

Computational Thinking

A Seven-Step Approach

Solving Programming Problems

- Last lessons: Green screen example
 - Specific problem that we wanted to solve
 - Worked through step-by-step
 - Problem statement → working code
- Now: A closer look at solving problems
 - Seven step approach

Solving Programming Problems

Problem Statement

I want to be able to take a foreground image and a background image and...

**Big Leap:
Break It Down**

Working Code

```
var fgImage = new SimpleImage("drewRobert.png");
var bgImage = new SimpleImage("dinos.png");
var output = new SimpleImage(fgImage.getWidth(),
                             fgImage.getHeight());

for (var pixel of image.toArray()) {
    x = pixel.getX();
    y = pixel.getY();
    r = pixel.getRed();
    g = pixel.getGreen();
    b = pixel.getBlue();
    if (g > r + b) {
        var pixel2 = bgImage.getPixel(x, y);
        output.setPixelAt(x, y, pixel2);
    }
    else {
        output.setPixelAt(x, y, pixel);
    }
}
print(output);
```

Seven Steps

1

Work
Example By
Hand

2

Write Down
What You Did

3

Find Patterns

4

Check By
Hand

5

Translate To
Code

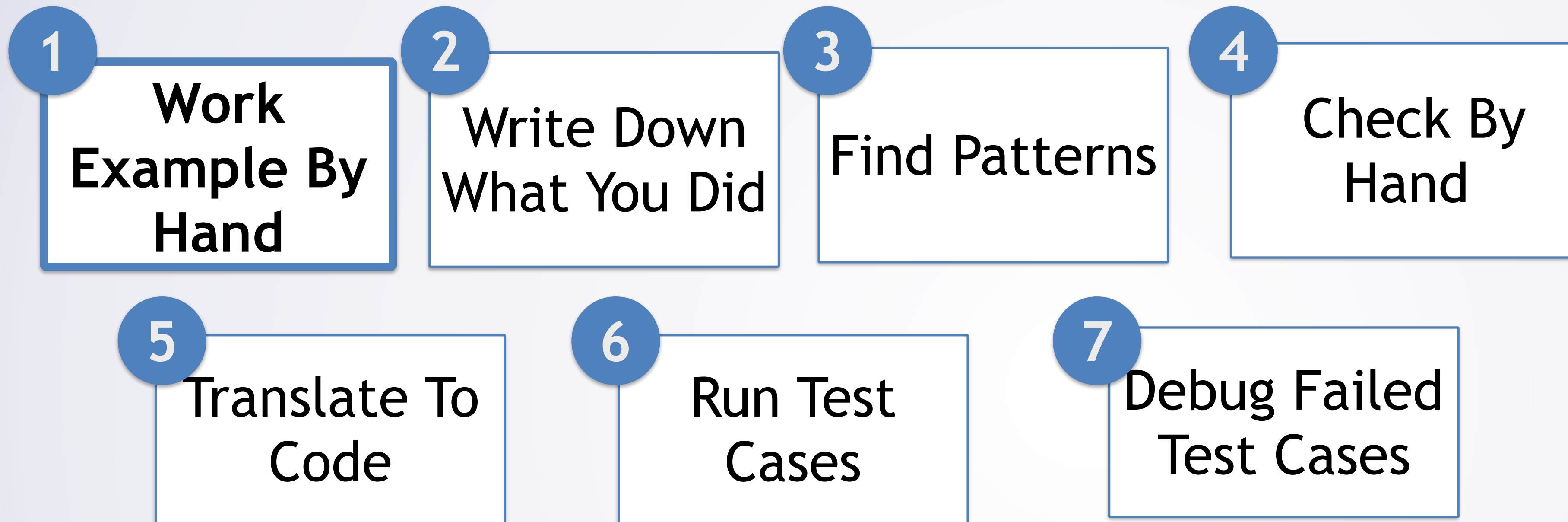
6

Run Test
Cases

7

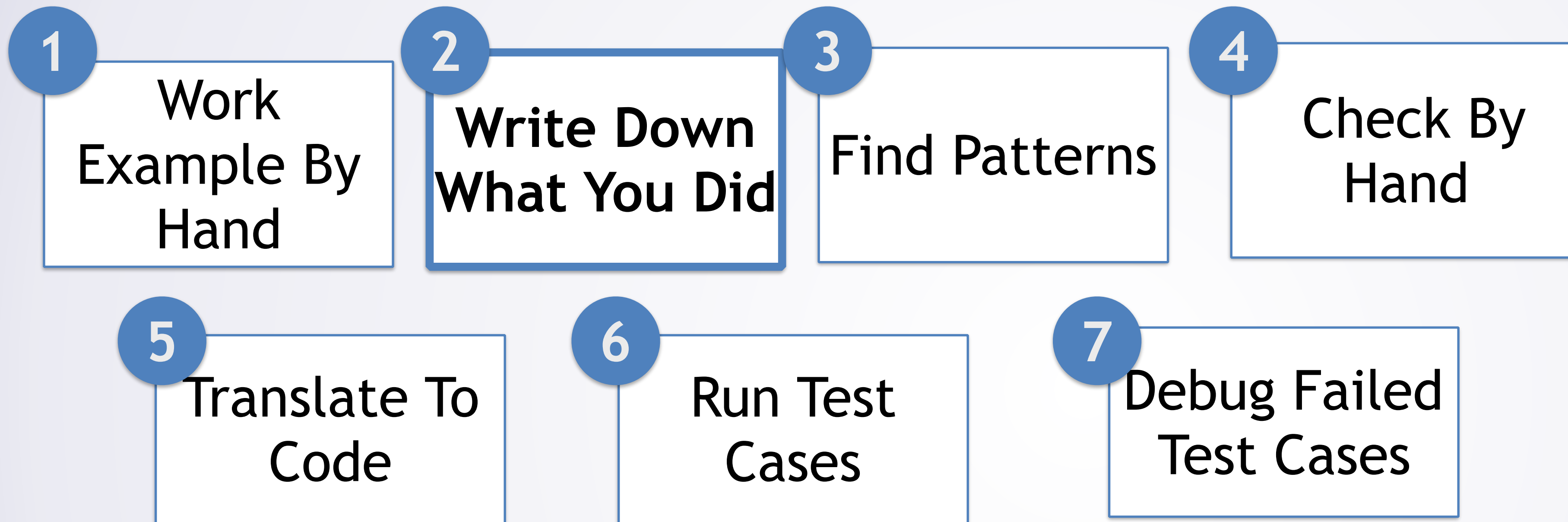
Debug Failed
Test Cases

Step 1



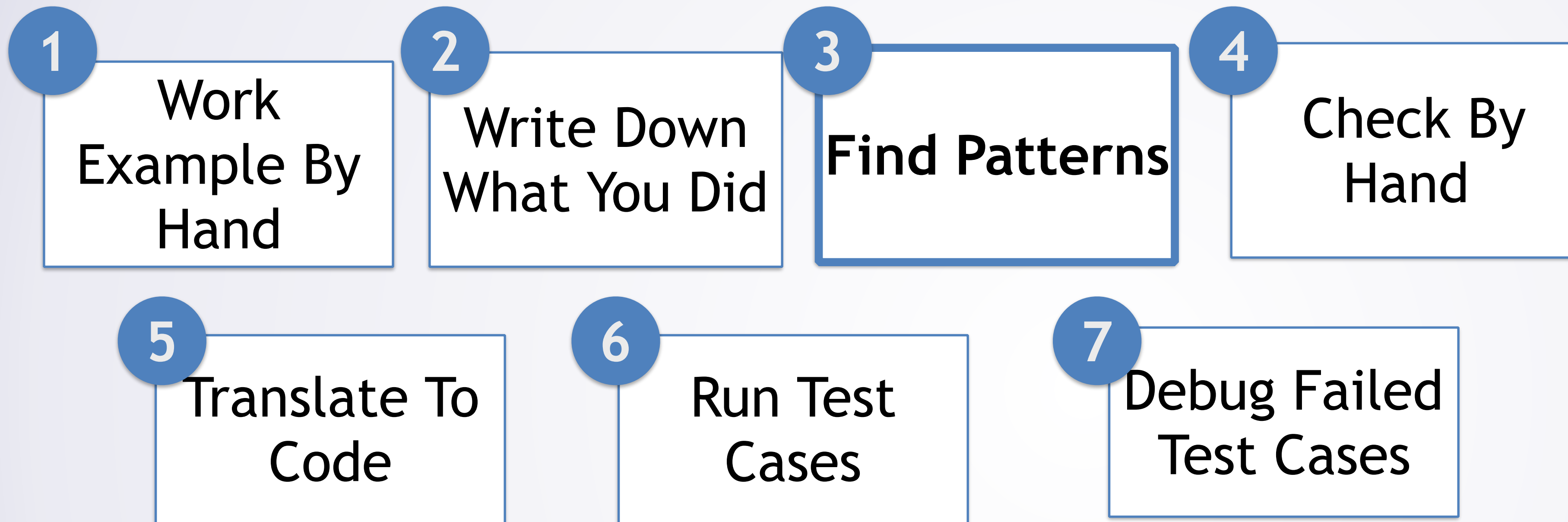
- Solve small instance by hand
- Unclear problem?
- Need **domain knowledge**?

