Decoding the Digital World: A Binary Challenge

Learning objective: I can understand how computers represent data using binary and convert between binary and denary numbers.

About 45 minutes. Grown-up tip: Encourage your child to draw out the place value columns (128, 64, 32, 16, 8, 4, 2, 1) at the top of their page to help them calculate.

In binary, each 'bit' represents a power of two, starting from the right: 128, 64, 32, 16, 8, 4, 2, 1. To convert a denary number to binary, check if the value fits in the column. If it does, put a 1 and subtract the value; if not, put a 0.

Example: To write 6 in binary:
8s column: 0
4s column: 1 (6-4=2 left)
2s column: 1 (2-2=0 left)
1s column: 0
Result: 0110

Kit the fox is helping his friends understand how computers 'think'. Computers use a system called binary, which only uses two digits: 0 and 1. These act like tiny light switches that are either off (0) or on (1). By combining these switches, a computer can represent any number, letter, or colour.

Word bank: Bit · Binary · Denary · Base-2 · Switch

1. What are the two digits used in the binary system, and what do they represent in a computer circuit? (2 marks)

2. Convert the denary number 13 into an 8-bit binary number. (3 marks)

3. What is the denary value of the binary number 00101100? (4 marks)

4. Explain why computers use binary instead of our usual denary (base-10) system. Give one reason based on how electronic circuits work. (4 marks)

5. Kit wants to send the message '10' using binary. If he uses a 4-bit system, what would the binary code be? Show your working out. (3 marks)

6. Write a short paragraph (up to 75 words) explaining how a computer might store the letter 'A' if it is assigned the denary number 65. Include the importance of standardisation. (9 marks)

Draw: A friendly fox named Kit sitting at a desk with a glowing computer screen showing lines of 0s and 1s, surrounded by autumn leaves.

Extension challenge: Total: /25. Challenge: What is the highest number you can represent using an 8-bit binary code? Explain how you calculated this. (Bonus: 2 marks)

I did it! Name: _____ Date: _____

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