**UNIT 9 Code 3 of 9**

**Activity Notes**

**Codes and Ciphers**

**Introduction and discussion**

T: You have met two types of bar codes so far – can you remember what they are? *(EAN Bar Codes and ITF Symbols)*

Can you think of one thing that neither of these types of codes can do? *(Code letters)*

T: What is needed to code both letters and numbers? *(A more complicated code!)*

T: Yes. One of the most used codes, found on, for example, many library tickets, security passes, hospital name tags is the Code 3 of 9.

T: Although it looks complicated, it is straightforward to understand. Each message starts and finishes with * and each code has 5 BARS and 4 SPACES

These have a total of 3 'thick' bars, coded 1, and 6 'thin' bars, coded 0. There is also a thin white space between each of the coded characters.

So A is coded

<table>
<thead>
<tr>
<th>BARS</th>
<th>1 0 0 1</th>
</tr>
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<tbody>
<tr>
<td>SPACES</td>
<td>0 0 1 0</td>
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</tbody>
</table>

T: What is the difference in thickness between '1's and '0's? *(‘1’s are twice as thick as ‘0’s)*

T: What is the total length of any code? *(12, using one unit for each ‘0’ and two units for each ‘1’, i.e. \( 6 \times 1 + 3 \times 2 = 12 \))*

T: Put your code sheet 9.4 away: see if you can now identify 1, 2 and 3 from the first sheet *(OS 9.1)*.

**Number of configurations**

T: Let’s try to find out how many codes are available. How can we do this? *(? Suggestions …)*

T: Consider the case if we have just one wide bar. How many thin bars will there be? *(3)*

T: How can we write this? *(1 0 0 0)*

T: Can we write it in any other way? *(0 1 0 0, 0 0 1 0, 0 0 0 1)*

T: So we have 4 ways of allocating the ‘SPACE’.

T: What about BARS with just 2 wide? How many ways are there of doing this?

**Notes**

T: Teacher  P: Pupil  Ex.B: Exercise Book

Interactive discussion on the different types of codes and their uses. Codes are designed for a particular purpose.

T asks Ps for other situations when names, and possibly numbers, need to be coded.

T shows OS 9.1 and gives a copy of it to each pair of Ps.

T also gives each pair a copy of OS 9.4.

T either puts the code for A on the board or uses the grid on OS 9.4.

T asks Ps questions, making sure that they all understand.

Ps can write on their copies of OS 9.1 if they find it helpful.

They should all attempt to identify the numbers before checking their answers.

Interactive checking orchestrated by T.

Ps ideas are used for calculating the table.

T should encourage Ps to play an active part in the discussion but must steer them in the right direction; OS 9.2 could be used here.

2 or 3 minutes are given for Ps to consider this.

(continued)
### Codes and Ciphers

#### UNIT 9  Code 3 of 9  Lesson Plan 1

<table>
<thead>
<tr>
<th>Activity 2 (continued)</th>
<th>Notes</th>
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</table>
| T: Who has an answer? Come and show us.  
P: There are 10 possible ways.  
| T: So how many ways are there in total?  
(4 × 10 = 40)  
T: Is this sufficient for all letters and digits?  
(Yes, 26 + 9 = 35)  
T: Why do we need to use more than 40 codes?  
(Punctuation, symbols, etc.)  
T: How can we do this?  
(By having different combinations  
of wide bars and spaces)  
T: Such as ...?  
(3 wide bars and no wide space,  
1 wide bar and 2 wide spaces)  
T: Any more?  
(0 wide bars and 3 wide spaces)  
T: OK. You have 5 minutes to calculate the possible number of codes.  
| Volunteer P illustrates the 10 possible ways. T must ensure that a systematic method has been used to obtain the answer.  
Ps now look again at OS 9.4 to check what is used.  
T encourages discussion; makes sure that Ps understand.  
T monitors progress, helping when required.  
Answers are reviewed interactively.  
35 mins |

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<thead>
<tr>
<th>Coding</th>
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| T: I will leave decoding for you to do as homework, but let's see how we can code a simple message  
* A Y R 4 *  
T: Be very careful; take your time and just follow the instructions from the character table.  
T (after 3 minutes): Who wants to work on the board?  
T: Who agrees/disagrees?  
T: How do you decode a message?  
T: This is for your homework.  
| Each P is given a copy of OS 9.5 to use with OS 9.4. T gives Ps sufficient time to work on this; it is easy to make mistakes when working under pressure.  
T monitors progress, helping when required.  
Volunteer P puts answers on board, using OS 9.5.  
Other Ps agree/disagree.  
Another volunteer P gives instructions.  
It is difficult to check answers so it might be helpful if each P is given a copy.  
45 mins |

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<thead>
<tr>
<th>Homework</th>
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<tr>
<td>Exercise 2 (on copy of OS 9.3).</td>
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