Step 2



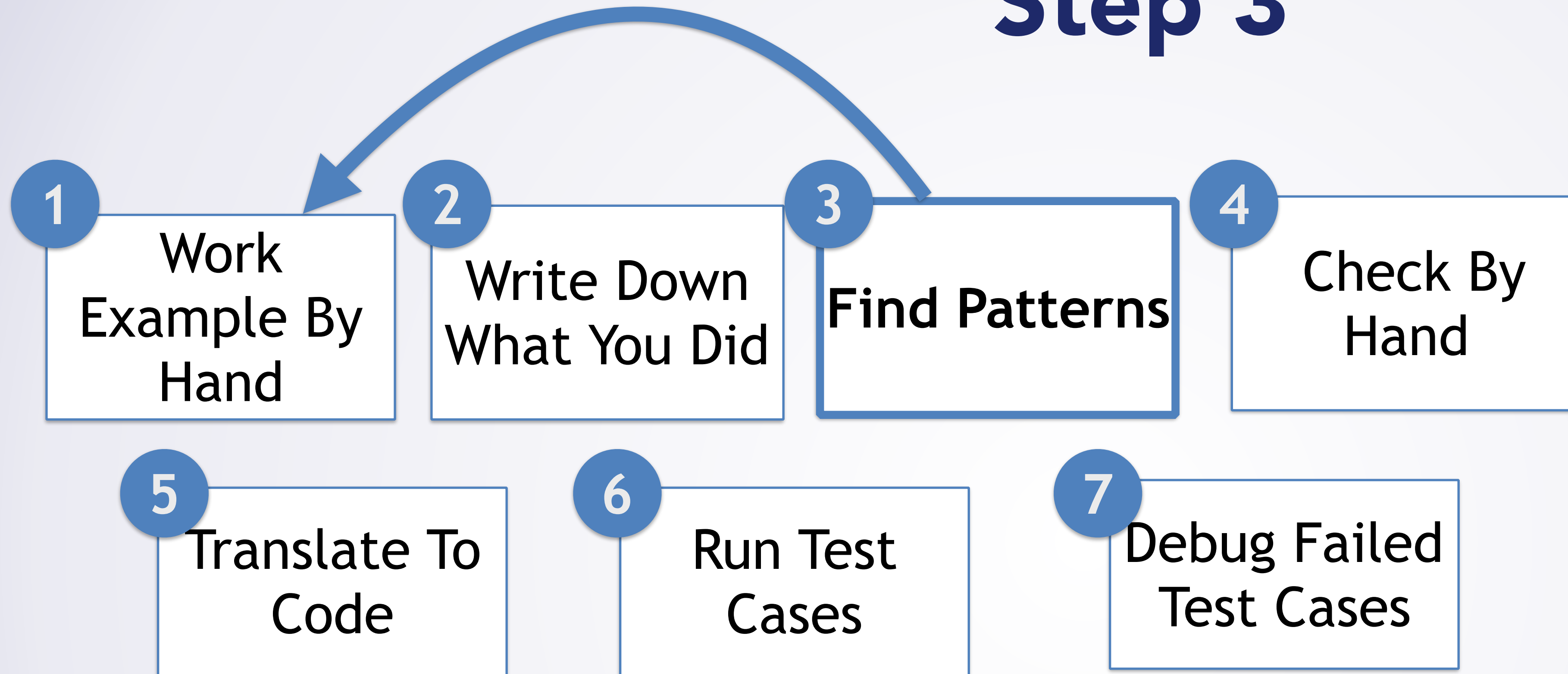
- Write down **exact** steps
- Just that instance
- Tricky: do without thinking

