

# Stacks: Pancake Pandemonium

## Overview

*Stacks* are a kind of data structure in computer science that are used for collecting and organizing information. They operate on a *first in, last out* basis. However, stacks extend beyond computer science. Say you have a gigantic stack of pancakes for breakfast. The easiest way to get a pancake is to simply take one from the top of the pile. When you try to take one from the bottom or the middle, the stack may fall over and land on the floor and then no one can have pancakes! In order to avoid that tragedy, we take from the top. In this activity, we'll be looking at how multiple stacks can interact with each other when we only take pancakes from the top, just as stacks operate. It is just like the classic Shel Silverstein poem, *Pancakes?*<sup>1</sup>

### *Pancakes?*

by Shel Silverstein

Who wants a pancake, Sweet and piping hot?  
Good little Grace looks up and says,  
"I'll take the one on top."  
Who else wants a pancake,  
Fresh off the griddle?  
Terrible Teresa smiles and says,  
"I'll take the one in the middle."

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<sup>1</sup> Silverstein, Shel, *Where the Sidewalk Ends* (Harper & Row), 1974, 34.

# Stacks

## Pancake Pandemonium

### Setting Up

- 3 pancakes (of different sizes: small, medium, large) [We used this vegan recipe.](#)
- 3 plates (each the same size)
- 3 sticky notes (or small pieces of paper)

### Steps

1. Write 1, 2, and 3 on the sticky notes and place them in front of the three plates. This will represent Stack 1, Stack 2, and Stack 3.
2. Stack the pancakes on the first plate (Stack 1) so that the largest is on the bottom and the smallest is on the top.
3. For our challenge with the stacks, there are two commands that we will use:

**"POP!"** When you remove a pancake from the top of a stack.

**"PUSH!"** When you place a pancake on the top of a stack.

4. Practice our new vocabulary. Call out "POP" and "PUSH" so that the child can practice picking up the pancake on top (POP!) and placing it on another plate / stack (PUSH!).

5. Now that we understand these simple commands, **Here is the challenge:**

We will move these 3 stacked pancakes from Stack 1 to Stack 3. But with some simple rules:

We may only move the pancakes one at a time. And whenever we stack the pancakes on top of each other, they must be in ascending order - that is, the larger/est is on the bottom and the smaller/est is on the top.

**Using our new vocabulary and the coded instructions on the next page, can you transfer the stack of pancakes from Stack 1 to Stack 3, following these two rules?**

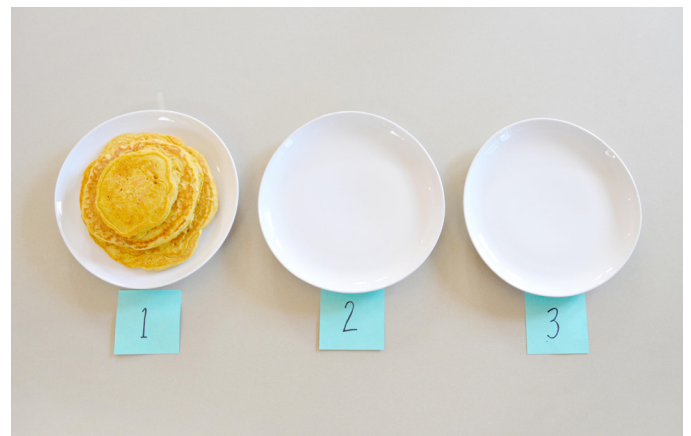
- You may only move ONE pancake at a time, removing a pancake from the top.
- Pancakes can only be stacked in ascending order (the largest is always on the bottom).

\*Hint: You have three plates, so you will be also using Stack 2.

Setting up:



*label the stacks*



*Place the pancakes on the first stack in ascending order*

6. To start, here are some simple coded instructions. Remember our new vocabulary - POP and PUSH - and follow this code to move the pancakes.

