UNIT 2 *Braille* Teacher Resource Material

Key Stage: *3 or 4*

Target: *High-achieving Year 7/8, mainstream Y9, coursework for GCSE*

Teaching Notes

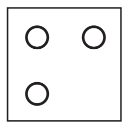
This is a great success story of a code, developed in 1833, and still in extensive use today. The topic provides a challenge for effective design and will stimulate worthwhile and productive discussion. Many pupils will have some ideas about the topic but little knowledge of the details. Starred (*) questions are identified as the most challenging.

Solutions and Notes (*For diagrams in this unit we use black circles to represent the raised dots and white circles for the blank spaces*.)

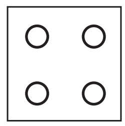
Exercise 1 There are $2^6 = 64$ different configurations; there are two distinct approaches to deducing this result, namely

(i) <u>*mathematical logic*</u>: Start with just two dots, where there are clearly 4 possible configurations,

Now add a third dot, which will give 2×4 possible configurations as the third dot is either 'on' or 'off'.



Similarly with a fourth dot, we have $2 \times 2 \times 2 \times 2 = 16$ possible configurations.

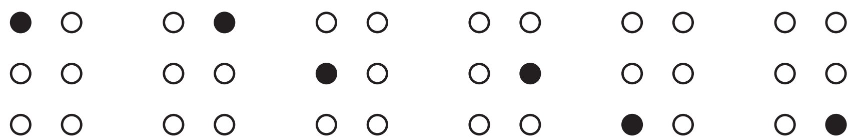


For n dots, there would be 2^n possible configurations.

For Braille, $n = 6$ and so there are $2^6 = 64$ possible configurations.

The advantage of this method is that we have not only solved the problems for the Braille system of dots, but for *any* system (this is helpful for Exercise 2).

(ii) <u>*method of exhaustion (or systematic search)*</u>: The best method here is to consider possible configurations with just *one* dot; with Braille there are clearly 6 of these.



Then consider using just two dots in a systematic way.

The final table, which is symmetric, is given here.

(Note that the configuration in which no dots are 'on' is not used, which means that the answer is 63.)

No. of dots	*No. of possible configurations*
0	1
1	6
2	15
3	20
4	15
5	6
6	1
Total	64

Exercise 2 (a) Punctuation symbols; capital letters, mathematical symbols, common words, etc.

(b) If each of the letters has to have two versions, lower case and capital, and if you include digits 0 – 9, punctuation and mathematical symbols, the total is more than 63.

(c) Not as it stands but you can overcome the problem by having KEY symbols for 'number', 'capital letter', etc.

Activity 1 Using the formula for n dots (whatever their display pattern),

$$\text{no. of configurations } = 2^n - 1 \text{ (ignoring no dots raised)}$$

we can calculate the results, giving

(a) $2^2 - 1 = 3$

(b) $2^4 - 1 = 15$

(c) $2^6 - 1 = 63$

(d) $2^9 - 1 = 511$

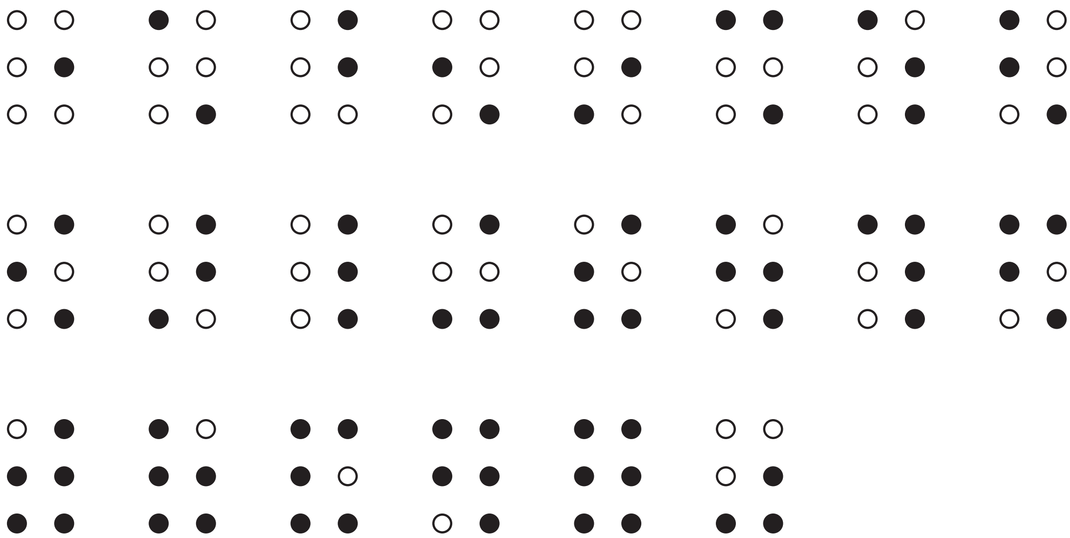
(e)* $2^{n \times 2} - 1$

(f)* $2^{n \times m} - 1$

Exercise 3 (a) God save the Queen

(b) meet me at 1600 hours

Activity 2 (a) There are 22 missing patterns; these are given below.



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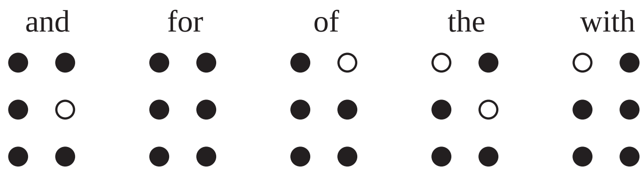
Activity 2 (continued)

(b) Mathematical symbols and more punctuation; also commonly used words, for example,



Detailed Lesson Plans are provided to help teachers in their delivery of interactive whole-class teaching.