Step 3



- Algorithm for any instance
- Find patterns
- Repetition, conditions, values

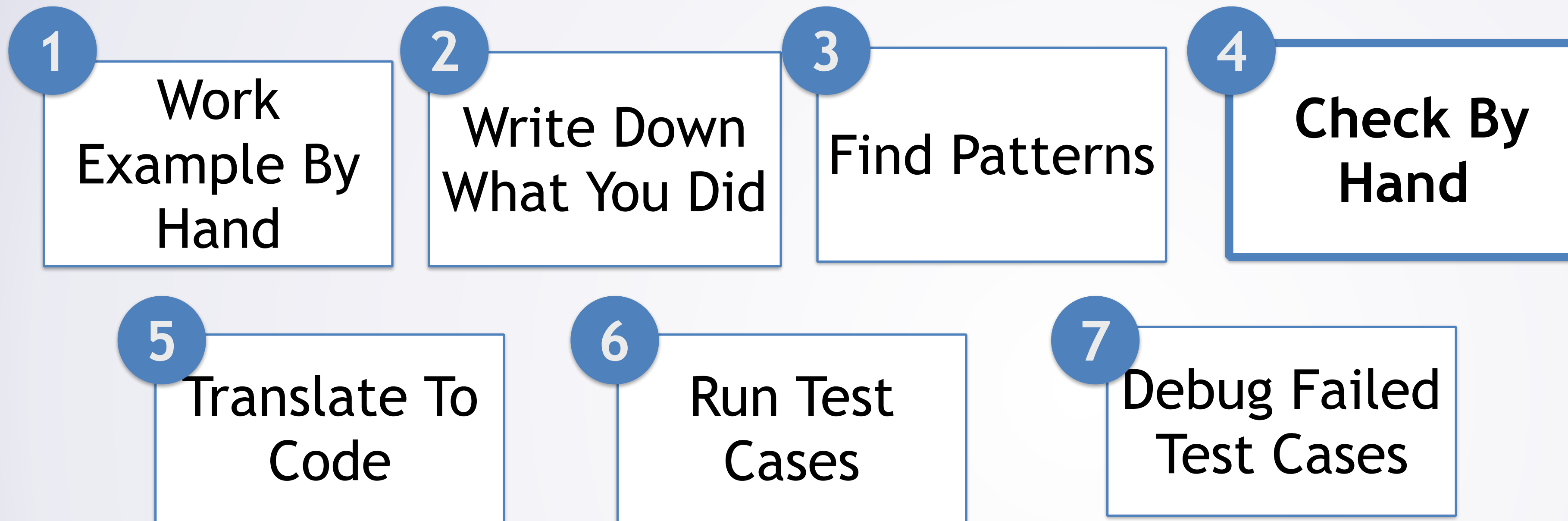
Step 3



- Difficulties?