## **Pancake Pandemonium Stack Code**

```
// POP a pancake off of Stack 1 and PUSH it onto Stack 3
```

```
// POP another pancake off of Stack 1 and PUSH it onto Stack 2
```

```
// POP a pancake off of Stack 3 and PUSH it onto Stack 2
```

```
// POP the remaining pancake off of Stack 1 and PUSH it onto Stack 3
```

```
// POP the top pancake off of Stack 2 and PUSH it onto Stack 1
```

```
// POP the remaining pancake off of Stack 2 and PUSH it onto Stack 3
```

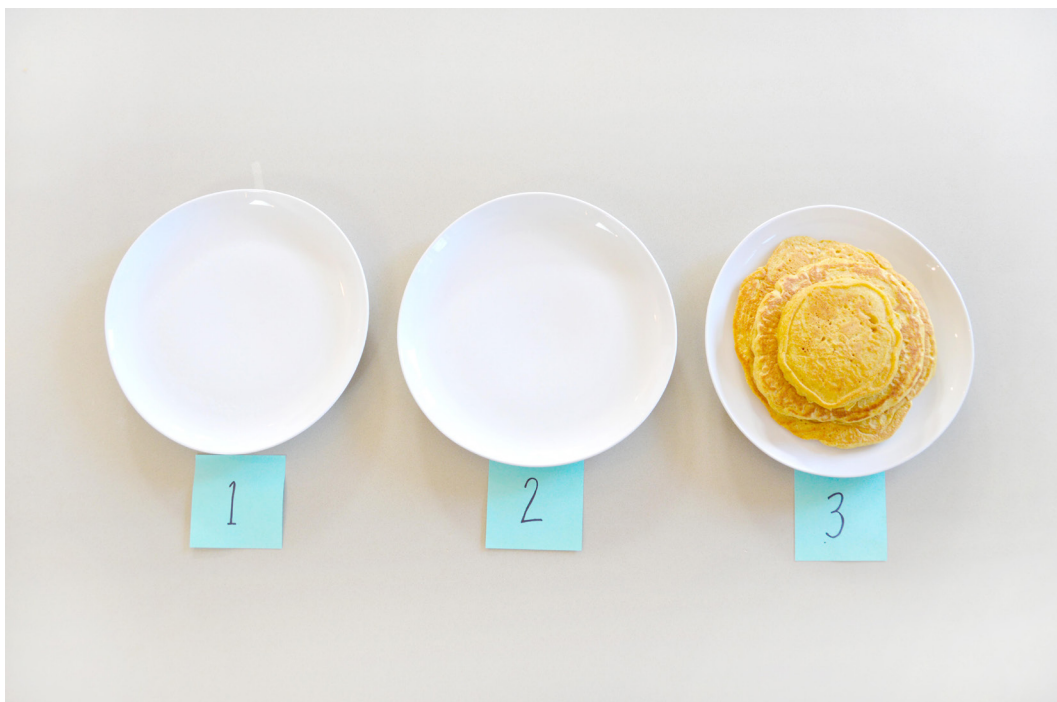
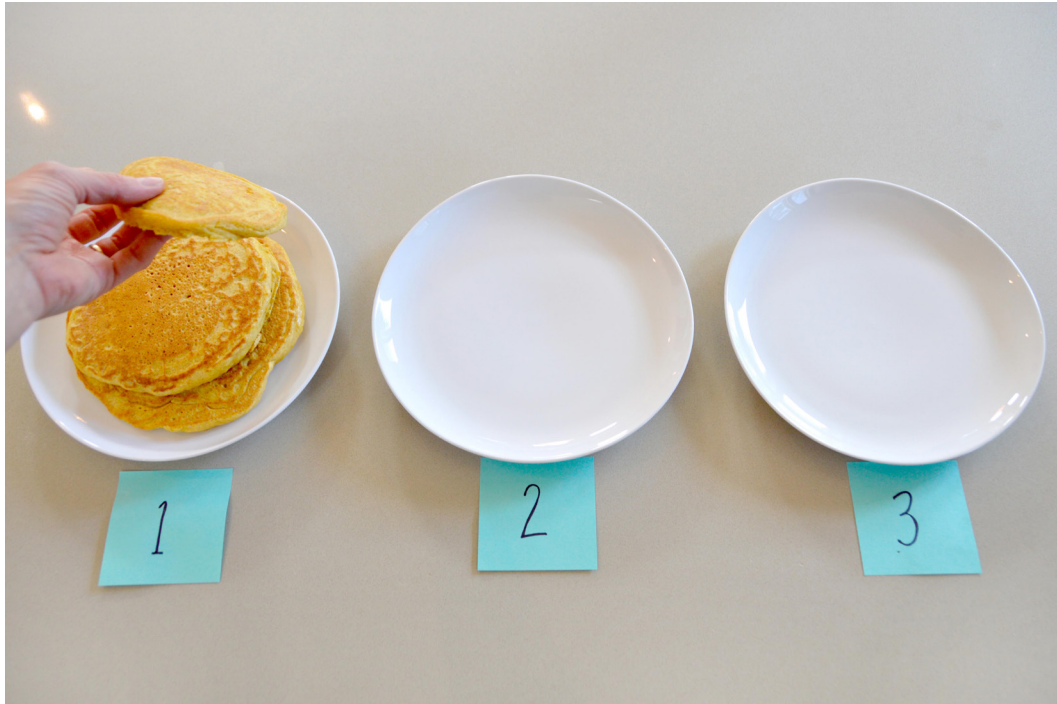
```
// POP the final pancake off of Stack 1 and PUSH it onto Stack 3
```

