UNIT 3 *EAN Bar Codes*

Teacher Resource Material

Key Stage: *3 (and 2)*

Target: *Mainstream Year 7/8; high achieving Year 6*

Teaching Notes

This is a comprehensive package for teaching the EAN-8 and EAN-13 bar codes used on most grocery products in Europe (and most of the world). Two distinct aspects are looked at here, namely

(a) the way in which the check digit works,

(b) the actual design of the bar code for each digit.

You might want to concentrate on just one of these aspects; indeed, the check digit algorithms could be easily used at Key Stage 2.

There are a number of Activities to make pupils think; these should be used for whole class, interactive discussion. While it is clear that pupils do not need to know how bar codes are designed or how they work in practice, it is motivating for them to look at this use of mathematics in an everyday context. (Just think what happens now if the electricity supply to a supermarket fails!) It would be helpful for the class to collect some examples of bar codes from products before starting this unit of work.

We have also designed computer programs that

(a) check pupils' answers when designing the sets of 10 distinct codes (for each of the 10 digits)

http://www.ex.ac.uk/cimt/resource/find-codes/

and (b) illustrate the actual bar code (8-EAN) when the numbers are input

http://www.ex.ac.uk/cimt/resource/barcode-editor/

These are incorporated with the model lesson plans provided.

Solutions and Notes

Activity 1 The full set is given in Appendix 1. You can also use the computer programs to check answers.

Exercise 1 (a) Check digit is 4 (b) Check digit is 1 (c) Check digit is 8

Exercise 2 (a) Yes (b) Yes (c) No (as $3 \times 16 + 14 = 62$ is not divisible by 10). Check digit should be 2.

Activity 2 If the first 7 digits are correct, then the number is

5 0 2 6 8 0 2 3

However, any one of the digits could be wrong; for example, the correct number could be any of the following:

6 0 2 6 8 0 2 0   5 3 2 6 8 0 2 0
5 0 3 6 8 0 2 0   5 0 2 8 8 0 2 0
5 0 2 6 9 0 3 0   5 0 2 6 8 3 2 0
5 0 2 6 8 0 3 0

All have just one change from the original number given, and all are correct as 8-digit EAN numbers.

Hence it is clear that the computer cannot correct even single errors and this bar code must be read again.

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Teacher Resource Material (continued)

Activity 3   Using an 8-module framework and keeping to the given rules, there are 8 possible patterns using a total of 5 black modules and also 8 using a total of 3 black modules. This gives 16 distinct patterns.

Changing the third rule in the list and, for example, adding 2, 4 or even 6 black modules will increase the number of patterns. (An additional 2 gives 5 more patterns; 4 gives 9 more and 6 gives 5 more.)

Activity 4   Number set B is a reflection of number set C.

Activity 5   There are 20 possibilities of which 10 are used for the coding (as shown in Appendix 3).

Activity 6   Clearly this is not possible with the 7-module design.

The results in Appendix 3 show that you can increase the number of patterns by increasing the number of modules and/or changing the rules. There are many possibilities!