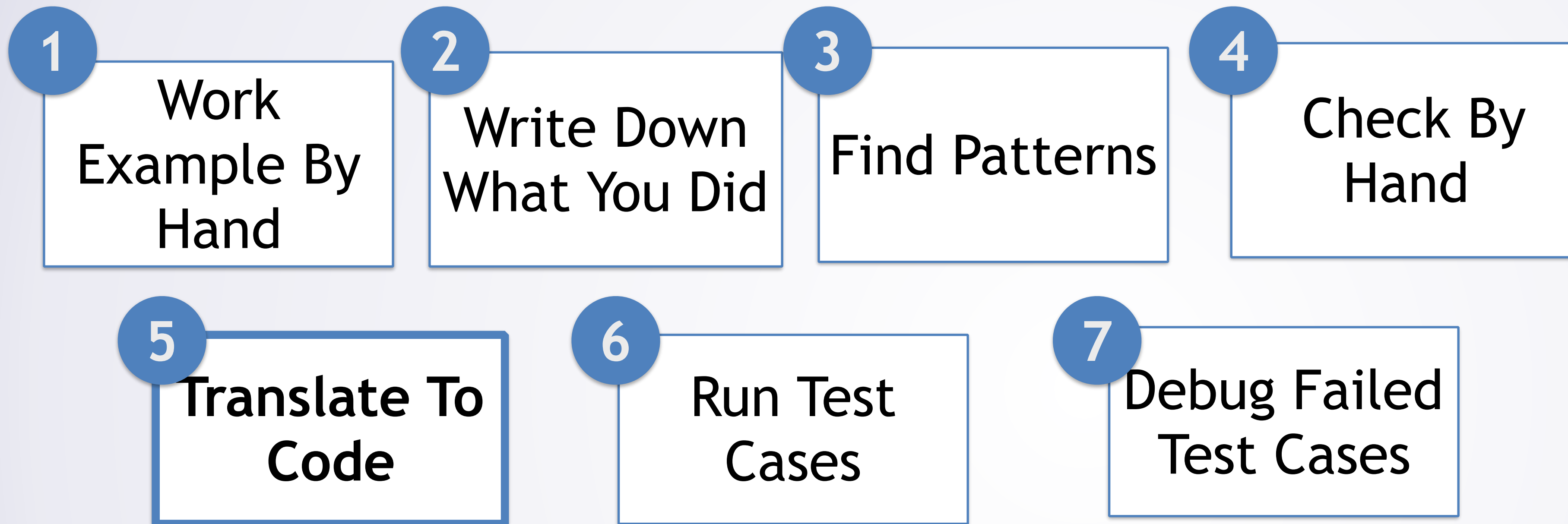
- Try Step 1 + 2 again
- Different inputs

Step 4



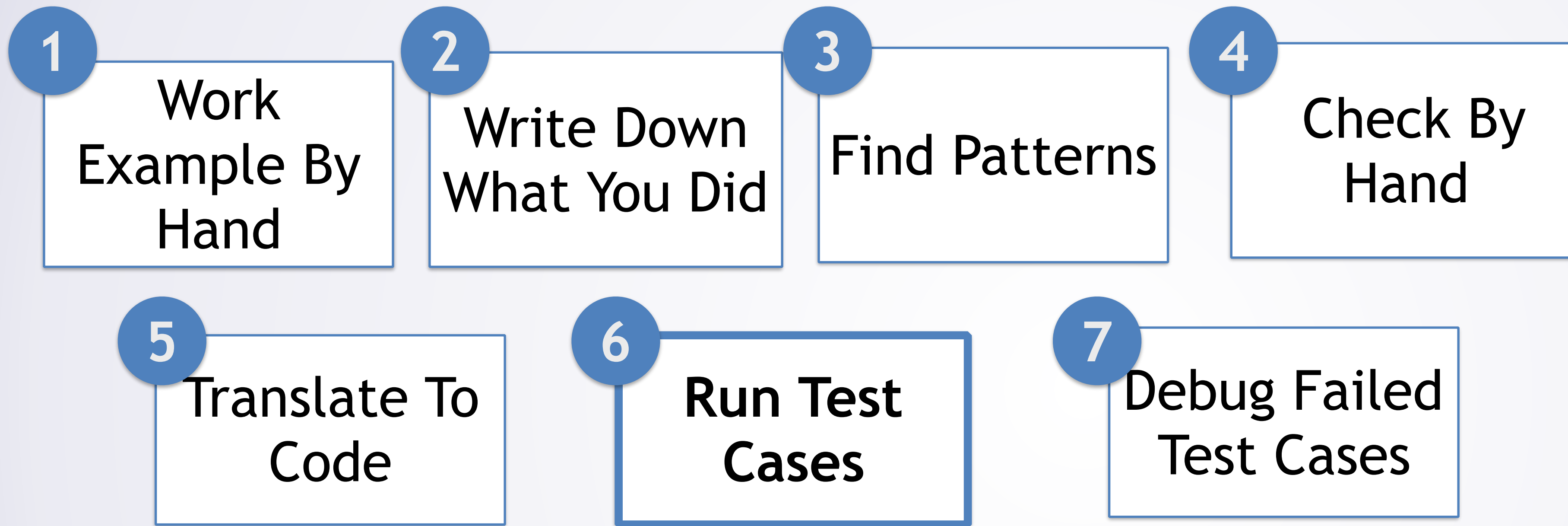
- Incorrect pattern? Find now
- Check with different inputs

