Kit’s Computing Challenge: Unlocking Binary

Learning objective: To understand how computers use binary (base-2) to represent data and to convert between denary numbers and binary sequences.

Use your knowledge of powers of two (128, 64, 32, 16, 8, 4, 2, 1) to solve Kit the Fox’s logic puzzles. Remember, '1' means the switch is on, and '0' means the switch is off.

Word bank: Binary · Denary · Bit · Byte · Base-2 · Switch · Sequence · Power

1. Kit needs to represent the denary number 13 in binary. Explain the steps you would take to find this sequence and write the final 8-bit binary code. (3 marks)

2. Convert the binary sequence 01011000 into a denary number. Show your working out clearly. (2 marks)

3. Compare and contrast denary (base-10) and binary (base-2). Why do you think computers find it more efficient to use binary rather than our standard number system? (3 marks)

4. If a computer uses a 4-bit system, what is the largest denary number it can represent? Justify your answer. (2 marks)

5. What might happen if a computer system only had 7 bits available to store data instead of 8? Explain the potential limitation. (2 marks)

Draw: Draw a diagram representing a row of 8 lightbulbs. Beneath each bulb, write its corresponding value in the powers of two sequence. Colour the bulbs 'on' (yellow) to represent the number 42 in binary.

Extension challenge: Design a secret code system using 5-bit binary strings to represent letters of the alphabet (e.g., A=00001, B=00010). Write a short message to a friend using your code and challenge them to decode it without using your key.