

COMPUTATIONAL THINKING WORKBOOK

Decomposition | Patterns | Algorithms | Flowcharts

Grades 5 – 9

No Coding Required — Just Thinking!

DECOMPOSE

PATTERN

ALGORITHM

FLOWCHART

50 Pages • 5 Chapters • 5 Real-World Projects • Answer Key

UM Printables

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Welcome, Thinker!

Computational thinking is not about computers — it is about how you solve problems. Every day, you face challenges that can be broken into smaller pieces, that follow patterns, and that need clear steps to solve. This workbook will teach you four powerful thinking skills:

Decomposition

Break a big, messy problem into smaller, manageable parts.

Pattern Recognition

Look for similarities, trends, or repeating sequences in data.

Algorithms

Write a clear, step-by-step set of instructions to solve a problem.

Flowcharts

Draw a visual map of your algorithm so anyone can follow it.

Each chapter in this workbook follows the same structure:

1. Learn the concept with clear explanations and examples.
2. Practice with guided exercises.
3. Apply your skills to a real-world challenge project.
4. Review what you learned.

■ TIP

You do NOT need a computer to complete this workbook. All you need is a pencil, your brain, and a willingness to think carefully!

By the end, you will be able to take any complex problem, break it down, find the patterns, write an algorithm, and map it out in a flowchart. Let's get started!

Vocabulary Anchor Chart

Algorithm	A step-by-step set of instructions to solve a problem or complete a task.
Decomposition	Breaking a complex problem into smaller, more manageable parts.
Flowchart	A diagram that uses shapes and arrows to show the steps of an algorithm.
Input	Data or information that goes into a process or algorithm.
Output	The result that comes out of a process or algorithm.
Pattern	A repeating sequence, trend, or similarity found in data or problems.
Pseudocode	A simplified, plain-language version of an algorithm (not real code).
Sequence	Steps that follow one after another in order.
Sub-problem	A smaller piece of a larger problem, created through decomposition.
Variable	A named placeholder that can hold different values (like a labelled box).
Condition	A decision point in an algorithm (e.g., IF this, THEN that).
Loop	A set of instructions that repeats a certain number of times or until a condition is met.
Debug	To find and fix errors in an algorithm or process.
Abstraction	Focusing on important information while ignoring irrelevant details.

Pre-Assessment

Complete BEFORE starting the workbook. Do your best!

Part A: Multiple Choice

1. What does decomposition mean?
 - A) Putting parts together into a whole
 - B) Breaking a complex problem into smaller parts
 - C) Writing code on a computer
 - D) Guessing the answer
2. Which of these is an example of a pattern?
 - A) A random list of numbers
 - B) 2, 4, 6, 8, 10
 - C) A paragraph of text
 - D) A dictionary definition
3. What is pseudocode?
 - A) A type of computer program
 - B) A secret code used by hackers
 - C) Plain-language steps that describe an algorithm
 - D) A flowchart symbol
4. Which flowchart shape is used for a decision?
 - A) Rectangle
 - B) Oval
 - C) Diamond
 - D) Parallelogram
5. What is the first step in computational thinking when facing a problem?
 - A) Write pseudocode
 - B) Draw a flowchart
 - C) Decompose the problem
 - D) Find a pattern

Part B: Short Answer

1. Describe one real-life situation where you had to break a big task into smaller steps. What were the steps?

2. Look at this sequence: 5, 10, 15, 20, 25. What is the pattern? What would the next two numbers be?

Chapter 2: Pattern Recognition

2.1 What Are Patterns?

A pattern is a repeating sequence, trend, or similarity that helps us make sense of the world. When you recognize a pattern, you can predict what comes next. Pattern recognition is the second key skill of computational thinking.

Patterns are everywhere! They can be found in numbers, shapes, nature, language, and even daily routines.

Examples of Patterns:

- Numbers: 2, 4, 6, 8, 10... (add 2 each time)
- Nature: The spiral of a seashell, the symmetry of a snowflake.
- Behavior: You feel hungry every day at 12:00 PM.
- Music: The beat of a drum repeating every 4 counts.