Step 5



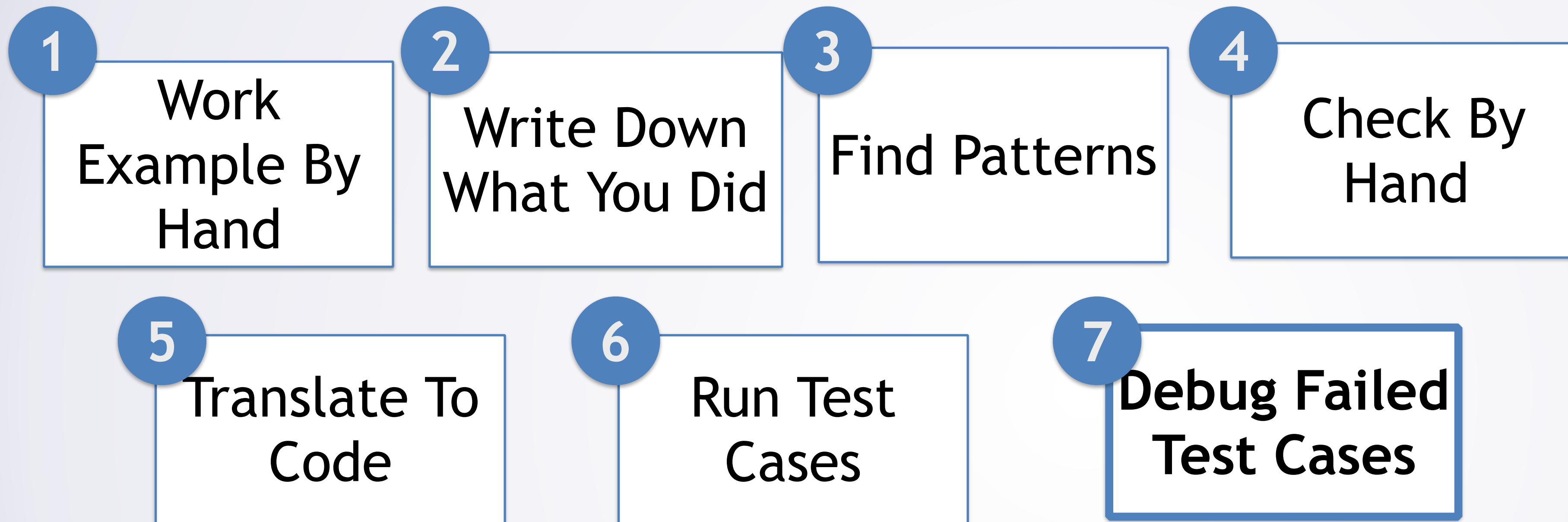
- Translate algorithm to code
 - Programming language

Step 6



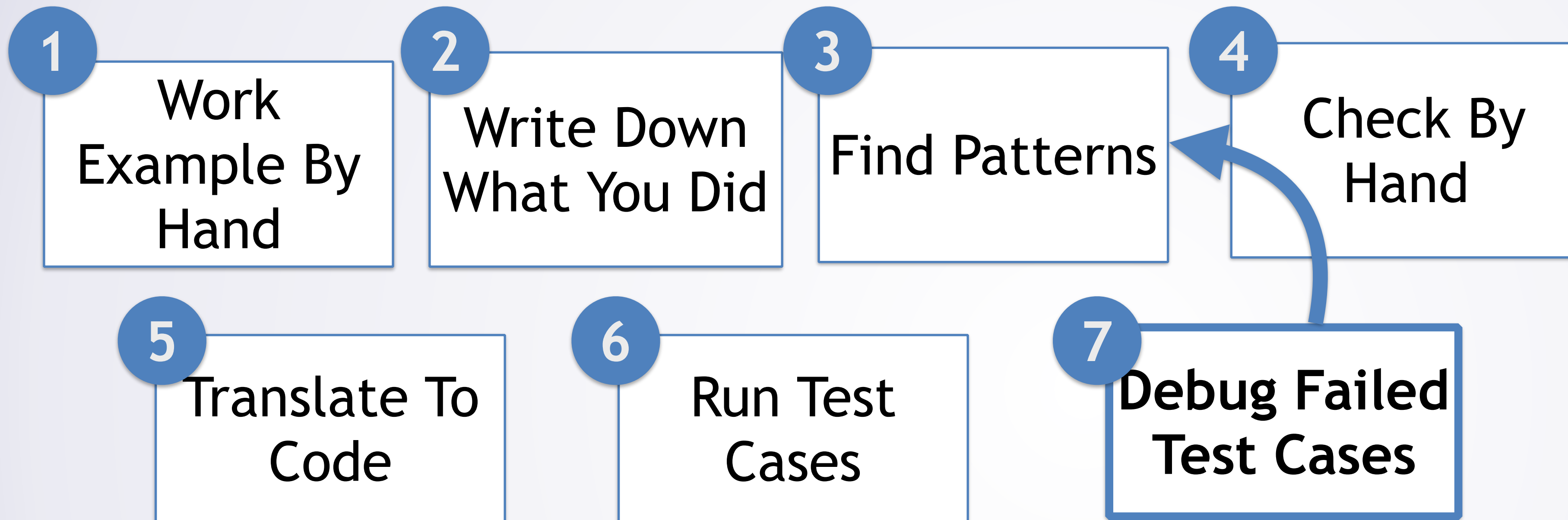
- Run test cases on code
 - Execute program
 - Check answer

