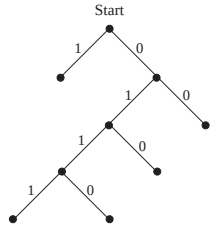
Codes and Ciphers

UNIT 17 *Huffman Codes* Lesson Plan 1

Activity		***Notes***
		T: Teacher P: Pupil Ex.B: Exercise Book
1	**Introduction** T: Does anyone know anything about ASCII computer codes? *(?)* T: They are used by computers to represent letters, numbers, etc. Look at this sheet – what do you notice? *(Each character uses 7 'bits' of 0 or 1)* T: That's right. How many different characters can be coded with this system? *(*$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^7 = 128$*)* T: Is this an efficient way to transmit messages/data, etc? *(?)* T: Can you think of a better way? *(Use shorter codes for letters which occur more frequently)* T: This is the basis of Huffman codes. *5 mins*	T builds on Ps' knowledge of computer codes, if possible. **OS 17.1** is shown, or Ps are each given a copy. T introduces, interactively, the concept of compressing data, etc. for internet transmission.
2	**Huffman code** T: We'll look at how this works when we use just 5 letters E A M N T which are given in decreasing order of frequency of use. T: We use a tree diagram to illustrate the code, with '0' to the right of the branches and '1' to the left – look at the diagram. T: How many codes are there? *(5)* T: What are the codes? *(*1, 00, 010, 0110, 0111*)* T: How do you think we allocate these? *(Shortest code for the letter with the highest frequency, etc.)* T: OK. Who can complete the table? P (on board): *Code* *Letter* *Length* 1 E 1 00 010 0110 0111 T: Now that we have the codes, we can decode 0 1 1 1 0 0 0 1 0 1 0 1 0 0 0 0 1 1 0 T: Now work in pairs to decode 0 1 0 0 0 0 1 1 0 0 0 0 1 1 1 1 0 1 1 1 1 0 0 T: What did you get? Well done. *20 mins*	Ps' ideas should be used whenever possible here, but T will need to ensure that they produce a sensible Huffman code.  or **OS 17.2** can be used. Volunteer P, at board, completes the table. Other Ps watch and agree/disagree. T praises if correct. T shows code on board and Ps identify letters. Ps work in pairs for a few minutes to decode; T monitors progress. Interactive review of answers.
3 *(continued)*	**Other Huffman codes** T: Are other possible Huffman codes that we could use? *(?)*	Whole class discussion of possible codes for 5 letters. T should give Ps sufficient time to

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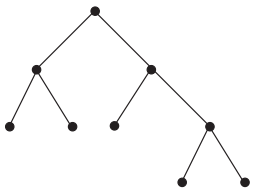
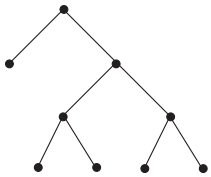
3 *(continued)*	T: So we have three possible solutions. Which one should we use? *(Depends on letter frequencies)* T: Absolutely! When should we use  *(When 3 letters have similar but higher frequency than the other 2)* and this?  *(When one letter is used much more than the other 4,*	think of all the possibilities. Ps display their suggestions. T can show **OS 17.3** if Ps do not suggest all these possibilities. T should try to get Ps to deduce the answers for themselves. The concept of length × frequency can also be used (see *Pupil Text)* to make this more precise.
	35 mins	
4	**Activity** T: Look at Activity 2 in the *Pupil Text.* Start with part a) and see how you get on. You can work with the person next to you for this. T: Who would like to give us an answer? Come and write one of your codes on the board. T: Does everyone agree that this is correct? Who would like to give us another code?	Ps work in pairs; T monitors work carefully to make sure that Ps have understood the concept and the problem. Review of part a) before Ps move on to part b).
	45 mins	
	Homework Complete Activity 2, part b).	