■ WHY IT MATTERS

Finding patterns helps us solve problems faster. Instead of figuring out each step from scratch, we can use what we already know from the pattern to predict the next step or find a solution.

Quick Check!

Look at this shape pattern: Circle, Square, Circle, Square, Circle... What shape comes next?

Chapter 3: Algorithms & Pseudocode

3.1 What Is an Algorithm?

An algorithm is a step-by-step set of instructions to solve a problem or complete a task. You use algorithms every day without realizing it! When you follow a recipe, assemble furniture, or tie your shoes, you are following an algorithm.

A good algorithm must be:

- Ordered: Steps must be followed in a specific sequence.
- Clear: Each step must be easy to understand, with no confusion.
- Finite: It must eventually come to an end.
- Effective: It must actually solve the problem!

Everyday Example: Brushing Your Teeth

1. Squeeze toothpaste onto the brush.
2. Turn on the water and wet the brush.
3. Brush the top teeth for 30 seconds.
4. Brush the bottom teeth for 30 seconds.
5. Spit out the toothpaste.
6. Rinse the brush and your mouth.

■ THINK ABOUT IT

What would happen if you swapped Step 1 and Step 6? The algorithm would not work! Order matters.

3.2 Writing Pseudocode

Pseudocode is a way to write an algorithm using plain English (or any language you speak) that looks similar to computer code. It uses standard keywords to make the logic clear, but it does not have to follow strict programming syntax.

Pseudocode Keywords:

- INPUT: Data you need to start with (e.g., INPUT name).
- OUTPUT: The result you produce (e.g., OUTPUT total).
- SET: Give a value to a variable (e.g., SET count to 0).
- IF / THEN / ELSE: Make a decision (e.g., IF raining THEN take umbrella).
- REPEAT / UNTIL: Loop an action (e.g., REPEAT stirring UNTIL smooth).

Example: Making Toast

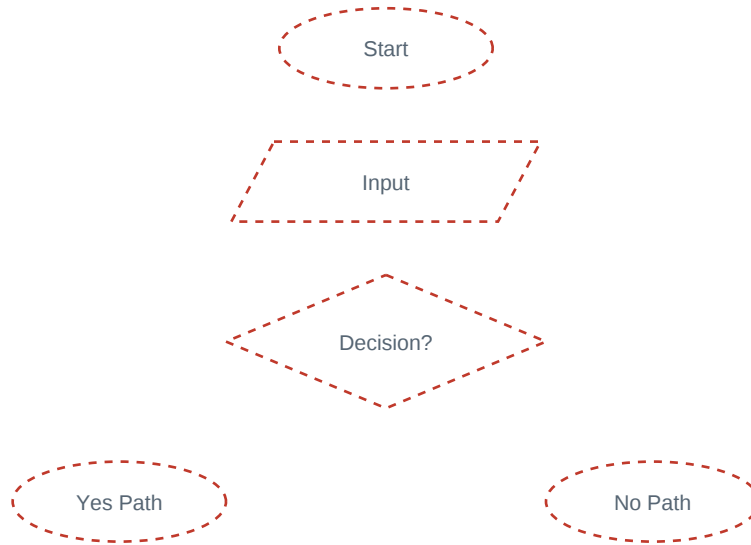
```
INPUT: Bread, Toaster
SET darkness to "medium"
IF bread is frozen THEN
  defrost bread first
ELSE
  put bread in toaster
END IF
push toaster lever down
REPEAT waiting UNTIL toast pops up
OUTPUT: Toasted bread
```

Notice how the pseudocode is indented inside the IF/ELSE block. Indentation shows which steps belong to which decision.