Step 7



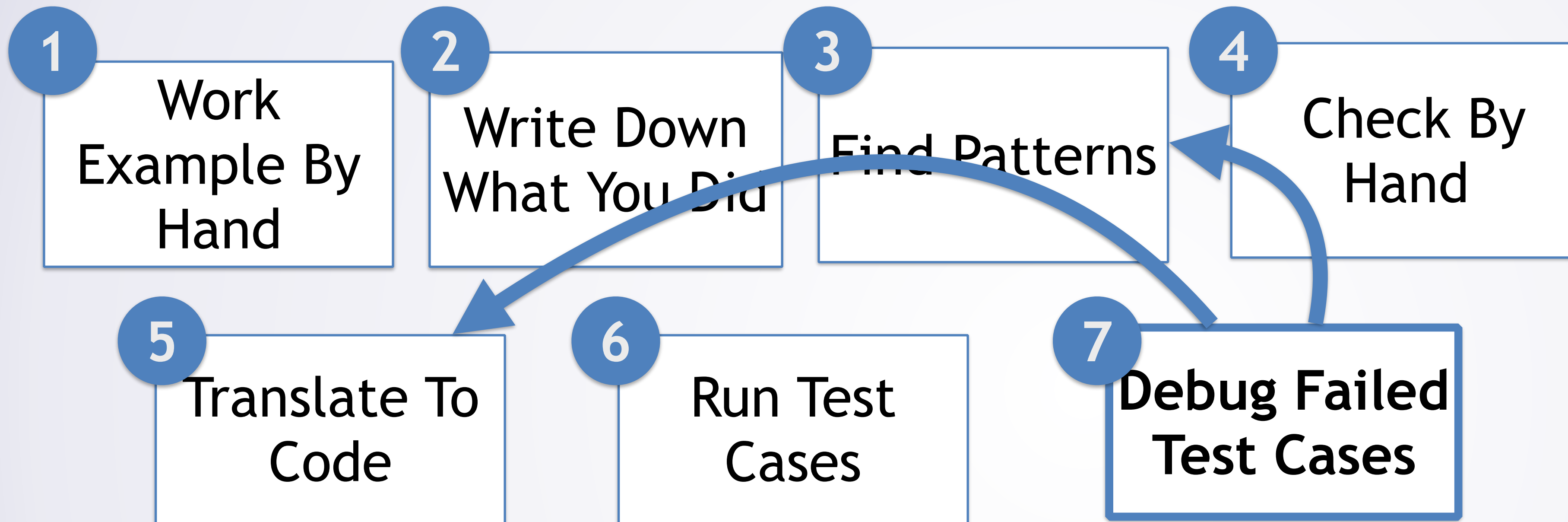
- Test failed? Debug
 - Use scientific method
 - Understand problem + fix

Step 7



- Algorithmic problem?

Step 7



- Algorithmic problem?
- Implementation problem?

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