Take a look - did you successfully move all of the pancakes from the first plate (Stack 1) to the third plate (Stack 3), placing them in ascending order?

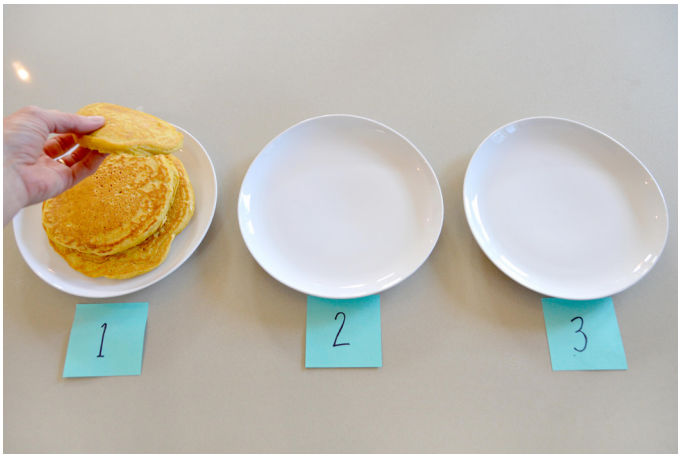
Now try to do it again, without using the code. Can you do it? Try counting how many moves it takes.

**Variations:**

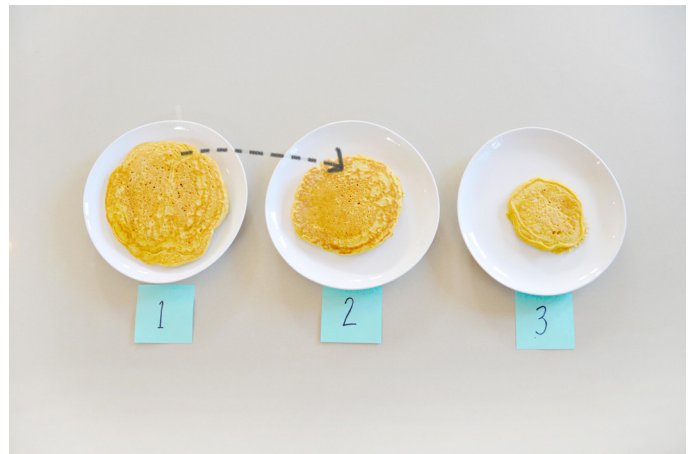
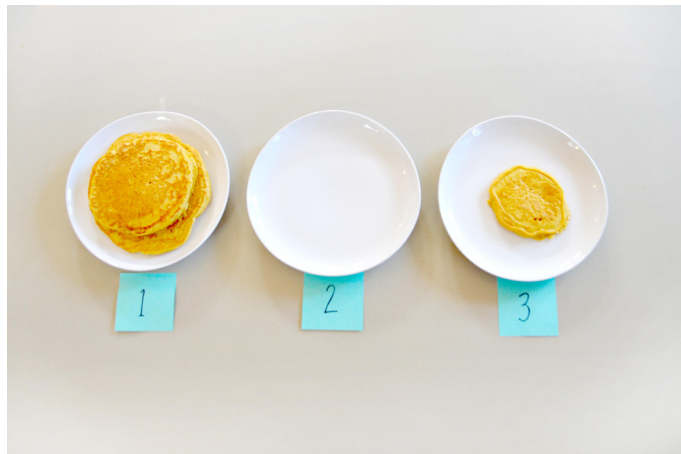
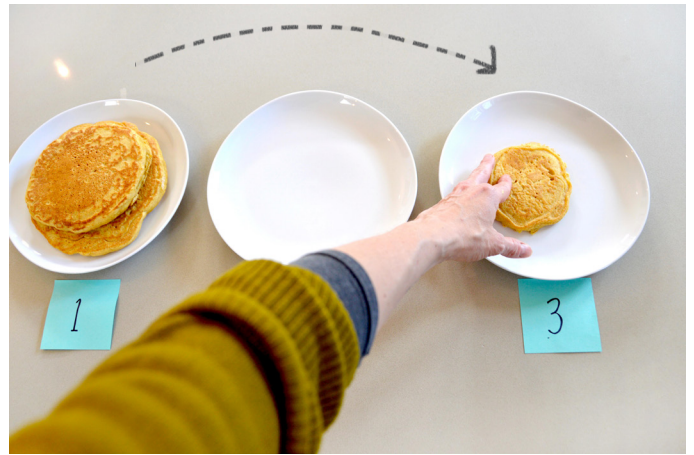
Add more pancakes; try first with four. What is challenging about it? Do you observe any patterns? The more pancakes you have the more challenging this becomes. Why?







