

Kit's Complex Computing Challenge: Mastering Algorithms

Learning objective: To design, write, and debug programs that accomplish specific goals by breaking down problems into precise, logical sequences.

Kit the Fox is building a robotic assistant to help tidy the library. However, the robot can only follow very specific, step-by-step instructions (an algorithm). Below, you must reorder the mixed-up steps to create a logical sequence for the robot to clear a pile of books from the floor and place them onto the shelf. Once you have sequenced them, identify the 'bug' in the final step.

Word bank: Algorithm · Sequence · Debug · Input · Output · Loop · Variable · Conditional

1. The instructions for the robot are currently jumbled. Number them 1-6 in the correct logical order:

- ☐ Place the book on the shelf.
- ☐ Walk to the pile of books on the floor.
- ☐ Check if the book is dusty.
- ☐ Lift the book up.
- ☐ Walk to the bookshelf.
- ☐ If dusty, wipe the cover clean. (3 marks)

2. Explain why it is essential for an algorithm to be written in a precise, logical sequence. What would happen if the robot tried to place the book on the shelf before picking it up? (2 marks)

3. Look at this line: 'If the book is heavy, use two hands.' Identify what type of programming logic this is (e.g., a loop, a conditional, or a sequence). Justify your answer. (2 marks)

4. The final instruction provided was: 'Walk back to the start.' Explain why this might cause a problem if the robot has already picked up all the books. How would you 'debug' this instruction to make the robot more efficient? (2 marks)

5. Compare and contrast a human following a recipe to a computer following an algorithm. How are they similar, and where does the computer's logic differ from human intuition? (3 marks)

6. Justify your answer: If you were to add a 'loop' to this algorithm to make it handle a pile of 20 books, where would the loop start and end? Why is a loop more efficient than writing 20 individual sets of instructions? (3 marks)

Draw: Draw a flowchart that represents the robot's decision-making process when it encounters a book. Include a 'Decision Diamond' (a shape for questions like 'Is the book heavy?') with two paths leading to different actions.



Extension challenge: Design your own algorithm for a 'Robot Breakfast Maker'. Write a sequence of at least 10 steps to make toast and pour a glass of juice. Include at least one 'conditional' (if/else) statement to handle a potential error, such as 'if the toaster is empty, wait'.