Flowchart Template Set

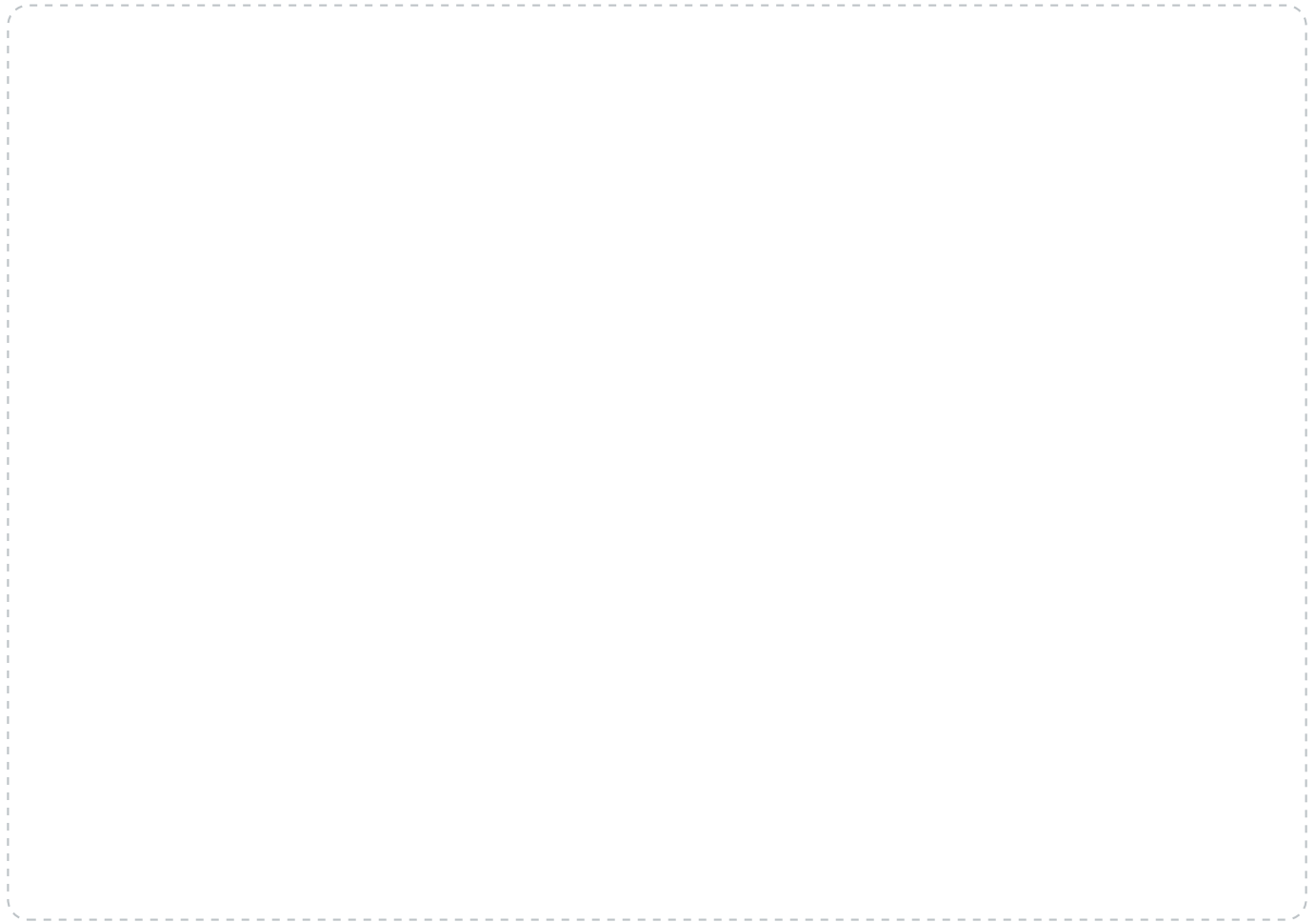
Use these templates to design your own flowcharts!

Template 1: Simple Decision



Template 2: Blank Canvas

Use the space below to draw your own flowchart from scratch!



Template 3: Pseudocode Outline

Use this structure to draft your pseudocode:

INPUT: _____

SET: _____

IF: _____

THEN: _____

ELSE: _____

REPEAT: _____

UNTIL: _____

OUTPUT: _____

Teacher Answer Key

Pre-Assessment (Pages 5-6)

Part A: 1-B, 2-B, 3-C, 4-C, 5-C

Part B: 1. Answers vary. 2. Add 5; next two are 30, 35.

