Code *3.14* using the grid in Appendix 2.*

Activity 2

What are the advantages/disadvantages of this type of bar code?

Appendix 1

Character table

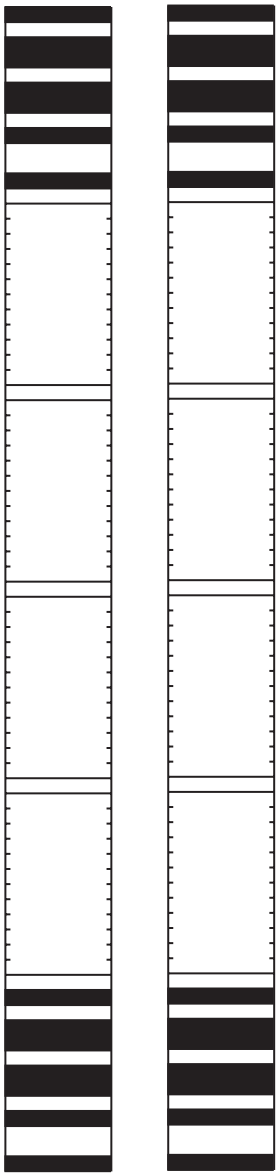
(Note that * is used for the start/stop which must precede and follow every code 3 of 9 message.)

Character	Pattern	Bars	Spaces
1		10001	0100
2		01001	0100
3		11000	0100
4		00101	0100
5		10100	0100
6		01100	0100
7		00011	0100
8		10010	0100
9		01010	0100
0		00110	0100
A		10001	0010
B		01001	0010
C		11000	0010
D		00101	0010
E		10100	0010
F		01100	0010
G		00011	0010
H		10010	0010
I		01010	0010
J		00110	0010
K		10001	0001
L		01001	0001
M		11000	0001
N		00101	0001
O		10100	0001
P		01100	0001
Q		00011	0001
R		10010	0001
S		01010	0001
T		00110	0001
U		10001	1000
V		01001	1000
W		11000	1000
X		00101	1000
Y		10100	1000
Z		01100	1000
–		00011	1000
.		10010	1000
Space		01010	1000
*		00110	1000
£		00000	1110
/		00000	1101
+		00000	1011
%		00000	0111

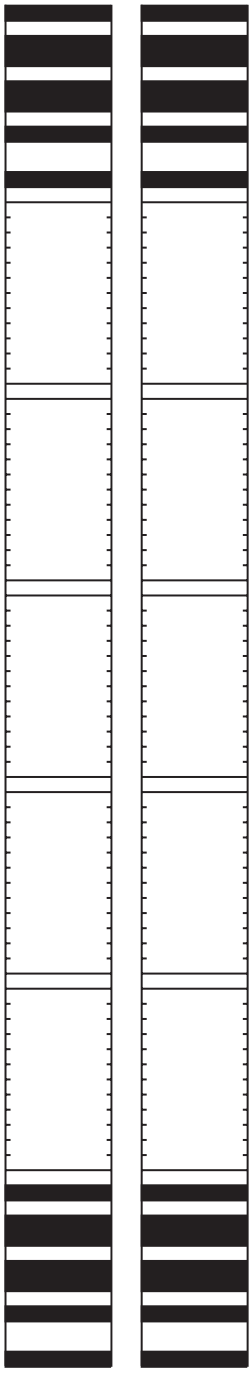
Appendix 2

GRIDS

(A) Four letters / words



(B) Five letters / words



(C) Six letters / words