

Kit's Computational Logic Challenge

Learning objective: To understand and apply logical reasoning in algorithms and debugging, specifically focusing on sequence, selection, and repetition.

Kit the Fox has designed a robotic lawnmower to navigate a garden grid. However, the code has bugs! Read the 'Sequence of Commands' below. For each question, you must identify the logical error, rewrite the corrected sequence, and justify your debugging process. Use the terminology from the word bank to explain your reasoning.

Word bank: Algorithm · Bug · Debug · Sequence · Selection · Repetition · Logic · Variable

1. Kit's current algorithm for the mower is: 1. Move forward 3 squares, 2. Turn 90 degrees left, 3. Move forward 1 square, 4. Turn 90 degrees left, 5. Move forward 3 squares. Explain why this sequence creates an 'infinite loop' if the garden is a 3x3 grid and justify how you would add a 'Selection' command to stop it once the grass is cut. (3 marks)

2. If the lawnmower costs £12.50 per hour to run and the job takes 4.5 hours, write a simple pseudocode snippet using a 'Variable' to calculate the total cost for the owner. (2 marks)

3. What might happen if the 'Repetition' command in the code is set to 'Repeat until path is clear' but there is a permanent obstacle in the garden? Explain the consequence for the algorithm. (3 marks)

4. Compare and contrast a 'Sequence' and 'Repetition'. Why is repetition more efficient for long, repetitive tasks in programming? (3 marks)

5. Kit wants the mower to change speed if it detects long grass. Suggest a 'Selection' (IF/THEN) statement that would allow the robot to adjust its power usage. (2 marks)

6. Justify your answer: Is it better to write one long, complex sequence of code or several small, modular sub-routines? Explain your reasoning using the term 'Debug'. (3 marks)

Draw: Draw a 5x5 grid representing a garden. Mark an 'S' for the starting point of the mower, an 'X' for an obstacle, and draw a continuous line showing the most efficient path (algorithm) the mower should take to cover all remaining squares without hitting the obstacle.



Extension challenge: Design a 'Branching Algorithm' flowchart. Imagine the mower has a budget of £50.00. Create a logic flow that decides whether the mower should continue working or return to its charging station based on how much of the £50.00 budget has been spent and how much of the lawn is left to cut.