Kit’s Clever Computing Challenge: The Algorithm Architect

Learning objective: To design, write, and debug precise algorithms to achieve a specific goal, understanding that sequence is vital for a computer to follow instructions.

Kit the Fox is building a robot to help tidy the BookFlik library. Below is a list of steps to move a book from the 'Returns' tray to the 'Fiction' shelf. However, the steps are currently jumbled! Your task is to sequence them correctly (1-6) to ensure the robot performs the task successfully. Once sequenced, identify the 'bug' in the instructions and suggest how to fix it.

Word bank: algorithm · sequence · debug · input · output · precise · logical · command

1. Arrange these instructions in the correct logical sequence (1-6): [ ] Move arm to Fiction shelf, [ ] Grip the book firmly, [ ] Lower arm to pick up book, [ ] Release the book onto the shelf, [ ] Scan the book's barcode, [ ] Return arm to home position. (2 marks)

2. If the robot tries to 'Release the book' before it has 'Moved to the Fiction shelf', what will happen? Explain why this sequence is essential. (3 marks)

3. Imagine the robot encounters a book that is too heavy and its arm slips. How would you 'debug' your algorithm to solve this problem? (3 marks)

4. Compare and contrast a human following instructions versus a computer following an algorithm. Why must a computer's instructions be more precise? (4 marks)

5. Justify your answer: Is it better to have a very long, detailed algorithm or a short, simple one? Why? (3 marks)

6. What might happen if the robot was programd with an 'infinite loop' where it never reached the 'Release the book' command? (2 marks)

Draw: Draw a storyboard showing the robot at two different stages of your sequence. Label the 'input' (the book) and the 'output' (the book placed on the shelf).

Extension challenge: Design a new algorithm for a 'Robot Librarian' to alphabetise a stack of books by title. Write your steps clearly and identify one possible 'error' the robot might make if your instructions aren't specific enough.