3. Answers vary (should include specific steps like "get bread", "spread peanut butter").

4. Oval=Start/End, Rectangle=Process, Diamond=Decision, Parallelogram=Input/Output.

Chapter 1 Review (Pages 13-14)

Part A: 1-C, 2-A, 3-D, 4-B

Part B: 1-False, 2-True, 3-True

Part C: B

Part D: 1. Decomposition is helpful because it makes big problems less overwhelming and easier to solve. 2. Answers vary (e.g., packing for a trip: clothes, toiletries, entertainment). 3. You know it is broken down enough when each sub-problem is a simple, actionable task.

Part E: Disagree. A to-do list is just a list of tasks; decomposition is a strategic breakdown of a complex problem into logical sub-problems.

Chapter 2 Review (Pages 21-22)

Part A: 1-Pattern, 2-Rule, 3-Anomaly, 4-Prediction, 5-Sequence

Part B: 1. 50, 60 (add 10), 2. 243, 729 (multiply by 3), 3. 72, 65 (subtract 7)

Part C: B

Part D: 1. Patterns let you apply a rule instead of guessing. 2. Answers vary. 3. Investigate why it happened; do not ignore it.

Part E: Rule: Add the previous two numbers. Next: 34, 55. Found in spirals of shells and pinecones.

Chapter 3 Review (Pages 29-30)

Part A: 1-B, 2-D, 3-C, 4-A

Part B: 1-False, 2-False, 3-True

Part C: 1. An algorithm is the logic/steps; pseudocode is the way you write it in plain language. 2. It must end so the computer/program knows when to stop. 3. Answers vary.

Part D: The IF and ELSE actions are swapped. Fix: IF correct THEN open inbox ELSE show error.

Chapter 4 Review (Pages 37-38)

Part A: 1-C, 2-D, 3-A, 4-E, 5-B

Part B: 1. Diamond, 2. Buy toy, 3. Save money

Part C: 1. To clearly separate yes/no logic. 2. Rectangles are actions; Parallelograms are data in/out. 3. Because a decision always has at least two outcomes (Yes/No).

Part D: Flowchart should have Start -> Look outside -> Raining? -> (Yes) Take bus / (No) Walk -> End.

Chapter 5 Car Wash Practice (Page 40)

Decompose: 1. Get supplies 2. Set prices 3. Advertise 4. Wash cars 5. Clean up

Patterns: If 2 students = 1 car, then 4 students = 2 cars (proportional pattern).

Algorithm: INPUT Car -> Wet car -> Scrub car -> Rinse car -> IF dirty THEN Scrub again ELSE Dry -> OUTPUT Clean car.

Real-World Challenge 5 (Pages 41-42)

Task 1: Decompose: 1. Arrange cots/sleeping areas 2. Set up food/water station 3. Create check-in desk 4. Organize pet area 5. Post safety rules

Task 2: Pattern is 1, 2, 3, 4, 5... The 5th period will have 5 families arrive.

Task 3: Pseudocode should include: INPUT family name, INPUT number of people, IF has pet THEN send to pet area ELSE assign cot in main gym.

Task 4: Flowchart should map the pseudocode visually with a decision diamond for "Has pet?".

Post-Assessment (Pages 43-44)

Part A: 1-B, 2-B, 3-C, 4-C, 5-C

Part B: 6. Answers vary. 7. Add 10; next are 60, 70.

8. Pseudocode must include IF book is overdue THEN pay fine ELSE check out book.

Part C: Students should show growth from the Pre-Assessment.

Grading Rubric for Open-Ended Challenges

4 (Exemplary): Thorough decomposition, complex patterns found, algorithm is fully detailed and sequenced, flowchart uses correct shapes and flow.

3 (Proficient): Adequate decomposition, basic patterns found, algorithm is mostly clear, flowchart is readable with minor shape errors.

2 (Developing): Incomplete decomposition, struggles to find patterns, algorithm lacks detail or order, flowchart is confusing or uses incorrect shapes.

1 (Beginning): Cannot decompose independently, no patterns identified, algorithm is missing or illogical, no flowchart provided.

Thank You!

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