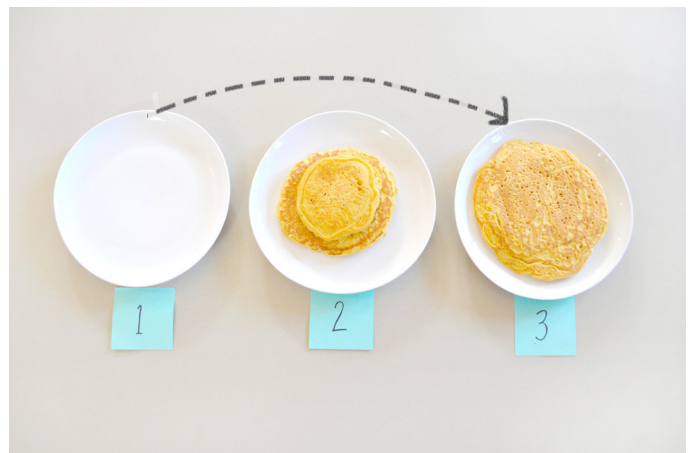
POP a pancake off of Stack 1 and PUSH it onto Stack 3



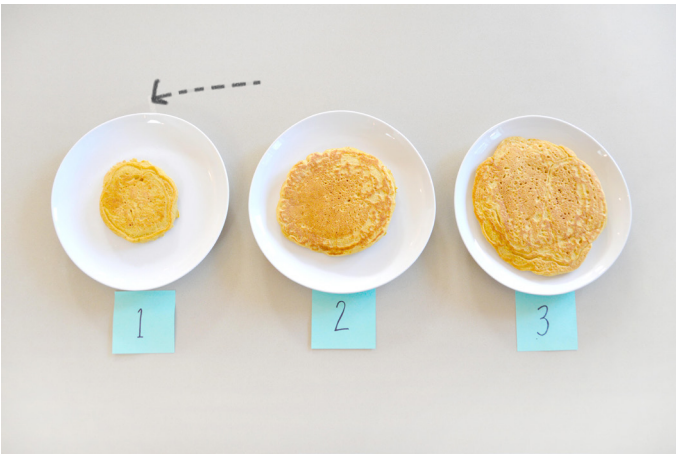
POP another pancake off of Stack 1 and PUSH it onto Stack 2



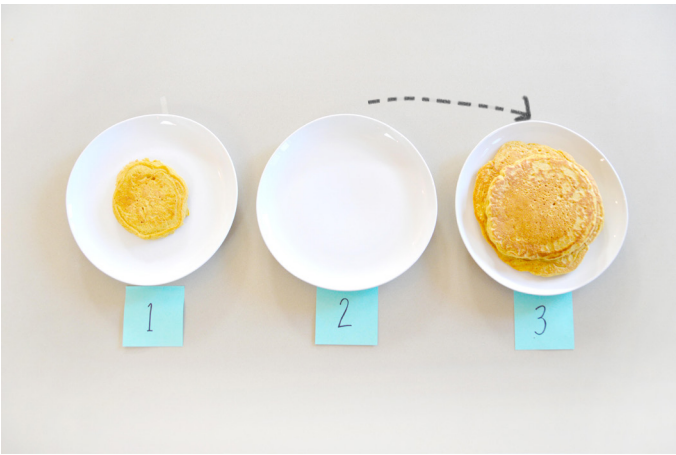
POP a pancake off of Stack 3 and PUSH it onto Stack 2



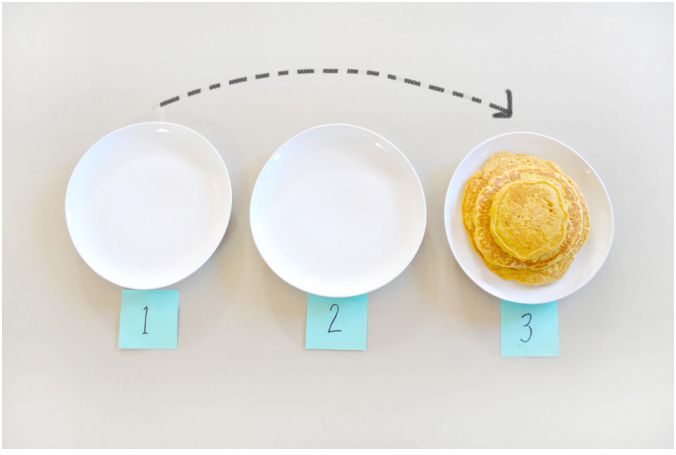
POP the pancake off of Stack 1 and PUSH it onto Stack 3



POP the top pancake off of Stack 2 and PUSH it onto Stack 1



POP the pancake off of Stack 2 and PUSH it onto Stack 3



POP the final pancake off of Stack 1 and PUSH it onto Stack 3

**EAT pancakes !!**

## Pancake Pandemonium Stack - Bonus Codes

For more of a challenge, you can try to follow these codes, which look a bit more similar to the codes that a computer understands.

### Intermediate:

```
stackOne.pop();  
stackThree.push();  
// pop a pancake off of the first plate and push it onto the third
```

```
stackOne.pop();  
stackTwo.push();  
// pop another pancake off of the first plate and push it onto the second plate so that only one pancake remains on the original plate
```

```
stackThree.pop();  
stackTwo.push();  
// pop the pancake off of the third plate and push it onto the second
```

```
stackOne.pop();  
stackThree.push();  
//pop the remaining pancake off of the first plate and push it onto the third
```

```
stackTwo.pop();  
stackOne.push();  
//pop the top pancake off of the second plate and push it onto the first
```

```
stackTwo.pop();  
stackThree.push();  
//pop the remaining pancake off the second plate and push it onto the third plate
```

```
stackOne.pop();  
stackThree.push();  
//finally, pop the final pancake off of the first plate and push it onto the last plate
```



### Advanced:

```
stackThree.push(stackOne.pop());  
//pop a pancake off of the first plate and push it onto the third
```

```
stackTwo.push(stackOne.pop());  
//pop another pancake off of the first plate and push it onto the second plate so that only one pancake remains on  
the original plate
```

```
stackTwo.push(stackThree.pop());  
//pop the pancake off of the third plate and push it onto the second
```

```
stackThree.push(stackOne.pop());  
//pop the remaining pancake off of the first plate and push it onto the third
```

```
stackOne.push(stackTwo.pop());  
//pop the top pancake off of the second plate and push it onto the first
```

```
stackThree.push(stackTwo.pop());  
//pop the remaining pancake off the second plate and push it onto the third plate
```

```
stackThree.push(stackOne.pop());  
//finally, pop the final pancake off of the first plate and push it onto the last plate
```

\*In 7 moves, you can move all of the pancakes from the first plate to the third.